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THE Canadian MINING REVIEW

Established 1882

Vol. XIV.—No 1 1895—OTTAWA, JANUARY—1895. Vol. XIV.—No. 1.

SCHOOL OF MINING,

KINGSTON, ONTARIO.

Faculty:

WM. L. GOODWIN, B.Sc. (Lond.) D.Sc. (Edin.) F.R.S.C.
Director and Professor of Chemistry.

WILLIAM NICOL, M.A.,
Professor of Mineralogy, Metallurgy and Assaying.

R. CARR HARRIS, C.E.,
Professor of Engineering.

WILLET G. MILLER, B.A., Lecturer on Geology and Petrography.

WM. HAMILTON MERRITT, M.E., F.G.S., Associate Royal School of Mines, England,
Lecturer on Mining Engineering, The Economic Geology of Ontario, and The Discovery and Winning of Minerals.

WILLIAM MASON, Lecturer on Freehand, Mechanical and Office Drawing, Topography and Surveying.

JOSEPH BAWDEN, Barrister at Law, Lecturer on Mining Law.

T L. WALKER, M.A., DR. ISAAC WOOD, M.A., Laboratory Demonstrators.

THE SCHOOL PROVIDES THE FOLLOWING COURSES OF STUDY:

1. *A Course of four years leading to the Degree of MINING ENGINEER, (M.E.)*
2. *A Course of three years, for which a Certificate in ANALYTICAL CHEMISTRY and ASSAYING is given.*
3. *A COURSE OF EIGHT WEEKS, (January and February), for Prospectors, Mine Foremen and others interested in Mines and Minerals.*

Lecturers are sent to any mining centre where a sufficient number of students is guaranteed, to conduct SHORT COURSES in Blowpipe Analysis, Chemistry, Mineralogy, Geology, Prospecting and Mining.

The different courses are made thoroughly practical by work in the well-equipped Chemical, Assay, Mineralogical and Petrographical Laboratories. A Mining Laboratory, furnished with Mills, Separators, Concentrators, etc., is in course of construction. It will be open for work in Session 1894-5. Surveying is practised in the field during the warmer months of the Session.

FOR CALENDAR OF THE SCHOOL AND FURTHER INFORMATION APPLY TO

WM. MASON, Bursar,

SCHOOL OF MINING, - KINGSTON, ONTARIO.

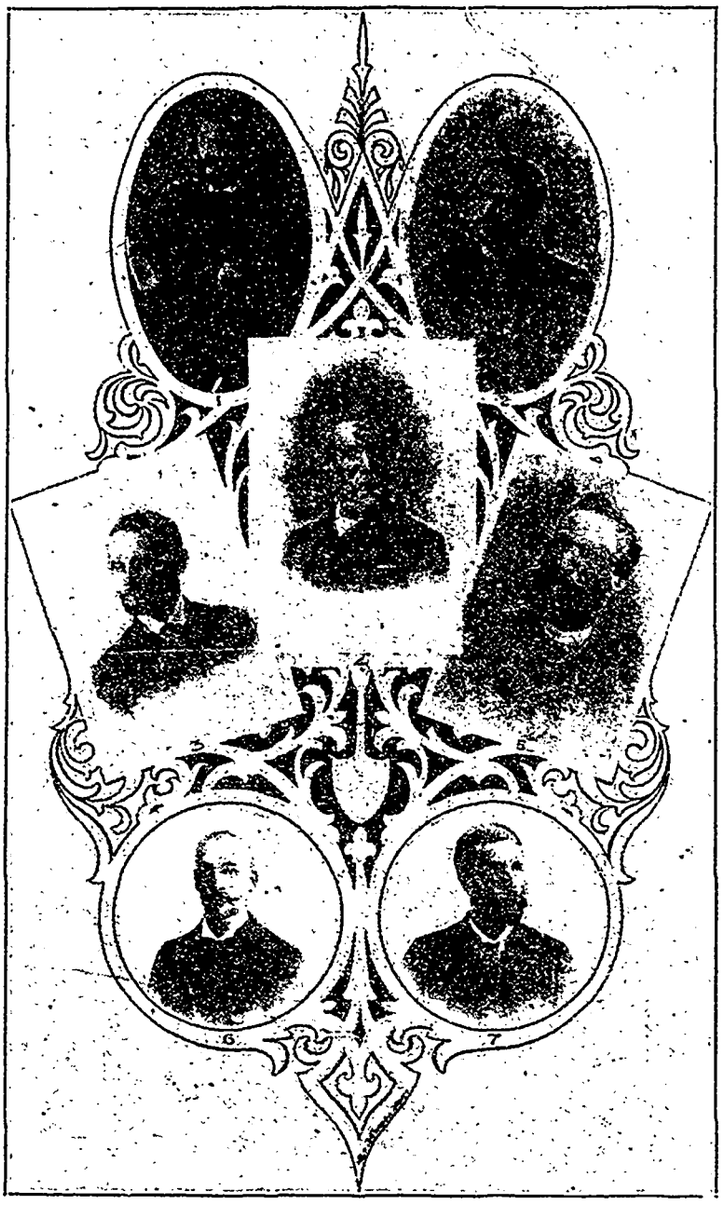
THE Canadian MINING REVIEW
Established 1882

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. Published Monthly. OFFICES: Victoria Chambers, Ottawa.

VOL. XIV., No. 1. JANUARY, 1895. VOL. XIV., No. 1.

Kingston School of Mining.



R. CARR HARRIS, C.E., *Prof. of Engineering.*

W. HAMILTON MERRITT, M.E., A.R.S.M., *Lecturer on Mining and Engineering.*

WM. MASON, *Lecturer on Drawing, Topography and Surveying.*

WM. NICOL, M.A., *Prof. of Mineralogy, Metallurgy and Assaying.*

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T. L. WALKER, M.A., *Laboratory Demonstrator.*

WILLET G. MILLER, B.A., *Lecturer on Geology and Petrography*

General Mining Association of the Province of Quebec.

Many new members elected. Students affiliated. Federation. Quebec Coal Trade, 1894. The Mining Industries of Quebec reviewed. A large number of valuable papers presented.

Fifth Annual Meeting.

The Fifth Annual General Meeting of the members of the General Mining Association of the Province of Quebec opened on Wednesday morning, 9th January, in the New Club Room, Windsor Hotel, Montreal, Mr. John Blue, C. & M. E. (Eustis Mining Co.), President, in the chair. There was a large attendance, among others the following:

Mr. J. S. Mitchell (Beaver Asbestos Co., Ltd.), Sherbrooke.
Mr. H. A. Budden (Intercolonial Coal Co., Ltd.), Montreal.
Mr. W. J. Nelson (Intercolonial Coal Co., Ltd.), Montreal.
Mr. John J. Drummond (Canada Iron Furnace Co., Ltd.) Radnor Forges.
Mr. S. L. Spafford (Nichols Chemical Co.), Capelton.
Mr. John J. Penhale (United Asbestos Co., Ltd.), Black Lake.
Mr. D. D. Mann (Victoria Hydraulic Gold Mining Co.), Montreal.
Mr. P. A. Patersen, C.E. (Horsefly Hydraulic Mining Co.), Montreal. [B. C.
Mr. John B. Hobson, M.E. (Horsefly Hydraulic Mining Co.), Quesnelle Forks,
Mr. J. M. Browning (Cariboo Mining Co.), Vancouver, B.C.
Mr. T. Drummond, M.E. (Cariboo Mining Co.), Montreal.
Mr. George E. Drummond (Canada Iron Furnace Co., Ltd.), Montreal.
Mr. George R. Smith (Bell's Asbestos Co., Ltd.), Thetford Mines.
Mr. John E. Hardman, S.B., M.E. (Pres. Mining Society of N.S.), Halifax.
Dr. James Reed (Harvey Hill Copper Mines), Reedsdale, Que.
Mr. Theodor Boas (Jeffrey's Asbesto Mine), St. Hyacinthe.
Mr. Dwight Brainerd (Hamilton Powder Co.), Montreal.
Mr. R. T. Hopper (Anglo-Canadian Asbestos Co., Ltd.), Montreal.
Mr. A. W. Stevenson, C.A. (Treas. G.M. Association, Que.), Montreal.
Mr. F. P. Back (Dominion Lime and Marble Co.), Sherbrooke.
Mr. E. B. Haycock (Star Gold Mines), Ottawa.
Mr. W. H. Nichols, jr., M.E. (Nichols Chemical Co.), New York.
Mr. Dan. Smith (Hamilton Powder Co.), Montreal.
Mr. S. P. Franchot (Emerald Phosphate Co.), Buckingham.
Capt. Robt. C. Adams (Anglo-Canadian Phosphate Co.), Montreal.
Mr. A. McNicholl (Gen. Pass. Agent Can. Pac. Railway), Montreal.
Mr. T. Tait (Asst. Gen. Manager Can. Pac. Railway), Montreal.
Mr. W. A. Carlyle, Ba. Sc. (McGill University), Montreal.
Dr. Frank D. Adams (McGill University), Montreal.
Mr. F. C. Innes (Montreal & B.C. Mining and P. Co.), Vancouver.
Mr. C. W. Spencer (Supt. Can. Pac. Railway), Montreal.
Mr. Frank Grundy (Gen. Manager Quebec Central Railway), Montreal.
Mr. W. F. Dean (Can. Gen. Electric Co.), Montreal.
Mr. J. T. Dwyer (Carriere Lane & Co.), Levis.
Prof. B. J. Harrington (McGill University), Montreal.
Mr. Walter Adams, Ba. Sc. (Peto Company), Montreal.
Mr. J. Fraser Torrance, M.E., Montreal.
Mr. F. Cirkel, M.E., Ottawa.
Mr. A. Macdonald, St. John's, Que.
Mr. J. Keith Reid, M.E., Montreal.
Mr. H. Lockwood, Beauce.
Mr. Judge Brooks, Sherbrooke.
Mr. W. S. Gardener (Mach Supply Co.), Montreal.
Dr. A. R. C. Selwyn, C.M.G. (Geol. Survey of Can), Ottawa.
Mr. J. C. Gwilliam, Montreal.
Mr. J. M. Turnbull, Montreal.
Mr. R. A. Gunn, Ba. Sc., Montreal.
Mr. G. F. Burnett, Montreal.
Mr. C. H. Taylor, M.E., Montreal.
Mr. Moses Parker, Montreal.
Mr. W. M. Webb, Montreal.
Mr. R. H. Stewart, Montreal. Mr. R. Green, Montreal.
Mr W. S. Johnstone, Montreal. Mr. J. W. Bell, Montreal.
Mr. W. M. Mussen, Montreal. Mr. R. W. Dougall, Montreal.
Mr. F. Rutherford, Montreal. Mr. H. N. Thompson, Montreal.
Mr. G. Hillary, Montreal. Mr. F. W. Angee, Montreal.
Mr. E. E. Van Barnweld, Montreal. Mr. W. Askwithe, Montreal.
Mr. O. C. Hart, Montreal. Mr. F. Wilkin, Montreal.
Mr. W. E. Archibald (Sec. McGill Mining Soc., Montreal.
Mr. B. T. A. Bell, Editor Can. Mining Review, Ottawa, and others.

The meeting was called to order at eleven o'clock, when the minutes of previous meetings were read and confirmed.

The Secretary's Report.

MR. B. T. A. BELL.—Notwithstanding exceptional commercial and industrial depression which, unfortunately, has not been without effect upon the mineral industries of the Province, it is gratifying to be able to report that the past year has been in many respects one of the most successful in the history of the Association.

The meetings have been well attended, the excursions full of interest and enjoyable in the extreme, while the numerous papers presented cover a wide field and have been instrumental in increasing knowledge of the art of mining and in spreading valuable information respecting the mining industries and mineral resources of the province and of the country.

By the death of Col. Lucke we have again to lament the loss of a popular officer, and one who took a deep and energetic interest in all its affairs. The startling intelligence of the sudden and untimely event was received during the excursion to Cape Breton, and was a sad interruption to the enjoyment of the members. A meeting was convened on board the steamer, and a resolution entered in the minutes recording appreciation of his services, and expressing most tender sympathy with his widow in her bereavement.

At the Sherbrooke meeting, Mr. W. A. Allan, Ottawa, was unanimously elected to the vacant Vice-Presidency.

Meetings were held at Montreal on 11th and 12th January, when four sessions were held: on board the steamer "Bonavista," en route to Cape Breton on the evenings of 6th and 9th July; and at Sherbrooke on 26th and 27th September.

During the year twelve papers were considered, as follows:—

(1) "The Diamond Prospecting Drill in Mining Canadian Apatite and Other Irregular Deposits," by Mr. J. B. Smith, Glen Almond.
(2) "Mine Tunnels and Tunnel Timbering," by Mr. W. A. Carlyle, Montreal.
(3) "Notes on the White Mica Deposits of the Saugenay District, Que.," by Mr. J. Obalski, Quebec.
(4) "On the Igneous Origin of Certain Ore Deposits," by Dr. F. D. Adams, Montreal.
(5) "The Canadian Iron Industry," by Mr. George E. Drummond, Montreal.
(6) "Ore Sampling," by Mr. J. T. Donald, Montreal.
(7) "The Silver Mines of West Kootenay, B.C.," by Mr. E. D. Ingall, M.E., Ottawa.
(8) "Slate: Its Formation, Extraction and Uses," by Mr. Harry Williams, Thetford Mines, Quebec.
(9) "The Magnetic Needle," by Mr. A. W. Elkins, Lennoxville, Que.
(10) "Repairs to Rock Drills," by Mr. A. Sangster, jr., Sherbrooke.
(11) "Chrome Iron: Its Properties, Mode of Occurrence and Uses," by Mr. J. T. Donald, Montreal.
(12) "The Occurrence of Chrome Iron in the Province of Quebec," by Mr. J. Obalski, M.E., Quebec.

As will be seen, these have been presented by three honorary and seven ordinary members, six of whom have contributed before.

A very notable feature of the year has been the interesting character of the excursions held under the auspices of the Association. By kind invitation of Mr. David McKeen, M.P., Resident Manager of the Dominion Coal Co., Ltd., Mr. R. H. Brown, General Manager of the General Mining Association Ltd., and the officers and members of the Mining Society of Nova Scotia, a delightful and instructive holiday was spent in Cape Breton, visiting the collieries and other important features of that beautiful and historic island.

The programme included:—

An excursion by water to the various shipping piers on Sydney Harbor of the Dominion Coal Company, Ltd.

An excursion by special train to the Bridgeport, Dominion No. 1, International and Caledonia Mines of the Dominion Coal Company, Ltd.

An excursion by water to the Old Sydney Mines of the General Mining Association, Ltd.

An excursion by water to the historic port of Louisburg.

A drive to the Coxheath Copper mines.

The members were entertained to a public banquet at Sydney by Mr. David McKeen, M.P., and to a luncheon by Mr. R. H. Brown at his residence at Sydney Mines.

The cordiality of the reception accorded to the Association by the officers of the various companies and the local authorities was such as is likely to be long remembered by those members who were present. The local committee, comprising Mr. McKeen, Mr. Brown, Mr. Blakemore and Mr. Archibald, made the most thoughtful, complete and satisfactory arrangements for the comfort and entertainment of our party, and special acknowledgment is due to them and to Messrs. Kingman Brown & Co., agents of the Black Diamond Line, for special rates and excellent accommodation provided for the round trip on their steamer "Bonavista."

The Autumn Meeting was held at Sherbrooke in September last, for the second time in the history of the Association, and was one of the most successful, alike as regards attendance, the number and importance of the papers and the thoroughly enjoyable character of the excursions. At Capelton our members inspected the extensive underground works of the famous Eustis Mine, and were entertained with characteristic hospitality by our esteemed President and his good lady, Mrs. Blue.

Our hearty acknowledgment is also due to Mr. Frank Grundy, General Manager of the Quebec Central Railway, for his courtesy in placing a special train at the disposal of the members for the excursion on the following day to the Dudswell Quarries and the chromic iron and asbestos mines on the line of his railway. A thoroughly enjoyable evening at the hospitable residence of the Hon. W. B. Ives, Q.C., M.P., where the members were entertained to dinner, concluded the proceedings of this meeting.

The question of consolidating the existing Mining Societies into an united organization was discussed at our last annual meeting, but inasmuch as the mineral rights are vested in the local governments and mining is carried on in the Provinces under widely different conditions and laws, it was thought advisable to preserve the autonomy of the Societies as they now exist, and a proposition to federate was substituted. The objects in view were three-fold:—

(*a*) Economy in publication.

(*b*) The consideration of such matters affecting or relating to the mining industries of the Dominion as might be within the jurisdiction of such an organization.

(*c*) The holding of a United Meeting once a year.

Mr. F. A. Halsey and the Secretary were delegated a committee to bring the matter before the Mining Society of Nova Scotia, and this was done at the annual meeting of that organization in March, when it was referred to a committee to report at a later meeting.

In the following April, the Ontario Mining Institute, a representative organization of the mineral interests of that Province, was formed, and on the question being submitted to it, federation was endorsed and a committee appointed to co-operate with the other Societies in drafting a scheme. The desirability of the step was further agreed upon at a united meeting of the members of all three Societies held at Sydney, Cape Breton, in July. As the outcome of further discussion at our Sherbrooke meeting, a committee comprising the President, Messrs. F. A. Halsey, L. A. Klein and the Secretary, drafted a scheme which, with minor changes, was approved by the Ontario Committee. Both reports were then submitted to the Mining Society and considered at a meeting in November, when certain radical amendments were introduced which it will be the duty of this meeting to consider.

Early in the year a complete volume of the transactions for the years 1891-92-93 was issued to members, and the heavy cost of this publication has been a serious drain upon our finances. The Hon. E. J. Flynn, Commissioner of Crown Lands, with commendable enterprise and foresight, purchased fifty copies for distribution

among the principal mining institutions and Public Libraries of Europe and the United States, where it is hoped the information will bear fruit in directing attention to our mineral resources and mining industries. Copies were also purchased by the Hon. W. B. Ives, President of the Privy Council, and the Hon. T. M. Daly, Minister of the Interior. The revenue from these sources was of great assistance.

In view of the importance to the country of a thorough education of Canadian students in mining and metallurgy, the establishment of a course of mining engineering and the magnificent equipment of the Science Departments of McGill College have been a source of gratification to every one interested in Canadian mineral development. With the object of placing such advantages as the Association may offer, within easy reach of the students attending these classes, there has been some correspondence respecting a student membership, or as an alternative, the affiliation of the McGill Mining Society, and a proposition will be submitted for the approval of the members at this sessions It has also occurred to me that our appreciation of the good work that is being accomplished might take a still more practical form if we offered a medal or a money prize for annual competition among the students for contributions from them to our proceedings.

The Mining Act, the law respecting the storage of powder, and the question of the free importation of mining machinery, subjects that occupied considerable prominence in the operations of the Association in previous years, having all been adjusted more or less to the satisfaction of the Association, there was no action on matters of legislation during the year.

The following comparative statement of the affairs of the Association since its organization to date, is respectfully submitted:—

MEMBERSHIP.

	Active.	Hon.	Total.	New.	Resigned.	Dead.
1891—	52	5	57	--	—	—
1892—	46	5	51	7	12	2
1893—	76	13	89	36	5	1
1894—	78	20	98	18	15	1

	Meetings.	Papers.	Deputations.	Excursions.
1891—	4	7	2	—
1892—	3	8	3	1
1893—	6	22	2	2
1894—	3	12	—	3

	Receipts.			Disbursements.		
	Ordinary.	Special.	Total.	Ordinary.	Special.	Total.
1891—	$510 00	—	$510 00	$311 20	—	$311 20
1892—	618 80	—	618 80	402 38	—	402 38
1893—	906 42	$1,500	2,406 42	726 19	$1,543 36	2,269 55
1894—	650 00	482	1,268 87	1,291 22	--	1,291 22

	Balance Credit.	Balance Debit.
1891—	$198 80	— —
1892—	216 42	——
1893—	136 87	——
1894—	--	$22 35

Financial Statement.

MR. A. W. STEVENSON submitted balance sheet for the year, showing the income received to have been $1,268.87, with a number of members' subscriptions outstanding. The expenditure included:—Printing, $655.88; engraving, $41; Secretary's grant, $150; Secretary's disbursements and expenses, $197.56; Treasurer's disbursements, $58.45; stenographing, $71.90; dinners and luncheons, $106.43; or a total outlay of $1,291.22. The amount charged to engraving was properly chargeable to current year, and when all outstandings were collected there would be a fair balance in favor of the Association.

THE PRESIDENT—Considering that we have had an unusually heavy disbursement on account of printing, the Treasurer's statement is very satisfactory.

Both reports were then adopted.

Student Membership.

On motion of the Secretary a new clause, among others, was inserted in the Constitution, as follows:—

"Student members shall be persons who are qualifying themselves for the profession of mining, metallurgical or mechanical engineering, or other branch of engineering, and such persons may continue student members until they attain the age of twenty-five years. They shall have notice of, and the privilege of attending, all meetings and excursions, and shall have all the privileges of the Association except voting.

"Student members shall pay an annual fee of one dollar."

Medals to Students.

A clause was also inserted whereby power was given to award annually a sum not to exceed fifty dollars, in the form of medals, or other awards, to student members, for original papers contributed to the proceedings of the Association.

New Members.

The following were elected active members:

Mr. H. A. Budden (Intercolonial Coal Co.), Montreal.
Mr. Huntley Drummond (Cumberland Ry. & Coal Co.), Montreal.
Mr. F. A. Routh (Carbray & Routh), Montreal.
Mr. T. B. Brown (Kingman, Brown & Co.), Montreal.
Mr. N. A. Belcourt, Q.C. (Wallingford Mica Co.), Ottawa.
Mr. T. F. Nellis (Vavassour Mining Association), Ottawa.
Mr. G. L. Burritt (Ingersoll Rock Drill Co.), Montreal.
Mr. Walter Fleming (Reddaway & Co.), Montreal.
Mr. Louis Gendreau, Jersey Mills, Que.
Mr. D. D. Mann (Victoria Hydraulic Gold Co.), Montreal.
Mr. J. M. Browning (Horsefly Hydraulic Mg. Co.), Montreal.
Mr. C. Berkely Powell, Ottawa.
Mr. C. H. Taylor, M.E., Montreal.
Mr. J. S. Palmer, Sherbrooke.
Mr. F. C. Innes, Vancouver.
Mr. Thos. Drummond, M.E., Montreal.
Mr. G. H. Bradford, Sherbrooke.
Mr. W F. Dean (Can. General Electric Co.), Montreal.
Mr. J. T. Dwyer (Carriere Laine & Co.), Montreal.
Mr. W. H. Nichols, jr., M.E., New York.
Mr. Moses Parker, Montreal.
Mr. Louis Chouillou, Montreal.
Mr. G. F. Burnett, Montreal.

Student Members.

The following were elected student members:—

Mr. R. A. Gunn, Ba. Sc., Montreal.
Mr. J. C. Gwilliam, "
Mr. W. M. Webb, "
Mr. R. H. Stewart, "
Mr. W. S. Johnstone, "
Mr. W. M. Mussen, "
Mr. O. C. Hart, "
Mr. F. Rutherford, "
Mr. G. Hillary, "
Mr. E. E. Van Barnweld, "
Mr. O. C. Bart, "
Mr. R. Green, "
Mr. J. W. Bell, "
Mr. R. W. Dougall, "
Mr. H. N. Thompson, "
Mr. F. W. Angel, "
Mr. W. Askwith, "
Mr. F. Wilkin, "
Mr. W. E. Archibald, "

Election of Officers and Council, 1895.

PRESIDENT:

Mr. John Blue, C. & M.E. (Eustis Mining Co.), Capelton.

VICE PRESIDENTS:

Capt. Robt. C. Adams (Anglo-Canadian Phosphate Co.), Montreal.
Mr. S. P. Franchot (Emerald Phosphate Co.), Buckingham.
Mr. G. E. Drummond (Canada Iron Furnace Co.), Montreal.
Mr. F. P. Buck (Dominion Lime Co.) Sherbrooke.

TREASURER:

Mr. A. W. Stevenson, C.G., Montreal.

SECRETARY:

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

COUNCIL:

Mr. Jas. King, M.P.P. (King Bros.), Quebec.
Mr. L. A. Klein (American Asbestos Co.), Black Lake.
Mr. John J. Penhale (United Asbestos Co.), Black Lake.
Mr. George R. Smith (Bell's Asbestos Co.), Thetford Mines.
Mr. H. A. Budden (Intercolonial Coal Co.), Montreal.
Mr. J. S. Mitchell (Beaver Asbestos Co.), Sherbrooke.
Mr. J. Burley Smith (British Phosphate Co.), Glen Almond.
Mr. C. H. Carriere (Carriere, Lainé & Co.), Levis.
Mr. R. P. Hopper (Anglo-Canadian Asbestos Co), Montreal.

Federation.

The Council having considered the report of the Mining Society of Nova Scotia, on the question of a federation of existing Canadian mining societies, reported the following recommendations:

Governing Board.

(*a*) That the clause "The qualification for full membership shall be an annual fee of ten dollars, etc.," be deleted.

(*b*) Be changed to read: "The Council shall elect a Chairman and a Secretary-Treasurer each year, the latter to receive such remuneration as may be determined by the Council."

Subscription.

Be amended to read: "The Societies in the federation shall each pay an annual subscription towards the expenses of the Institute, of such an amount as may be determined upon at each annual meeting; but the contribution from each Society shall at no time exceed in amount the sum of three dollars *per capita*."

Publications.

Be amended to read: "Publications of the Institute shall be supplied only to members in good standing in their respective Societies, one copy to each member, and the balance shall be sold by the Council at such prices as may be determined.

"Contributors of papers shall be entitled to 20 copies of a reprint of any paper presented by them and published by the Institute.

"Copies of the Proceedings sent for exchange shall be accompanied with a request for such exchange for each society in the Federation."

The Secretary reported that these recommendations would receive the indorsation of the Ontario Mining Institute.

On motion, the suggested amendments were unanimously agreed to, and the Secretary was instructed to forward them to the Mining Society of Nova Scotia for reconsideration.

The meeting adjourned at one p.m.

Afternoon Session.—Notes and Statistics respecting the Mineral Industries of the Province of Quebec during the Year 1894.

The members reassembled at two p.m., the President in the chair. The hall, as at the morning session, was crowded. The first item was the consideration of a series of reports on the mineral industries during the year.

Notes on the Pig Iron Trade of 1894.

MR. G. E. DRUMMOND.—The year 1894 is not likely to go down to history as a year of unparalleled success in the iron trade of the world. In common

with nearly all other leading industries, that of iron has been working on "rough ground." In the United States, now the leading iron market of the world, the shadow of the panic year of 1893 seems to have darkened every avenue of Trade and Commerce, and not least of all the Iron industry. The exhaustion, following on so severe a shock, of itself prevented any very rapid recuperation at the commencement of the year. At the commencement of 1894 the outlook was gloomy enough, and as the year wore on it brought with it a long series of troubles calculated to prevent reviving confidence and enterprise.

Among the difficulties referred to, the depletion in the government gold reserve, beginning in January, led to enormous issues of bonds, which of course went to prolong the season of depression. Then the coal and railway strikes, and finally the great uncertainty of the tariff question. This combination of adverse circumstances all tended to bring about an unparalleled shrinkage in values, effecting everything in the iron line, from the raw material to finished product, and of course served to restrict the purchasing ability of the people.

New and economic methods of production were introduced wherever capital permitted, but withal the work from the first has been unprofitable to capital and labor. Many works have been kept in operation simply to keep the men employed, even if at what a year or two ago would be called "starvation wages."

Despite all this the feeling of hopefulness has never died out, and for instance, at the close of the year the output of pig iron in several districts reported, shows an increase over the production of 1893, with many more furnaces in operation.

There is a more hopeful feeling abroad, brought about in a great measure by the result of the recent elections in the United States, and 1895 opens with numerous enquiries from consumers, who are not unlikely to be good buyers in the near future. While the experience of the last two years in the iron trade; and in fact in all other trades in the United States has not been a pleasant one, yet the enforced "breathing spell" is not unlikely to prove a blessing in disguise. Great economy has been practiced in all branches of trade, and this must result in good. For instance, the railway companies have been so economical that their rolling stock has run down to a great extent, and they must very soon come into the market as large buyers. When they do, the whole tone of the iron trade will be strengthened, and it is hoped that capital and labor will be able to earn at least a fair return.

The course of the British iron market during 1894 was marked by the great strike among the Scotch coal miners, which lasted for several months, beginning in July and not coming to an end before October. It appears to have been altogether uncalled for, and did not awaken the public sympathy as did the English coal strike of the previous year. The result, however, was that the Scotch iron trade was brought almost to a standstill while it lasted, and it will be a long time before the loss of trade can be made up. For over three months hardly a furnace was in blast in Scotland, but owing to the fact that the great proportion of the foundries, rolling mills, and other consumers of pig iron were also idle for want of coal, the local demand for iron was light, and prices did not advance to any appreciable extent. Warrants remained stationary about 42/- to 43/- and the closing price on 31st December was close on 42/-. The effect, however, on special or shipping brands of iron was to advance the price of these about 5/- to 7/6 per ton, owing to their scarcity. No. 1 "Summerlee" was sold as high as 58/6 in Glasgow, the highest point it has touched for the past two years. Several brands were entirely unobtainable. It shows that the Scotch market no longer controls the iron trade of the world, for such a scarcity happening ten or twenty years ago would have sent prices up to an alarming extent. As it was, however, the production and consumption of iron for 1894 shows a large decrease on the previous year, the figures being as follows:—

Official returns show that the Scotch pig iron production

in 1894 was	655,614 tons,
as against in 1893	785,867 "
a decrease of	128,253 tons.

The consumption also shows a decrease, and whilst taking all British made iron into calculation, the consumption only fell 41,657 tons behind that of 1893, yet the decrease in the consumption of Scotch iron, owing probably to the strikes and consequent high prices of coal, was 125,657 tons.

STOCKS.—At the close of 1894 the stock in Connell's store

amounted to	287,886 tons,
as against in 1893	320,851 "
a decrease of	32,965 tons.
Stock in makers hands at the close of 1894	70,713 tons,
as against at the close of 1893	60,936 "
an increase of	9,777 tons.

English irons, that is those made in the Middlesboro district, remain almost unchanged, and a large quantity finds its way into Scotland.

Bar iron and manufactures of mild steel, such as plates, angles, etc., have remained practically unchanged during the year, but owing to the quiet state of trade, prices closed a few shillings lower than the opening figure of the year. The change that has come over the trade in these goods is very marked. A few years ago almost the entire requirements of the country in mild steel, and all the bar iron that was not produced in this country, came from Great Britain. During the year just ended the importations of these goods from Great Britain were practically nothing. Prices on the American side have been forced down, by keen competition, to such an extent that all the steel plates, and the great proportion of the angles and other shapes now come from Pittsburgh, at prices which the English manufacturer cannot touch.

CONTINENTAL IRON TRADE.

The same general features of restricted production and consumption, brought about by the depression in trade, obtains in the iron markets of Germany, Sweden, France and Belgium, with the exception that the returns from Belgium evidence an increase in the output, although the consumption has been unsatisfactory.

CANADA.

In sympathy with the condition of the iron trade elsewhere, the Canadian iron industry has felt the depression in some degree. The battle over the tariff question that was fought at Ottawa throughout the winter months, and had the effect of retarding the progress of the industry, and it may be safely claimed that the first half of the year was, to a certain extent, lost in uncertainty.

Happily the Dominion Government decided that the industry should be encouraged. This restored confidence, and the iron masters took up the work promptly. The effects, however, of the depression in the United States had a very marked effect on the trade of the last six months of 1894. The overstocks of the American iron furnaces were thrown into the Canadian market, and American pig iron found its way as far east as Montreal, at prices that, under ordinary circumstances, would be quite impossible, and that certainly did not return any profit to the American manufacturer. In many cases the bankrupt stocks held by American banks were thus unloaded, presenting a formidable competition to Canadian iron masters. Aside from this, the general depression affected the largest consumers in Canada, such as the railways, and the consumption fell short of the ordinary requirements.

Under the existing circumstances and compared with the state of the trade in the United States, Great Britain, and elsewhere, the Canadian iron industry has made very good progress in 1894, at least demonstrating that those now interested in the manufacture of iron have thrown themselves heartily into the work of development, even under most adverse circumstances.

In Nova Scotia, the New Glasgow Iron, Coal and Railway Co. have kept their furnace in full blast from the beginning of the year, and their record of output for 1894 will quite likely equal (if it does not surpass) that of 1893. The affiliated company, the Nova Scotia Steel Co., has gone on steadily extending their operations in the steel department.

The Londonderry Co. who seek their principal market for pig iron in Ontario, have perhaps felt the American competition more keenly than the New Glasgow Co. but they have done comparatively well for the times.

The Picton Charcoal Iron Co. at Bridgeville, were in operation for several months of the year, and although closed down at the present moment, will show a fair output.

The same applies to the work at Drummondville in the province of Quebec.

At Radnor Forges, the operations of the Canada Iron Furnace Co. in all its branches, will surpass the record of 1893. In the charcoal iron department the output is practically the same as last year.

In August last, the company after a continuous campaign of nearly two years, found it necessary to shut down for relining of the furnace, and the campaign for 1894 was from this and similar causes, reduced to a period of a little over nine months. In this nine months the company produced of high class

Charcoal Iron	7178	660/2240 net tons.
Ore made	15,866	1033/2240 "
Charcoal	663,269½	bushels.
Cordwood	23,363½	cords.

An average of some 650 men and 300 horses were employed throughout the year in the fields and at the works.

The work of prospecting has been carried on vigorously as in the past, and the ore fields extended and perfected over a very large territory.

The company has found competition very keen during the year, but the high quality of their iron has commanded a steady market for it. The auxiliary businesses in connection with the company have all shewn progress, and the value of the industry to the province, and especially to the farming community, has been more than ever demonstrated.

ONTARIO.

Aside from the difficulties experienced by Canadian iron masters in meeting the panic prices of their American rivals, another grave difficulty has recently arisen by the passage at Ottawa of an Order-in-Council, 2nd Nov. 1894, entitled, "Re-drawbacks on import goods used in Canadian manufactured articles, and exported." This Order-in-Council was passed with a view of encouraging the exportation of agricultural implements to foreign markets. The principle of encouragement was perfectly correct but the way in which the enactment is framed, and the manner in which it works, are most detrimental to the development of the Canadian iron industry, in its broadest sense.

As it stands to-day, it obliges Canadian consumers to use foreign raw material before they can avail themselves of the encouragement offered by the government, and it bars out altogether the use of Canadian raw material. A striking illustration of this was given a few weeks ago, when a Western plow manufacturer wrote to one of the iron furnace companies, and said that much as he desired to use Canadian material at competitive prices with those of American, yet, inasmuch as he exported largely to Australia and Great Britain, he was compelled to use American iron and steel, so as to take advantage of rebates from the Dominion Government.

Another Canadian manufacturer when absent from home recently, received a letter from his house reading somewhat as follows:—

"We beg to advise having just received an order for plows for shipment to Australia. The shipment must be made by outgoing steamer, and we deeply regret that we have been compelled to use Canadian steel, as we have no American steel in stock, hence we must sacrifice the ordinary rebate."

In the United States things are done somewhat differently. Manufacturers of agricultural implements are entitled to rebates equivalent to what the duty would be had they imported the raw material used in their machines, but they are left entirely free to use American raw material, and as a matter of fact they do so in almost every case.

It is quite evident that the manner in which the Dominion Order-in-Council was drawn up, and is now being acted upon, is merely an error, but it is one that should be rectified immediately, as it simply serves to nullify the protection and encouragement to the Canadian iron industry granted by the Dominion Government itself at the last Session of Parliament.

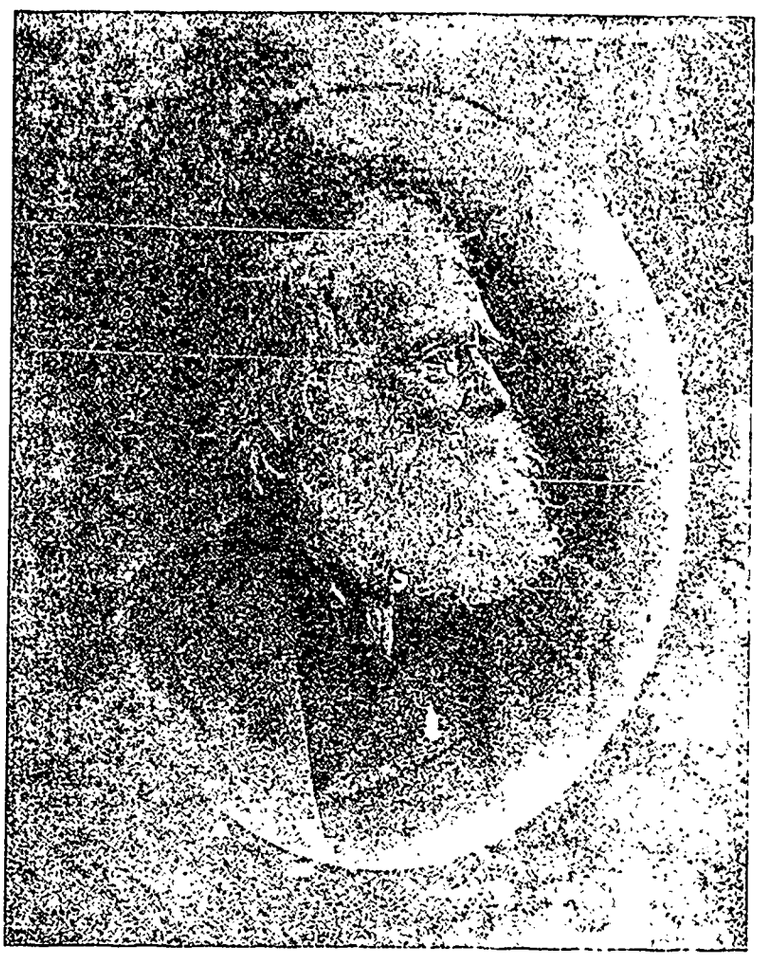
It is quite evident that so long as the Order-in-Council referred to remains as it is to-day, and the present condition of the American iron market exists, Ontario agricultural implement manufacturers will prefer to confine their purchases to American iron and steel, so that they will be relieved from the trouble and annoyance of locating specific importations of iron and steel necessary in making out papers calling for the rebate of duties.

Among other important legislative enactments of the year is one passed by the Liberal Government of Ontario, and which reflects great credit on the wisdom of the legislators of that Province. For some time back the Ontario Government have been making a very full investigation as to the importance of the pig iron industry in the proper development of the mineral wealth of the province. Their investigation has finally culminated in the passage of an Act, now in the Statute Books of Ontario, entitled, "An act relating to mines and mining lands," by which Ontario appropriates the sum of $125,000 to aid miners and producers of iron ore, in developing the ore deposits of that province.

Clause 12 of the said Act authorizes the Treasurer of the province to pay out to miners, or producers of ore, upon all ores which shall be raised or mined, and smelted in that province, for a period of five years from 1st July, 1894, the equivalent of $1.00 per ton on the pig metal products of such ore, this to a maximum amount of $25,000 per annum.

In better times the effect of this Act would likely have been ere this the formation of companies for the erection of several furnaces in Ontario. As it is, a coke furnace of large capacity is now being erected at Hamilton, Ont., and it is expected that it will be in blast during the ensuing summer. Other furnaces are talked about, and there is not the slightest doubt but that Ontario, hitherto so dilatory about developing one of the greatest natural wealths that she possesses, will very shortly, under such wise legislation as the Act referred to, come to the front in the manufacture of iron in Canada.

Geological Survey of Canada.



The late Sir Wm. E. Logan,

Director 1843 to 1869.

It will be in the best interests of Quebec if our legislators will meet the action of Ontario promptly, and not only preserve to this province the credit of having been the first iron producer, but to-day the largest producer of high class charcoal iron within the limits of the Dominion.

Quebec possesses such a great wealth of the very highest class of ores, and wood necessary for the manufacture of charcoal, that it only remains for her government and people to give the industry every sympathy, and at least give the same support as that offered by her sister province Ontario.

Copper Pyrites.

THE PRESIDENT—The mining of Copper Pyrites in the Province of Quebec for the year 1894 has been confined to the Township of Ascot, in the County of Sherbrooke. All the Pyrites mined was utilized for manufacturing acids in the first place, the copper and silver contents being subsequently extracted.

The quantity mined for the year amounted to	35,560 tons.
Of this quantity there were exported to different points in the United States	27,965 "
And consumed in Canada	7,000 "

The market for the product of these mines has been very depressed during the year, and prices very low in consequence. At the present time, with better demand and increased consumption, better prices are being realized.

The Asbestos Industry, 1894.

MR. JOHN J. PENHALE (United Asbestos Co.)—The production of asbestos for the year 1894 has been approximately 8,600 tons. These figures indicate a very marked increase over the previous year; and the shipments from the mines show that the demand for crude is very much better than it has been at any time for the last three years.

During the year just closed, the total shipments from the mines on the line of the Quebec Central Railway have run up to 7,318 tons, being only exceeded in the year 1891, when 7,774 tons were sent away.

The figures of shipments sent, do not include the shipments from the Jeffrey mine at Danville, but their output is included in the total given above.

Eight companies have been engaged in the mining of asbestos in 1894—four at Thetford Mines, viz.:—King Bros., Bell's Asbestos Co., Johnson's Asbestos Co., and the Beaver Asbestos Co. At Black Lake, the American Asbestos Co, the United Asbestos Co., the Anglo-Canadian Asbestos Co., and at Danville, P.Q., the Jeffrey Mine. Employing in all about eight hundred men and boys.

About 1,000 tons have been sent to the United States, and the balance to various European points.

The principal points of shipment in the United States are: New York, Erie, Pa., and Baldwinsville, Mass. In Europe, London, Rotterdam, Genoa, Hamburg, and Glasgow.

Very little has been manufactured in this country, there being only one firm engaged in the business, viz., M. B. Berry, of Quebec; and the record of shipments show only twelve tons sent to that place.

This, however, does not mean that only twelve tons have been used, as I am in a position to know that Mr. Berry had a considerable stock of crude on hand.

The demand for crude asbestos during the year has been fair, but the prices realised have not been up to former years—'90 and '91.

All shipments have gone direct to the manufacturers, and not as in previous years, to dealers and brokers.

Miners too have adopted the plan of mining only the quantity required to fill their contracts, so there is not now the danger of overstocking the market that there was three or four years ago at the time of the "boom."

On the whole, the past year has been a very successful one in this branch of the mining industry of the Province.

A rough estimate of the value of the production would be $516,000. This, however, may be too high.

The annual report, "Mineral Statistics and Mines," for 1892, just issued by the Geological Survey, places the production of asbestos from 1882 to 1892, inclusive, at 49,161 tons.

The record of actual shipments, via Quebec Central Railway for that period is 36,630 tons, or a slight difference of 12,531 tons in favor of the Geological Survey. I am aware that these figures are compiled from returns sent in by mine operators: but it shows at once how little reliance can be placed on reports from the Geological Survey Dept., and would give anyone unacquainted with the facts the impression that the asbestos miners were carrying a stock of 12,000 tons of crude asbestos in their sheds at that time, an impression that might do considerable injury to the market, and have a tendency to knock down prices.

Coal Imports by Rail and Water.

MR. B. T. A. BELL—The importation of bituminous coal into the Province of Quebec is of so great importance that no mineral statistics would be complete without its figures. The following returns have been compiled with the greatest care, at first hand, and are as authentic as it is possible to make them:

CARRIED BY WATER.

a) From Canadian Collieries—

General Mining Assn., Ltd., Cape Breton	109,351 tons.	
Dominion Coal Co., Ltd., "	544,953 "	
Intercolonial Coal Co., Ltd., Pictou County	80,587 "	
Cape Breton Colliery, Cape Breton	500 "	
Total water imports, 1894		735,791 tons

During the season of 1894 this trade employed 363 cargoes, 49 steamers, 18 sailing vessels and two barges, and distributed on account of labor $369,688; on wharfage, $55,586; Pilots, $55,333.

CARRIED BY RAIL.

Intercolonial Coal Co., Ltd., Pictou County	100 tons.	
Canada Coals & Rail. Co., Ltd. Cumberland County	15,800 "	
Cumberland Ry. & Coal Co., Ltd., Cumberland Cty.	98,913 "	
Acadia Coal Co., Ltd., Pictou County	5,000 "	
Total carried by rail		119,813 tons

CARRIED BY WATER.

From Foreign Collieries—

English, Scotch, Welsh and American (St. Lawrence)	73,658 tons	
American bituminous (Canals, &c.), estimated	10,000 "	
Total foreign by water		83,658 tons

CARRIED BY RAIL.

American bituminous, about	1,000 tons	
Total rail bituminous		1,000 tons
Or a total import of bituminous coal in 1894 of		940,262 tons

RECAPITULATION.

Canadian by water	735,791 tons	
" rail	119,813 "	
		855,604 tons
Foreign by water, about	83,658 "	
" rail, about	1,000 "	
		84,658 tons
Total importation of		940,262 tons

ST. LAWRENCE DELIVERIES, 1893-1894.

PORT OF MONTREAL.

	1893.	1894.	Increase.
Canadian coal	613,279	655,779	42,500 tons.
Foreign coal	36,074	55,849	
Total—	649,353	711,628	62 275 tons.

PORT OF SOREL.

			Decrease.
Canadian	16,685	11,636	5,049 "
Foreign	1,528	1,932	
Total—	18,213	13,568	4,645 "

PORT OF THREE RIVERS.

			Increase.
Canadian	9,218	9,481	263 "
Foreign	nil	nil	
Total—	9,218	9,481	263 "

PORT OF QUEBEC.

Canadian	51,587	46,559	Dec. 5,028 "
Foreign	9,520	15,877	
Total—	61,107	62,436	Inc. 1,329 "

GRAND TOTAL.

			Increase.
Canadian	590,769	723,455	132,680 "
Foreign	47,122	73,658	26,536 "
Total—	637,891	797,113	159,222 "

Gold Mining.

MR. E. B. HAYCOCK—In the County of Beauce there has been very little mining doing this season, 1894.

On the Gilbert River, litigation and the want of a quiet title has much delayed mining. The American Gold Mining Co., under Mr. Fernando Wadsworth's management, ground-sluiced a large piece ready for sluicing. A few men did a little sluicing; the returns gave from $48 to $76 per day. I understand Mr. Wadsworth will push the work next season.

Although the Ditton secton has proved rich in gold, little or no mining has been done. This is a section well worth looking into; a good field for prospectors. I have no doubt the veins from which the gold is derived will be found in close proximity to the alluvial.

A little prospecting on the Du Loup and Chaudiere was done during this season, and it is being carried on with more or less success.

The Mica Industry.

MR. B. T. A. BELL.—The United States being the principal consumer of Canadian Mica, the industrial depression which has existed in that country resulted in an almost complete collapse of our mica trade during the first half of the year, the official returns for the fiscal year ended 30th June, giving only an export value of $26,553 as against $96,900 in 1893. During these periods the distribution of the product was as follows:

	1893.	1894.
To United States	$86,871.	$26,484.
" Great Britain	10,024.	58.
" Germany	5.	11.
Total	$96,900.	$26,553.

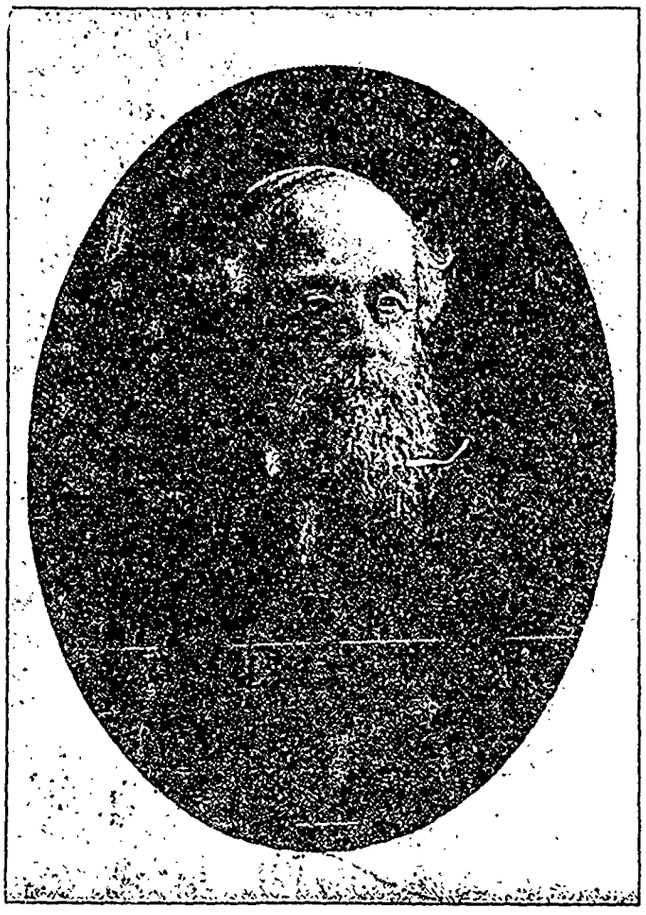
Towards the end of the season the demand increased very notably and mining was actively carried on at a number of the mines. The companies and operators were as follows:

Vavassour Mining Association	in	the Township of	Hull.
Lake Girard Mica Mining System	"	"	Templeton.
Wallingford Bros., & Co.	"	"	Templeton.
Cascades Mica Mine	"	"	Hull.
The Blackburn Mine	"	"	Templeton.
Beaver Lake Mines	"	"	Saugenay District.
Hayes Mica Mine	"	"	Murray Bay.
McGie Mine	"	"	Saugenay District.
Goldering Mine	"	"	Templeton.

The total production in the Province of Quebec from returns kindly furnished by the operators being about 400 tons, employment being given to about 150 persons.

The quantity exported for the calendar year from figures kindly furnished by the customs' officials was as follows:

Geological Survey of Canada.



Dr. A. R. C. Selwyn, C.M.G., Etc.,

Director 1869 to 1895.

Port of Ottawa	..$22,765.
" Montreal.....	4,347.
" Quebec	120.
Total exports to 31st Dec. '94.....	$27,232.

During the year the Canadian Mica Co., Ltd., was registered in London Eng., with an authorized capital of £90,000, to engage in mica mining in Canada. The Beaver Lake, Hayes & Perkins properties were purchased and work, we are told, is to be conducted on a large scale during the coming season.

The following is a comparative statement compiled from the trade and navigation returns showing the exports and distribution of Canadian mica from 30th June 1890 to 30th June 1894.

EXPORTED TO	1890.	1891.	1892.	1893.	1894.
United States	$26,865 00	$21,762.00	$67,238.00	$86,871.00	$26,484.00
Great Britain	42.00	550.00		10,024.00	58.00
Newfoundland.....	25.00		25.00		
Germany			480.00	5.00	11.00
	$26,932.00	$22,312.00	$67,743.00	$96,900.00	$26,553.00

PHOSPHATE MINING IN QUEBEC.

MR. B. T. A BELL.—Extreme stagnation in the European Fertilizer market together with competition from other and cheaper sources of supply have almost obliterated the mining of Canadian phosphates and the production of this mineral has been reduced from 31,758 tons in 1890 to about 9,000 tons. The exports of the year were to: —

Great Britain.	United States.	Canada.	Total.
3,239 tons.	2,000 tons.	700 tons.	5,993 tons.

Prices have fallen from 16½ d. per unit for 80 in 1890 to 7d. in 1894 equal to $8.74 Montreal F.O.B. and $6.88 Buckingham. In 1890 the lower grades brought as follows:- 75% 13d; 70% 12 d; 60% 9 d., while in 1894 70% realized 6 d. per mint equal to $3.70 per ton Buckingham and 60% $3.00 per ton unground Buckingham. The companies who did any business during the year were the Phosphate of Lime Co., at High Rock; the British Phosphate Co., at Glenalmond; the Lake Girard Mica System, at Templeton; and the Dominion Phosphate Co., at the North Star, the whole of whose shipments were to Capelton, for use in the manufacture of superphosphate.

While this industry may be considered in a state of complete collapse and old time activity may not be resumed in the immediate future, the outlook is not without hope. The expansion of the phosphate business in Europe goes on uninterruptedly, and one would be rash to predict that the end of the century will not find us nearly abreast of supply, if we do not overlap it. Mr. David Boyd, a Glasgow authority, writing in the American *Fertilizer* says:

"Besides the gregarious follow-my-leader element in the increase of the use of new fertilizers, it has been wonderfully stimulated by the abnormally low prices of rock which have now ruled for some time. The experience of the past 25 years is likely to hold good again—every cycle of low prices is succeeded by a stronger reflex current, which affects a much larger area, and does its best to make the ends of supply and demand meet but not overlap. Such confidence in the future may appear a little extravagant, in view of the enormous amount of rock now being mined on both sides of the Atlantic, but "enormous" is really a relative quantity, and the chances are that, while that word may be correct for to-day, it will have a totally different meaning when viewed from the standpoint of 1900. So long as money is abundant and cheap, so long will the enterprise representing lasting industries find favor, even if these for a time tax the patience of investors for adequate returns."

The world must have phosphate; Canada possesses the highest quality known, scattered over a wide area; human ingenuity will surely devise means to make these deposits available for the world's needs. Even though at present there may in some cases be disappointment in the result of phosphate enterprises, as there will be in all mining ventures, we may feel assured that a great and prosperous future awaits the Canadian industry, and that it is destined to fulfil an important part in the economic development of the country.

Canada is an immense wheat growing country, but as yet it uses only a few hundred tons of fertilizers per annum. This cannot continue and the example of other countries must be imitated. Prof. H. W. Wiley points out that 19 lbs. per acre of phosphoric acid are absorbed by grain and 12½ lbs. per acre are absorbed annually by the grass crop. The cereals and grass crop of Canada extract from the soil (*Annual Report, Minister of Agriculture, 1893*), 235 million pounds of phosphoric acid, equal to 117,972 tons of 2000 pounds. Supposing one-half only to be returned to the soil in the stable manure, there is still left a deficit of 59,000 tons of phosphoric acid. The percentage of phosphoric acid in Canadian apatite is stated to be about 33 per cent. Taking this as a fair average the requirement for the production of the needed quantity of phosphoric acid to be restored to the soil would be about 177,000 short tons of apatite. There are extensive mines and workable deposits of pyrites in Quebec and in Ontario containing 40 to 45% of sulphur suitable for the manufacture of sulphuric acid Indeed at the Nichols Chemical Works at Capleton an important industry in the manufacture of chemicals and superphosphates has already sprung up and is expanding. The older portions of Canada which formerly raised vast quantities of grain have been allowed literally 'to go to grass,' but the knowledge of the use of mineral manures rightly applied will redeem the land from barrenness. It is therefore the duty of our Departments of Agriculture and Experimental Farms and those interested in the future of this industry to spread this information among the farming community, and by the establishment of fertilizing works continue the industry and enrich themselves and the province and the country.

CHROMIC IRON PRODUCTION.

MR. B. T. A. BELL.—The latest addition to the mineral industries of Quebec and one of some importance in consequence of the comparative scarcity of the mineral and its utility in the arts and industries has been the development of valuable areas containing chromic iron of excellent quality at Coleraine and Thetford, on the line of the Quebec Central Ry.

The occurrence, character, uses and methods of working this mineral have been so fully described in the papers by Messrs. Obalski and Donald at the Sherbrooke meeting, that it will be only necessary to supplement their data with such information as has been obtainable respecting the output and shipment of the mineral.

A statement furnished by Dr. Reed, of Reedsdale, an owner of a number of the areas worked, shows the following production:—

Jos. Lamelin, working six months, 20 acres. Lot 10 Coleraine, 350 tons, royalty $5.00 per ton to Dr. Reed.

W. H. Lambly & Co., working six months, 28 acres in Coleraine, on lease from the Coleraine Mining Co., 700 tons.

Frechette & Co., working two months, 28 acres under lease from Coleraine Mining Co., 100 tons.

D. Wilson & Co., working on royalty lands of Dr. Reed, in the Tp of Coleraine, two months, 25 tons.

Fortier & Co. Tp of Coleraine. Royalty. Dr. Reed. 1 month, 20 tons.

Lemieux & Co. Tp of Coleraine. Royalty. Dr. Reed. 1 month, 25 tons.

Leonard & Morris, Little Lake St. Francis, six months, 500 tons.

The Anglo Canadian Asbestos Co. Tp of Coleraine, about 20 tons for two months. A total production for the year of 1740 tons, of which 801 tons were shipped, as per returns kindly furnished by the Quebec Central Railway.

DR. REED again called attention to differences in the buyers and sellers analyses of shipments, and urged the appointment of a government analyst whose certificate would be binding on both.

MR. G. E. DRUMMOND pointed out that the only remedy lay in careful sampling and the appointment at the mines of an efficient analyst.

After considerable discussion Messrs. R. T. Hopper, Dr. Reed and Mr. John J. Penhale were appointed a committee to enquire into the matter and report to a later meeting of the association.

GRAPHITE AND PETROLEUM.

MR. B. T. A. BELL.—A large number of men have been employed by the Walker Mining Company in the Township of Buckingham during the year and several hundred tons of merchantable graphite is reported ready for the market. A 20 stamp mill equipped with suitable appliances has been erected, having a capacity of 10 tons in the 24 hours. The quality of the graphite mined by the company is excellent. From experiments made in the Laboratory of the Geological Survey, Mr. Hoffmann, F.C.S., considers that in respect to combustability it may claim perfect equality with that of Ceylon, and that it is in no wise inferior to the latter as a material for the manufacture of crucibles.

At Gaspé, The Petroleum Oil Trust, Ltd., has had a large force drilling for oil. A heavy expense has been entailed in equipping and putting down numerous wells, some of them at considerable depth, but so far as can be ascertained, only a few barrels of oil have been obtained.

The meeting adjourned at six o'clock.

The following papers were read at the sessions of the Association on Wednesday evening, Thursday morning and afternoon, and on Friday afternoon:—

On the Occurrence of Lignite and Anthracite Around Hudson Bay.

By DR. ROBERT BELL, Assistant Director of the Geological Survey of Canada.

The title of my paper, as announced, is changed to read as above, so that it may give a more definite idea of the region I intend to cover in the following remarks.

The existence of good lignite, anthracite, or coal of any kind, in the northern mainland of Canada, is of so much importance that any information on the subject is eagerly welcomed. I say northern mainland, because it has been pretty well ascertained that workable coal seams to occur on some of the islands of the northern seas, all of which now belong to the Dominion. About all that is known to have been ascertained up to the present time in reference to the lignite around James Bay, was recorded either in the reports of the Geological Survey, or in those of Mr. E. B. Borron, who has made practical tests of some of the deposits for the Ontario Government; and all the information that could be gathered in reference to the existence of anthracite on the east coast of Hudson Bay is given in my geological reports on that region. The first mention of the occurrence of this mineral on the above named coast is the following at page 325 of my official report for 1875:

"When at Moose Factory, Captain Taylor of the Hudson's Bay Company, presented me with several specimens of a mineral having all the (ordinary) characters of a very fine anthracite, except that it contains, according to Mr. Hoffman's analysis, only a very trifling amount of ash. (Vide, Mr. Hoffman's report, analysis No. 4.) Two specimens were obtained by an Indian from Long Island, south of Great Whale River. I was told by Mr. James L. Cotter, of the Hudson's Bay Company, to whose intelligent observations I am indebted for much valuable information, that a similar mineral was reported by the Indians as occurring some miles inland from Little Whale River. I could ascertain nothing in regard to its mode of occurrence further than that the Indian who brought the specimens from Long Island stated that there was plenty of it there. It appears to have resulted from the alteration of a mineral like Albertite, by losing nearly the whole of its bitumen.

The following is Mr. Hoffman's description and the analysis above referred to. (Report Geol. Survey of Canada for 1875, page 423.)

ANTHRACITE.

"The specimen examined was very compact homogeneous; colour, pitch black; powder, deep black; lustre, bright metallic; fracture, highly conchoidal; it does not soil the fingers. When boiled in a solution of caustic potash, it was apparently unacted on; the solution remained colourless, and the powder black. Gradually heated or when projected into a bright red hot crucible, in either case decrepitated but very slightly. The specimen had been kept in the laboratory for months.

"The following is the mean of two very closely concordant analyses:—

Fixed Carbon.....	94.91
Volatile Combustille Matter.....	1.29
Water	3.45
Ash	0.35
	100.00

"It was scarcely changed in appearance by coking, the ash which had a reddish iron black colour was attracted by the magnet; it showed not the slightest disposition to agglutinate, even at a bright red heat."

In 1877 I visited the east coast of Hudson Bay and in my (Geological Survey) report for that year, page 24 C., is the following statement:

"*Anthracite*: The existence of this valuable mineral on Long Island was referred to in my report for 1875, page 325. It has a conchoidal fracture and bright lustre and was found by Mr. Hoffmann to contain 94.91 per cent. of fixed carbon, and only

Geological Survey of Canada.

Dr. G. M. Dawson, C.M.G., Etc.,

Appointed Director, January, 1895.

0.35 per cent. of ash. It is probable that it does occur as a seam of altered bituminous coal, like ordinary anthracite, but rather as resulting from hardened pitch, or a mineral like albertite by the loss of its bitumen, and it may not exist in large quantities. I was prevented by circumstances from visiting the locality at which it is found, which is said to be on Long Island, at four or five miles from its south-western extremity."

It appears that a trial opening had been made by some prospectors at the above locality many years ago. Two of my men happened upon the spot when out hunting on the island one day, but they did not tell me of it till we had left the neighborhood, and it was impossible for me to return that year, and I have never been near the place since. The island is upwards of 30 miles in length. If an intelligent search for this valuable mineral were made upon Long Island, and some of the islands to the north westward of it, important results might perhaps follow. It will be observed that the anthracite is of extra good quality. In order that expectations based upon my discovery might not be disappointed, I thought it as well in mentioning it in my report, not to allow it to be inferred that the mineral existed in large quantities until we knew more about it. Still I know of no reason why it may not occur there in some cases in deposits large enough to be valuable. If it exists in workable quantity, it will no doubt be found in the form of vein or veins, analogous to those of albertite in New Brunswick and not in beds like ordinary anthracite. In my first announcement of anthracite, above quoted, I mentioned that the late Mr. Cotter had informed me that a similar mineral was reported by the Indians as occurring inland or eastward from Little Whale River. In confirmation of this report, Mr. A. P. Low of the Geological Survey on his late traverse of the Labrador Peninsula found a vein of this mineral about seven inches in thickness. It would be a rare chance if this were identical with the occurrence mentioned by these Indians, and we may presume that these rocks hold many such veins; and this leads us to hope that sooner or later, one or more of a workable thickness may be discovered.

LIGNITE.

Indications of a variety of lignite, closely allied to *bituminous coal*, were observed by me in 1871, when surveying the Albany River, the most southern of the large streams, which flow into the west side of James Bay. In reporting its occurrance, I said (page 112, Geological Survey Report for 1871):

"In one place just below the mouth of the Goose River, or three miles below the point where the river turns southeast, bright red marl occurs on the north bank, and on a small island a mile further down some loose fragments of a bright bituminous coal were found. The Hudson Bay Company's officers informed me that coal had never been brought into the country; and considering that the conveyance of even light and valuable goods is so expensive in this region, this is only what might have been expected, so that I cannot suppose this coal to have been brought here by human agency.

The occurrence of lignite on the Kenogami, the great southern branch of the Albany, is mentioned in the same report. On this river, which discharges Long Lake into the Albany, there is an interesting deposit of lignite in the drift filling a preglacial channel of a stream which probably corresponded in its general course with the existing river. It occurs at six miles, by the stream, above the mouth of the large southern branch called the Baguichewan (or Pa-wetch-a-wan). Here the river makes a sudden bend to the north and about a mile further up another similar bend. "These unusually sharp curves, which are unlike any others in the course of the stream, appear to be caused by the river traversing preglacial excavations, in the Silurian strata, which here consist of dull red, coarse, somewhat indurated arenaceous marl with green blotches and layers. These excavations have become filled up with loose material before the formation of the present river channel. At the lower bend gravel fifty feet deep is exposed in the south bank. At the upper bend the excavation of the Silurian marls is plainly seen. Starting from the level of the river, the lower ten feet of the filling of this hollow consists of boulder-clay. Upon this rests a bed, six to eight feet thick, of soft lignite, containing many flattened stems of small trees which are partially carbonized, but are somewhat elastic when newly excavated and still wet. The lignite bed is overlain by thirty or forty feet of rudely stratified red and grey drift *holding rounded boulders and many pebbles. Marine shells were observed in the* drift along the Kenogami, almost up to this point, which, according to my barometic readings would have an elevation of about 500 feet above the sea" (See Annual Report of the Geological Survey for 1886, p. 37-38 C.)

With reference to lignite in the basin of Moose River, I will quote the following from my report for 1877, page 4 C.:

"The existence of lignite on the Missinaibi River was referred to in my report in 1875. During the past season I have found it *in situ* in several places on this river between the Long Portage and its junction with the Matagami. The first or highest of these was in the west bank of Coal Brook, three quarters of a mile from its mouth. Coal Brook is a small discharge or channel which leaves the main river opposite the head of the fourth or Riverside Portage, and rejoins it at five and a half miles below Round Bay, at the foot of Hell's Gate. This bed of lignite is about three feet thick and is underlaid by soft sticky blue clay, and overlaid by about 70 feet of drift clay or till, full of small pebbles and passing into gravel towards the top. Much of the lignite retains a distinct woody nature. Some of the embedded trunks are two feet in diameter. When dry it makes a good fuel, but contains a little iron pyrites.

"On the south-east side of the river, at nineteen miles below Coal Brook, or two miles above Woodpecker Island, a horizontal seam of lignite was found in the midst of a bank of till 125 feet high. It is from one and a half to two and a half feet thick and is made up principally of sticks and rushes. Below the lignite are 80 feet of yellow-weathering grey clay and about 45 feet of blue clay. Both varieties of clay are full of pebbles, and they also hold some striated boulders of Laurentian gneiss, Huronian schists and unaltered Devonian limestone.

"At three miles below Woodpecker Island, or nine miles above the mouth of the Opazatika (Poplar) River, another bed of lignite occurs in the bank on the same side. It is six feet thick, but diminishes to the eastward and is of a shaly character, being made up of laminæ of moss and sticks. Immediately beneath the lignite is a layer, one foot thick, of irregularly mingled clay and spots of impure lignite. Next below this are 40 feet of unstratified drift, full of small pebbles, under which are a few feet of stratified yellowish sand and gravel. Resting upon the lignite are five feet of hard lead-colored clay with seams and spots of a yellow color and layers of red, grey, drab and buff. Above all and forming the top of the bank, 65 feet high, are 10 feet of hard drab clay with striated pebbles and small boulders and holding rather large valves of *Saxicava rugosa*, *Macoma calcarea* (*Tellina proxima*) and *Mya truncata*.

Small seams of lignite were seen in two places in the bank on the same side at, and again half a mile below, the foot of a rapid which occurs about six miles above the Opazatika. In the interval between one and two miles above this stream the whole bed of the river appeared to be underlaid by lignite. When sounded with a heavy pole it has an elastic feel and gives off large volumes of gas which may also be seen at any time bubbling up spontaneously here and there all along this part of the river. This phenomena has been observed by the Indians from time immemorial, and the locality has received the name of the 'Bubbling Water.'"

Since the above was written Mr. E. B. Borron, J. P., Stipendiary Magistrate for Northern Ontario, was sent by the Provincial Government to test the lignite beds of Coal Brook by boring. I have not seen his report, but I have been told that he found the mineral to be of fairly good quality, I have also been informed on good authority that beds of lignite have been found within the last few years on the lower part of the Abittibi River, where we noticed loose pieces of it in 1877.

Considering the very small amount of exploration which has yet been done in the regions referred to in the above extracts and notes, the discoveries which have been mentioned appear to indicate the existence of a good supply of lignite scattered over a vast area in the level country around the southern and western side of James Bay, where valuable deposits of iron ore are also known to occur.

"Charcoal; its Bearing on the Utilization of our Forests."

By Mr. T. J. Drummond, Montreal.

In asking the attention of a Mining Association to a paper on a forest product, I think perhaps it is best at the outset to remind you that, as so far, charcoal is the only known fuel natural to this province for the smelting of iron ore, this important product of the mine must be governed by the product of the forest. If we cannot produce cheap charcoal, and if we cannot see a supply ahead, then any attempt to establish an iron industry in this province, on anything like an extensive scale, would mean failure. The importance of this question of the production of charcoal and its encouragement, and the conservation of woods for its manufacture, therefore, cannot well be over-estimated. Canadian have truly a magnificent national asset in their forests, and every care and thought should be given to the question of how it may be utilized.

It will be unnecessary for me to dilate on the forests of the Dominion. While the variety of trees is not as great, still the area under timber in Canada is certainly equal to that of the United States, and the woods are useful and valuable. In our own province there are probably not more than fifty or sixty species, but they have already yielded a large revenue to the country, and with proper care they will continue to do so for generations to come. In fact, with a climate like ours, our supply should be unending, as it is in every way favorable to the growth of forests, and if a proper system of cutting is followed and due care given by the government through a system of inspection, new forests will spring up to replace the timber removed, where the land is not put to agricultural or other purposes. To preserve these forests, and to utilize them to the best advantage to the country, should be both a national and provincial care and if necessary, vast districts should be set aside and reserved for this purpose, over which the government should exercise full control.

We have forest wealth now, and so, as I have said, what we must consider is how we can utilize this to the best advantage to the nation. In considering this, it seems to me that as in the case of private assets, we must consider each class of wood separately, and try and find out in what way these woods can be utilized so as to return the greatest benefit in cash and labor, and in my opinion, we should not be content to be simply "hewers of wood" and allow others to reap the benefits derivable from the labor that may be employed in bringing any of our woods to a higher state of finish and value, but should encourage by legislation and otherwise, the manufacture within our own boundaries of whatever articles the variety of our woods may be suitable for.

If we are to advance in wealth and population, if we are to build a nation, we must be able to offer fair work and fair wages, and to do this, we must develop our natural resources, more especially in those directions that require the greatest amount of labor. When we have labor and the producing power of the earth working together, whether in agriculture, mining, or the utilizing of our forests, we are doing this, and the higher the point to which we can bring the earth's product, with the consequent increase of value through extra labor expended within our own boundaries, the better for our country. So, I reason, that if instead of shipping our forest products in practically a raw state, we can carry the process of finishing to a higher stage, then our forests will of a necessity yield us so much greater benefit. To a very large extent, the value of a forest tree is the value received for the labor expended in hewing it into square timber, sawing it into boards, or turning it into an article of furniture, and it stands to reason that the tree that was by Canadian labor transformed into furniture, has yielded more than its fellow that was exported in the form of square timber, or that a spruce tree shipped in the form of paper yields more than if it had left Canada in the form of sawn logs or even pulp. As with our soft or merchantable woods, so with the unmerchantable or hard woods. If we burn these woods to clear the land, it means dead loss, or if we use them for domestic fuel, the return is small, and if we turn them into charcoal and export the charcoal in that shape, the value to the country will not be very great, but if we use those woods in such a manner as to develope an industry that must otherwise be non-existent, then we have obtained something worth while, and so I hold that by burning into charcoal and using that coal for the smelting of iron, the value of the cord of wood to the country becomes the value of the labor expended in producing the amount of pig iron that quantity of wood will smelt, in other words, the value of a cord of wood for domestic purposes to the farmer would be say $1 50 to $2.00, and would yield nothing beyond that to the country. But if that cord of wood was burnt into charcoal, and by that fact an iron industry becomes possible, then as it takes from two to two and one-half cords of wood to obtain sufficient charcoal to produce a ton of iron, so it must be plain that a cord of wood utilized in this way brings through the labor consequent on raising the ore, flux, etc., and smelting, say from $6 to $9 per cord, according to the class of ore smelted and wood used. In making this statement, I am, of course, dealing principally with our Province of Quebec, where the conditions are such that without charcoal an iron industry cannot be commercially established, and where, with proper attention, consideration, protection and encouragement towards the utilization of what are known as unmerchantable and waste woods, insuring a long and regular supply of charcoal, a charcoal iron industry can be developed as great and as important to the province and the Dominion as that industry has been, and is to Sweden and the United States.

Now that I have given in a general way my ideas as to the utilization of our forests, and the bearing those forests have on the iron industry in this province, I will, in as few words as possible, explain the different systems of manufacture of charcoal generally followed, giving particularly the practice adopted at the works with which I am identified.

In cutting wood for pit burning, the custom in Sweden is to cut the logs in about 9 foot lengths, but in our own experience we have found it better to cut to shorter lengths for reasons hereafter given.

For kiln burning, the general practice in the United States is to cut to 4 ft. lengths. Formerly the cutting to lengths as well as the felling was done with the axe, but latterly the saw has been brought into general use, with a view not only to quicker work, but to prevent waste. The value of the saw in cutting the cordwood to length is considerable, for the axe chips represent a very material loss. The axe seldom makes a cut at an angle less than 45 degrees, so that in practice as much wood is cut away as remains in the two adjacent points, and the loss of chips in cutting to four foot lengths with the axe, amounts to fully from 8% to 10% according to the size of wood cut.

In the Province of Quebec, when we first took up the charcoal iron industry, we found that the practice was to work wholly with the axe, and to cut to 3 ft lengths, and we saw that this must be changed, as the loss was considerable in labor through cutting to such short lengths, and as already pointed out the loss in chips also was naturally very great. We had a great deal of prejudice to overcome, but we are now making for kiln purposes solely 4 ft. wood, and our men are using the saw for cutting to length. And we find that not only do we effect economy for reasons given, but our men are able to earn, working in pairs, with the saw, better wages than they formerly could, working singly, with the axe.

In burning into coal two systems are generally followed, viz., pit or meiler burning and kiln burning, and in the United States "retort" burning has been attempted. This is carried on, I believe, on a small scale at present, but I do not think it has ever proven to be a commercial success although perhaps if given full trial it might be found to be more economical that it has so far proven to be.

KILN BURNING.

Two styles of kilns are generally used,—the "rectangular" and the "bee-hive." The latter has been found to be the most satisfactory, and has practically superceded the "rectangular" kiln. In our own experience the "rectangular" kilns have given us good results both as to durability and the making of coal, but we have found them more difficult to keep air-tight than the "bee-hive," and that they also require more experience and care in handling, being more subject to cracking and opening through being effected to a greater extent by expansion and contraction. They have also to be well bound with heavy frames of wood, which are affected by weather and time and require replacing.

Our present battery of "rectangular" kilns is, however, in first class condition, although it has been in operation about twenty-four or twenty-five years. This is perhaps mostly due to the fact that they have been carefully looked after, and repairs promptly made when necessary.

When in operation, it is necessary that the burner watch the "rectangular" kilns very closely, owing to there being a greater liability to burn down to the centre than in the "bee-hive" kilns. The form of the latter giving solidity while the action of expansion and contraction from heat and cold is not so great, and the "bee-hive" kiln is therefore easier to keep air-tight, and for these reasons the coal produced in the "bee-hive" is more uniform.

Apart from the question of coal, the "bee-hive" kiln is much easier to keep in repair, as it is not necessary to have any wood frames or binding. The wood can also be handled somewhat cheaper and faster in the "bee hive" than in the "rectangular" and owing to their greater liability to straining from expansion and contraction already referred to, the "rectangular" kilns require about two or three days longer to cool, and therefore cannot be "turned over" as often as the "bee-hive," and for general results the latter has been found to be the most suitable.

PRINCIPLE OF MANUFACTURING IN KILNS.

In our "rectangular" kilns, an opening is left from the front door to the centre of the kiln. This is made by piling the cordwood in such a manner that a canal of say 12 inches square is left in the middle of the kiln leading from the door to the centre. At this point a sort of crib work is built, known as a "chimney," leading to the top of the kiln. On all sides of this dry wood, or brands, is piled so as to fire easily. A small quantity of split brands is then placed in the hole in the centre. The wood on all sides is ranked in the same manner as cord wood and is piled as closely as possible. Along the top of the kiln the lighter wood is laid, and this for two reasons. First, it is easier to handle, and secondly, the fire will run through it quicker than through the heavy timber which is left in the centre of the kiln, then a fair quantity of light wood (or brands) is placed along the bottom and at the ends. When the kiln is closed and ready for firing, the top door is opened, and a piece of oily waste is inserted by means of a long pole to the centre of the "chimney." The draft to the top of the kiln carries the fire upward and along the top, and once fairly started, the top door is closed and the air is allowed to draw down to the lower vents, three rows of which are open around the base of the kiln. These vents are operated by the burner in such a manner as to draw the heat from point to point of the kiln, and thus to "cook" the whole mass. The direction and force of the wind have a large bearing on the manipulating of the heat, and will drive it from one side of the kiln to the other,—hence the holes have to be closed and the windward side protected to prevent combustion, as otherwise the wood would become over-heated and be reduced to ashes. The condition of the coal in the kiln when approaching the finishing point is generally determined by the color of the smoke and sometimes by the insertion of an iron rod at various points to ascertain by feeling the condition of the wood or coal. This latter mode is only occasionally resorted to.

BEE HIVE KILNS.—The same mode of piling and firing applies to the "bee-hive" kilns as described in regard to the "rectangular." The fire is started at the bottom and allowed to burn upwards. Once fairly started among the light or dry wood, the kiln is closed, and as the gases escape from the wood they practically supply sufficient heat to "cook" the entire mass. Care must be taken at all times to prevent too great a supply of air to the kiln, and thus cause combustion.

The properly cooked kiln should contain only the ashes made by the wood that surrounds the "chimney" with a little from the dry or light wood on the top, the combustion of which has supplied sufficient fuel to heat the mass and cause the drying and evaporation of water and gas in the whole.

What a charcoal burner must keep before him all the time is, that the wood is to be "cooked" and not burned, so that every care must be taken to prevent combustion, and sufficient heat must be introduced into the kiln or the "chimney" or canal leading to it, or by the combustion of a small quantity of light or dry wood on top to "cook" the whole mass. The light wood, of course, will be consumed, but in the meantime it should have imparted sufficient heat to the rest to draw off the water and the lighter gasses.

The burning of charcoal is more or less a process which distils or throws out the undesirable gas leaving the mass of wood charred to the centre. If this could be carried out to perfection, the coal should be solid without any breaks or cracks or tendency to fall to pieces.

Both our "bee-hive" and "rectangular" kilns have a capacity of about 55 cords, and they generally take from ten to fourteen hours to fill, according to the class of wood handled, and from five to six days to burn, which is again largely governed by the class of wood. The "bee-hive" kilns take about eight days to cool and can be easily discharged in one day. The "rectangular" kilns generally take two or three days longer to cool, as already stated, owing to their being more affected by expansion and contraction. In our kiln work we use cord wood all the way from a limb of 2½ inches in diameter up to the trunk of the heaviest tree that is too solid or knotty to be split with the axe, so that in our practice there is practically no waste wood, as we use tops, lops and everything.

THE MANUFACTURE OF COAL IN PITS OR MEILERS.

In Sweden the coal is very largely manufactured in pits and this has been carried on on quite a large scale also in the United States. One advantage of the pit system is that farmers and others can do coal burning on their own lands and obtain the results of the labor, and at the same time the cost of transportation is naturally greatly lessened as forty bushels of charcoal can be transported for considerably less than a cord of wood, of which it is an average equivalent. In general results throughout the United States it would seem that the quantity of coal per cord obtained by pit burning has not been equal to the quantity obtained in the kilns. The general average seems to be about thirty-five bushels per cord from pit burning as against about forty bushels from the kilns. In my opinion, this is very largely due to lack of care or knowledge on the part of the pit burner, as with the same care and attention, and with a thorough knowledge of the work, there does not seem to be any good and valid reason why the results as to quantity should not be about equal. Apart from this, however, in our own experience of pit burning, the coal produced was of a better quality than that obtained in the kilns, (*i.e.*, where the work was well done.) We found the coal dense and close, and practically solid to the centre, and this class of coal develops at least 15% to 20% more gas than the ordinary coal obtained in kiln practice. It will not consume as rapidly, and gives a greater and more enduring heat, and has proved itself as economical even where an equal quantity per cord was not obtained, as compared with kiln practice.

In manufacturing coal in pits, the process of firing is practically the same as that practised in kilns, a canal being made to the centre in which to insert the fire and a "chimney" built to the top along which light wood (or brands) is placed.

The whole is then covered with eight or ten inches of evergreen branches, leaves and sand or earth. After the fire is thoroughly started, the top or the centre over the chimney will fall in, owing to the total consumption of the wood at that point, and a supply of hard wood is kept on hand, which is driven into this hole as soon as the covering shows a tendency to fall in. After it is thoroughly re-filled, a fresh covering is put on, then vents are opened along the sides towards the base. The condition of the coal inside is ascertained by feeling with an iron rod, and as the burner finds it at any point properly "cooked" he can open it and withdraw a portion of the coal, covering the balance rapidly and carefully again in the same manner as at first. This process is kept up until he knows by the color of the smoke and by the inserting of his "try rod" that the whole is properly "cooked." It is all then carefully covered in and allowed to cool and die out.

This mode of burning coal requires very careful and constant watching, owing to the liability to fire. As I have already said, the practice in Sweden is to use wood for pit purposes in nine or ten foot lengths, and when we took up the question of getting the farmers and others in our district to make coal in this manner, we had them follow the usual Swedish process in cutting, but from various reasons, principally owing to the density of our woods, the burning of shorter lengths has proved more satisfactory, and our best results have been obtained from wood cut in four or five foot lengths, and a portion of it split, and also by using smaller pits.

The pits which we first operated contained as much as forty-seven to fifty cords, but the results were unsatisfactory, the process proving too slow and too many brands being made. The coal obtained, however, was fairly good. Our burners then resorted to smaller pits containing from 20 to 25 cords of 4 ft. wood. These burned faster and gave better coal. Where our men had had experience in the work, the coal was clean and solid, and as pointed out, gave better results in the furnace than ordinary kiln coal.

In pit and kiln practice, we have used the following woods:—maple, birch, beech, soft maple, white birch, tamarac, hemlock, balsam, and in point of value they can be reckoned in the order named. Our principle consumption has been in maple, birch and beech, with which our district abounds. In practice in kilns and in pits both, we have found it possible to use 25% to 30% of soft wood, but for furnace purposes we prefer not to go above that as the coal made from the softer woods is more friable and will not carry a heavy burden of ore.

RETORTS.

In the United States attempts have been made to manufacture charcoal in retorts or closed vessels in which the wood is placed, and the charring done by external heat. In a report on this system, made by a prominent expert, he mentions that one system is to erect a furnace, and supply it with a number of vertical cylindrical vessels, which are handled with a crane. These vessels are filled with wood, tightly sealed, lifted into the furnace and connected by means of nozzles with conduits leading to condensers. After the fire has been maintained a sufficient length of time to properly char the wood the vessel is lifted out and allowed to cool, another taking its place in the furnace. In this method the retorts serve also as cooling vessels, but they must be handled, and the outlets for gases must be disconnected and closed at each change.

Another plan consists of a cylindrical retort hung from trunnions over a furnace. It is raised to a vertical position to receive the charge of wood, and reversed to discharge the charcoal into the cooling vessel, where the process is completed. The difficulty of filling these retorts and maintaining them, makes this plan undesirable.

A system largely employed in North Pennsylvania and South New York, consists of a series of cylindrical vessels set permanently in a horizontal position over furnaces. These retorts are filled with wood either thrown in, or, in improved retorts, placed in a crib which has been previously loaded. When the carbonization has proceeded sufficiently, the coal is withdrawn into a cooling tank, which is hermetically sealed, until such time when the danger of the mass taking fire is greatly reduced.

Other forms have also been followed, but as far as I can ascertain, none of them have ever proved commercially successful, and the old-fashioned kiln and pit system still seems to be for general charcoal purposes the economical, and, in fact, the only systems by which charcoal can be successfully manufactured for general commercial purposes, or at least for the manufacture of iron.

BY PRODUCTS.

Of late years considerable attention has been given to by-products obtainable in the manufacture of charcoal, and it has been found that with a chemical plant attached to a battery of kilns, that every cord of wood can be so handled that the exact weight that went into the kiln will practically be taken out, when everything is taken into consideration. What by-products can be drawn from a charcoal kiln would be too numerous to mention. In fact there seems to be very little that cannot be taken out of the wood in this way, but for commercial purposes the principal by-products, and

those to which most of the companies using a chemical plant have given their attention, is the production of wood alcohol and acetate of lime, and those have been found to be, I believe, profitable, and it is very probable that within a very short time every battery of kilns will have its chemical plant adjoining, and the smoke that is now wasted will be drawn down and distilled, so that nothing will be lost. When this is done the value to the country of a cord of wood will naturally be largely increased.

Now that I have roughly outlined the systems followed in the making of charcoal, I must ask your permission to touch on the value to the country, and to this province in particular, of charcoal making, and the principal industry connected with it, and on the difficulties in the way of its development, and to ask your consideration and assistance towards overcoming those difficulties and developing the "charcoal industries."

COLONIZATION.

In colonizing our wooded lands, the value of the charcoal industry will be readily seen. Heretofore, and with good reason, the settler looked upon the wood on his lands (from which, as a general thing, the lumberman had removed the merchantable timber) as a detriment, and he (the settler) had very little to hope for until he had made a respectable clearing, and put in seed for his first crop. If he was within one or two miles of railway communication, it might be possible for him to sell a certain amount of selected wood to cord wood merchants. They did not take the run of the forest, nor would they accept branches or knotty sticks, or anything of that kind, so that at the outside he could very seldom afford to team the wood more than a mile or two, and even then, owing largely to the amount of waste, his remuneration is small. With the charcoal iron industry in the district, all this is changed, and the settler on taking up a piece of wooded land finds ready at his hand a crop that will yield good returns from the day he first swings an axe, whether he delivers his wood at kilns for burning, or at the nearest railway station in the form of cord wood, or whether he burns it himself, he can utilize practically everything, as the furnace companies can take practically all classes of wood grown in this province, and they are ready to accept the tops and branches, the large knotty sticks that cannot be split, and everything in the shape of sound wood. In our long winter months he can fell trees, saw them into cord wood and team to the nearest wood depot, or he can, with the assistance of his sons and what help can be obtained, burn the wood on his own farm in pits, and he can work at it all the year round if he desires, or during his slack season, and earn good wages whether he makes cord wood or coal.

When I speak of the importance of the fact of charcoal kilns or pits being able to utilize tops and branches and knotty pieces, etc., I think you will understand how very important this is to the settler when I say that as an actual fact, in the average forests only about one-third of the wood felled is fit for merchant cord wood, and of the balance the settler can use a portion for his own purposes, but the great bulk has to be chopped into a suitable size for piling and burning, and then watched carefully in the spring, or almost as much attention given to it by a careful settler as if he was burning for charcoal purposes, owing to the danger to the surrounding forests from fire, so that the making of merchant cord wood cannot be considered as remunerative to the settler in comparison with the making of wood for charcoal purposes. Then too, there is this burning of refuse, and I think you will understand what the danger in that is. If the settler is careless, his spring "bonfire" means the destruction of miles of valuable timber, for the settler's "clearing up" fires have certainly been instrumental in causing more forest fires than anything else we know of.

Where the charcoal iron industry exists, the wood that was formerly a detriment becomes a valuable asset to the settler, and he realizes it, and knowing it to be an assurance of abundant and remunerative labor, he becomes a caretaker of our forests instead of a danger, for with good cause the owners of timber limits have grown to look upon the settler as something to be kept out if possible, through fear of the effects of his spring burnings.

Where wood can only be sold in the form of merchant cord wood, as I have already pointed out, it would scarcely pay the settler to locate further back than say two miles from the railway line, if he was looking forward to obtain anything for the wood he cut, but where charcoal iron industries exist the better average price obtained allows of his teaming his wood greater distances, and if he burns into charcoal he can afford to transport that material even farther.

VALUE TO THE FARMER.

The value of the charcoal industry to the farmers of the district is, of course, the same, to a large extent, as that derived by the settler. During slack seasons they can make wood and coal on their own lands at remunerative figures, or they can arrange to work on adjacent lands, and use their horses during the winter months for teaming their own wood or coal, or that of neighbors, and where they are not desirous of working on their own lands they and their sons can find work in contractors' camps either felling, or teaming, or burning.

The charcoal iron industry is essentially a farmer's industry, and affords, both from coal and ore, steady and remunerative labor from one end of the year to the other if necessary, and certainly in all slack seasons. Our farmers have, unfortunately, a good many slack seasons, and I think it is largely due to this fact that farming has not been as remunerative as it might be. There are so many months in the year when there is nothing for the farmer to do and he has to live during those on the results of the other months. Now if he is an industrious man, and there is a charcoal iron industry in the district, he can fill in every day of his off seasons. As I have said, in winter he can fell wood, burn charcoal, and team either on his own or neighboring lands, and in early spring time, if he has confined himself to cutting wood during the winter, he can burn his coal then, and in the summer time from seed time to harvest he can find employment in the ore fields raising ore and teaming, and in our St. Maurice district he can, in most cases, make and wash ore on his own land, and the result in that district is that both settlers and farmers are prosperous, and reports which we have received direct from the farmers themselves and from the Cures of the district go to show that since the establishment of our works in the St. Maurice district the agriculturists have reaped large and lasting benefits. They have obtained plenty of remunerative labor during off seasons, and a good market for whatever produce they have raised on the farms.

The province of Quebec, as I think was very fully pointed out in a paper last year, has every natural requirement for the production of charcoal pig iron, and the value of such an industry to the Province and the Dominion must be fully recognized by every one. We have the iron ore, and while we have neither coal nor natural gas, we have plenty of hard and unmerchantable or waste woods, and this fact makes it possible for the establishment of an iron industry of the greatest value, and I see no reason why such an industry should not be carried to a successful issue, as it has been in Sweden and the United States. What is wanted, however, is the assurance of an adequate supply of charcoal, both for the present and the future. To do this some steps must be taken by our government to conserve certain woods or portions of forests so that this industry can be established on a permanent basis. How this can be done is some thing that will have to be carefully thought out, but if it is done the value to Canada will be great. If it is not, then we will have wasted a very large proportion of our forest wealth, for that is wasted which is not used to the best advantage, and I hold that more profit can be derived from our unmerchantable and waste woods by utilizing them and conserving them to the development of the charcoal iron industry than in any other way. If this is done the establishment of the industry is possible and certain, if it is not, then it can only be carried on in a very desultory way.

One of the principal difficulties that stand in the way of the establishment of the charcoal industry in some of the districts is the fact of large tracts of lands being held by limit holders. Limit rights were originally intended to convey an area valued for its merchantable timber alone, yet the limit holders, even in cases where the merchantable timber has been removed, still retain possession and control, with the result that the hard and unmerchantable wood cannot be utilized. The only way by which these woods can be diverted is by actual settlement, and, as in a great many cases, the land may not be suitable for agricultural purposes, the wood, if these conditions are to exist, is practically inaccessable.

Another great difficulty is the lack of knowledge in regard to charcoal burning. Of course so far as kiln practice is concerned men can be readily obtained or educated to good practice, but for pit burning it is necessary that a much broader system of education than could be carried on by a private enterprise should be adopted, as a knowledge of pit burning would be of the greatest value to our settlers and farmers in the wooded districts.

Now, these two questions are, I hold, provincial and national ones, and these difficulties should be considered and overcome by our governments.

In Sweden there are national schools for charcoal burning, which have done and are doing good work in training men and spreading information throughout the country as to the most economical systems of making charcoal, especially in pits. Both the Dominion and the Provincial Governments should follow this example, and disseminate useful information on the subject among agriculturalists, especially in the wooded districts and where charcoal consuming industries have been or can be established. This should be done by lecturers, papers, and in every practicable manner. The practice, especially of pit burning should be taught in our agricultural institutions, and certainly no mining school should be without a course in charcoal burning, and when development comes, as it surely should come in a land of wood and iron, national schools should be established, as in Sweden. Our governments have spent large sums in this way on dairy practice, and we all know that the results have been profitable and satisfactory, and I believe that if the same course is adopted in regard to charcoal making, which is a farmer's and practically a domestic industry, the results will be also to the national good.

Steps should also be taken to prevent the locking up by speculators or others of woods suitable for charcoal purposes, and where this evil exists, as in the cases I have referred to, it should be overcome by just changes in the present laws if necessary. I do not believe that in the case of the limits any value was considered or paid for, nor was it intended to convey to the limit holders the unmerchantable woods for which lumbermen and others purchasing these limits have no use. This is proven by the fact, I consider, that at all times the government has reserved the right to settlers taking up any portion of the land, the only reservation in favor of the limit holder being in regard to the merchantable wood, which he is given a certain time to remove. I therefore hold that under all circumstances, and especially where the lands are not suitable for agricultural purposes, and the unmerchantable wood cannot be realized on through the settler, the government should have the right to divert unmerchantable wood to other purposes when and where it is deemed advisable.

When an enterprise that requires this fuel can be started in any district, it should be especially encouraged by the setting aside of woodlands to insure a continued supply and by assistance in teaching the principles of "burning" to the inhabitants of the districts, and by rebating of stumpage dues where the wood is used for charcoal purposes, and encouragement given in every practicable manner within the powers of the Dominion or Provincial Government.

The industry is, and must always be, if successful, a settler's, a farmer's, and a people's home industry, and for this reason it is especially deserving of national support and encouragement.

Our farmers should be taught and enabled to use to their own and the nation's profit everything the land has to give, and here are mighty crops wasting, burning and rotting that properly used might here in Canada, and especially in our own Province of Quebec, be made, as in Sweden, the mainstay of a nation.

Mr. President and gentlemen,—This is a "burning" question. Let us hope it will not remain a "burning shame," but in the near future become a "burning" success.

Mining as an Investment.

By Robert C. Adams, Montreal.

If one wishes to give a capitalist cold shivers, he can usually produce the effect by requesting him to invest in a mine; or if he desires to descend to the depths of humiliation he can get there speedily by taking to heart the scorn and contempt which, by word or look, often meet the solicitation to risk money in digging. Yet we learn from the last U. S. Census that over one thousand million dollars is invested in the country in securing the earth's products from beneath its surface. The exact figures are $1,284,911,435. Such an outlay would not be made unless it afforded a considerable amount of profit to some of the workers. It is therefore safe to assume that the mineral producing industries are often profitable, though whether they are so on the average is a matter for question. Especially does this doubt pertain to the mining of precious metals, which, in many instances, gives *bonanza*, but in more cases yields *formica*. A statement of some of the facts and figures relating to the gold, silver and copper mines of the United States will enable us to form some conclusions as to the pecuniary results of mining operations.

The *Engineering and Mining Journal* publishes a list of 144 dividend paying mines and 145 non-dividend paying mines. The latter have never paid a divident and some of the former have not paid a dividend since 1870.

Of the dividend paying mines 51 have paid over a million dollars and 25 of these have paid more than their capital stock. Of the 51 only 27 have paid dividends since 1891. Only 13 of these have paid more than their nominal capital, and only three companies that have paid a total of less than a million, and have paid dividends in the last three years, have paid more than their capital.

The 144 dividend paying mines are capitalized at a total of $643,000,000. If 25 cents on the dollar has been paid in, this would give of cash paid $161,000,000. Assessments have been levied to the amount of $53,000,000, making total cash paid in $214,000,000; the total of the dividends paid is $241,000,000, so that the returns

would be about 13% more than the principal. But if only 10% of the share capital was paid in the profit would be over 100% on the investment beyond the repayment of capital.

Taking the whole list of 293 mines the total capital is $1,164,000,000, and the total assessments $85,000,000=$1,249,105,066. Total dividends are only 20% of this amount. If 25% of the capital has been paid the total dividends would be 60% of the outlay. If only 10% was paid, 118% of the outlay would have been returned. Some eminent authorities, whom I have consulted, tell me that probably not more than 10 cents on the dollar of the capital has been paid in on the average.

When we consider the large number of mines that are abandoned before they are turned over to companies, and of the prospects that never become mines, but are spoiled in development, besides the great expenditure made in the unsuccessful search for minerals, we are forced to accept the common statements that more money is put into the ground than ever comes out of it, and that every dollar costs a dollar. Indeed many assert that dollars, whether silver or gold, cost at least two dollars apiece, and Mr. Del Mar has stated that every dollar secured from the Comstock Lode has cost five dollars. It was often said there, as in other less favored districts, "It takes the product of one mine to work another."

CAPITALIZATION OF MINES.

Of these 293 listed mines in the United States, 223 have a nominal capital of a million dollars and over, and of these 70 are capitalized at $10,000,000 and over. But the capital stock gives no idea of the amount of money actually paid in. It is customary in California to capitalize the companies at ten million dollars and sell the shares at one cent or ten cents on the dollar or even give them away, anything in fact to get them into the hands of people who will pay assessments.

The U. S. census of 1880 reports 140 mines whose nominal capital is $1,019,111,250, but whose market value is $85,641,222, or about 12 cents on the dollar, but even these prices were probably inflated above the true values.

The last U. S. Census gives some important data:

In 1889 the value of production of gold and silver was	$99,283,732
The operating expenses were estimated at	63,451,136
Leaving a surplus of	$35,832,596

The capital invested was $486,323,338 so that the profit was about 7½% on the investment. But when the short lives of mines is considered and the consequent deterioration of capital is taken into account, this showing must be regarded as proving that mining for the precious metals does not pay on the average.

Of 6,004 mines that are known 1,266 were idle; 1,009 were working, but non-productive; 1,610 were producing less than $1,000 per annum; 1,408 were producing less than $10,000 per annum; 437 were producing less than $50,000 per annum; 95 were producing less than $100,000 per annum; 107 were producing less than $250,000 per annum; 44 were producing less than $500,000 per annum; 28 were producing over $500,000.

SUCCESSFUL MINES.

Leading the list of the United States comes the Calumet and Hecla Coppe Mine, which, with a share capital of $2,500,000 and paid assessments of $1,200,000, has paid in dividends $40,850,000. Then come in order the Ontario Silver Mine, Utah, with total dividends of $13,175,000; Granite Mountain, silver, Montana, $12,120,000; Quincy, copper, Michigan, $7,070,000; Idaho, gold, California, $5,489,000; Homestake, gold, Dakota, $5,237,503; Eureka Consolidated, silver and gold, Nevada, $5,112,500; Richmond, silver, Nevada, $4,359,887; Horn Silver, Utah, $4,930,000; the Tamarack, Standard and Small Hopes Consolidated have paid over $3,000,000, and the Daly, Minnesota Iron and Plumas Eureka over $2,000,000.

California from 1848 to 1881 produced $1,163,000,000 in gold and $15,000,000 in silver.

The yield of the Comstock Lode in Nevada from 1860 to 1890 was $350,000,000 and $130,000,000 were paid in dividends. The bulk of this was produced during the first 15 years. The original purchasers of the Comstock paid $50 for three-fourths interest and bought the other quarter for an old blind horse. One of the mines, the Virginia Consolidated, paid $42,930,000 in eight years, and the California paid $31,320,000 in five years. The original discoverers, as usual, got no benefit. This summer a car load of ore from the Mollie Gibson Mine at Aspen, Colorado, yielded 20,000 ounces of silver to the the ton, or 85%. More then four-fifths solid silver.

Did time permit, similar stories could be told of mines in Australia and South Africa. An expert sent out by the Rothschilds to Witwatersrand reports that one billion dollars in gold is available in that district, and one of the newly discovered mines in Coolgardie, Australia, is reported sold for £250,000.

Australia in 1852 produced $79,200,000 in gold, and in 1853, $50,400,000. Two gold nuggets were found worth $42,000 and $38,000. In California single nuggets have been found worth up to $30,000. One claim on Carson Hill had a vein from which gold was chiselled out in big chunks, one weighing 112 pounds, a single blast gave $110,000, and the yield in two years was $2,000,000. Many miners working single handed washed out from $100 to $1,000 a day. Three sailors on Murderer's Creek got 11 pounds daily and $2,700 has been washed from one pan. The Doran Mine in South Carolina yielded $300,000 from a space 300 feet long by 2 feet and 15 feet, the excavation of which should not have cost $20,000.

Canada is not without its stories of bonanzas. The early history of the Cariboo and Fraser River Districts in British Columbia abounds in stories of sudden fortunes; and the great hydraulic operations now in progress produce results that promise yields in single workings of $1,000 a day. The greatest yearly gold production of British Columbia was $3,913,563 in 1863, but this had declined to $390,525 in 1892. The highest average earnings per man in one year were $1,223 in 1875. The earnings for 1892 were $298 per man employed, or about $1 per day.

In Nova Scotia there have been some brilliant successes in gold mining, and a steadily productive and fairly remunerative industry is being carried on. The yield of gold for 1892 was 21,080 ounces, and the yield for nine months in 1893 was 14,030 ounces representing 97,471 days' labor, or an average of nearly $3 per day per man employed. The total yield of gold was about $10 per ton of rock crushed.

In the Chaudiere District of the Province of Quebec there has been some remarkable finds of gold in the streams, and if titles could be made clear and proper methods employed some large fortunes might be realized

The story of Silver Islet gives the greatest romance of Canadian mining. The original owners became discouraged and sold it for a moderate sum to United States capitalists. These prosecuted the development on a large scale and were rewarded by striking extensive deposits of ore that were often almost solid silver and for a time yielded an immense revenue.

In Hastings County, Ontario, there are gold-bearing rocks that are destined to realize fortunes to investors when the chemical secret is discovered as to a means of overcoming the effect of arsenic in the amalgamation of ores.

The nickel mines of Sudbury produced in 1892 2,413,717 pounds of nickel and 2,203,795 pounds of copper, and one of the companies is paying a dividend of 8% per annum on a capital of $2,500,000.

SPECULATION.

As good an illustration as can be had of the chances of investment in mining shares is furnished by the history of the dealings on the San Fransisco Stock Exchange. "Crown Point" in November, 1870, sold at $3.00 per share. On favorable reports it advanced to $1,800. Other mining shares rose in proportion and all California went wild. In 1872 the crash came and silver stocks declined $60,000,000 in ten days. A friend of mine who could have sold out his holdings for $800,000 but who was determined to become a millionaire ended $60,000 in debt, with a lawsuit on his hands.

In 1872 Virginia Consolidated began paying dividends of $300,000 monthly. An expert said there was $1,500,000,000 in sight in the two mines, Virginia Consolidated and California. Shares rose from $4 to $780 and were maintained with some fluctuations for a considerable time. In 1875 Virginia Consolidated produced $15,000,000 in seven months. Then came a decrease in production and Comstock values sank $100,000,000. The Bank of California failed, and Rolston's body was found in the sea. In January, 1875, the market value of Comstock shares was $300,000,000. In the spring of 1885 it was $2,000,000; in the autumn it rose to $70,000,000, and in 1890 it was $6,000,000. Stock that sold for $700 in 1875 sold for 25 cents in 1885. During the excited dealing in shares in 1872 one man made 25 millions, another 20 millions, and two others 10 millions each.

Placer and hydraulic mining is now receiving much attention. After the first outlay is made the average cost of washing one ton of gravel by hydraulic process is three to ten cents, whereas the cost of mining and milling the most favorable free milling gold is one to two dollars per ton and is often nearer five dollars; and the mining and treatment of silver ores sometimes runs up to $100 a ton, and is seldom under $20. The first outlay for hydraulic mining is usually heavy and the cost of 154 ditches in California was an average of $70,000 each, or $3,800 per mile.

As to the profits of mining in the present day it should be said that there are numbers of small companies in California and other States that are paying from $1,000 to $40,000 a month. They are usually each controlled by a few people, who are looking for results from legitimate mining rather than from stock speculation, so there are no puffs in the papers and one rarely hears of them. Probably the number of mining properties that are being worked by individuals or close corporations far exceeds those that are listed upon the stock exchanges.

No estimate can be made of the amount of money expended in prospecting and developing mineral properties, yet the money expended in these preliminary operations should be considered when reckoning up the profits of mining as a whole. There has been a thousand prospectors at one time ranging the mountains of the Kootenay District (B.C.), and it is safe to say that more than a million dollars has been spent in the last three years in exploring and developing the Slocan District alone, whereas the ore is only now beginning to go to market in appreciable quantities and no mine has yet repaid its outlay.

During the palmy days of California $60,000,000 were produced in one year. But 100,000 miners were employed and the average output was only $2 per day per man, while wages were $4 and $5 per day. This shows that although many made fortunes, more made little or nothing. Mining is a lottery with few immense prizes, numerous moderate gifts and a multitude of blanks. The losses in mining are often due to other causes than bad luck. Managers on the Comstock built mills and reduced ores at a cost of $15 per ton, but charged the other shareholders $14, which was often as much as the ore produced. Law suits and disputes about titles have been a fruitful source of the loss of time and money. One law suit between the Ophir and Moscow mines on the Comstock Lode cost $1,070,000.

A great hindrance to profitable mining in Western Canada is the fact that while supplies can best be obtained from the United States and that the market for ores is mainly in that country, the policy of the Canadian Government has been to maintain the tariff on these supplies and to prevent the development of railway communication with the South.

The high rate of wages in the West, $3.50 per day, and the excessive cost of transportation are causes for many mining failures.

There are two classes of investors in mines. The first class is composed of those who invest, hoping for profit from the sale of the property or its products. The second class consists of speculators who buy mining shares for a rise. The investors in public companies in England are usually of this second class, and most of the companies that are promoted are organized for the purpose of gambling in the shares. The promoters employ brokers to buy and sell shares on the stock exchange until the outside public are attracted. When the prizes have been forced to a suitable point, or to where it is thought they will not go higher, the original holders unload their shares.

To those who wish to speculate in mining shares, this advice may be given. Select some company that has great names in the directorate and is under the management of some well known, successful financial firm. Do not concern yourself too much about the merits of the mine, for if you are an outsider you have no chance of learning the truth about the value of the property. Content yourself with following the lead of men who are good "boomers" and who have a strong interest in "whooping up" the enterprise. Consider that the probability is that the affair is a swindle and will eventually be a dead loss to the shareholders. Therefore when the shares advance sufficiently to afford a good profit, do not hold on too long, but sell out before the downward turn comes.

To those who wish to invest in the legitimate mining industry for the sake of dividends from the operations, the following general rules may be given: Avoid the companies with showy names, heavy expenses of management, large capitalization or where large amounts are paid for the property. Favor investment with men of whose trustworthiness you have personal knowledge, or whose skill in mining has been proved. When you can "get in on the ground floor" with such men "take a flyer," if you have any spare cash to lock up and will not be distressed if it is lost. If you know some good practical prospecting miner, who is ready to explore in some district of good repute, "grub stake" him, that is put up the money for his expenses and go halves with him in his discoveries. You cannot expect to be able to form any accurate judgement of the value of a mining property unless you have a thorough familiarity with the business. If you visit the mine you will only see a hole in the ground and will know no more of its productive capacity than you did before. Your investment must be made usually upon the basis of personal confidence in the managers of the enterprise or the reports of your professional advisers.

From the consideration of the facts and figures which have been mentioned, it may be assumed that mining on the average is not a very profitable undertaking, that is, more money is put into the ground than ever comes out of it. But many enter-

prises pay fairly well, and some of them pay enormously. It is the chance of large profit and sudden acquisition of great wealth that tempts men to invest. When a great strike is made, hundreds and thousands invest in the same neighborhood hoping for similar luck. These fortunate discoveries have been called "the devil's decoy ducks" as they draw many to the spot and often to the slaughter. It must be admitted that mining success is often a matter of luck. Some of the largest properties have been discovered by accident or have become valuable by almost the last stroke of work before their proposed abandonment. Many of the discoveries have been made by unprofessional men, and the theories of skilled engineers have often been worthless. Miners say "The mineral is where you find it and one man can see into the ground as far as another."

When we remember that it is said that only four or five men in a hundred succeed in commercial business, we must not be too exacting as to the record of success in mining. The men who gamble in stocks or corner produce probably loose as largely in proportion as those who invest in mines and they lack the moral satisfaction of having promoted production or employed labor. Public spirited men have every patriotic and philanthropic motive to invest in mining.

England owes her supremacy to her coal and iron mines. It was due mainly to the desire to obtain the precious metals that America was discovered, and the development of the Pacific slope and the construction of the transcontinental railways is largely due to the mining industries. Australia and South Africa have been opened up largely by miners. The miner has also often discovered possibilities for the production of agricultural wealth. A mine gives work directly and indirectly to a large number of people. The man who has lost money in the actual working of mines can comfort himself with the assurance that his effort has tended to the development of his country and has benefitted hardy laborers. It has not, as is often said, been merely thrown into the ground.

The investment in railways is probably no more remunerative than the investment in developed mines and offers fewer opportunities of brilliant success. Mining will always attract adventurous enterprise and as the tendency of the times is to conduct its operations upon a business basis, its hazards will be continually reduced.

It may be proper to ask, why it is that so large a proportion of mining enterprises are successful? The answer will be that in addition to natural risks there is added a large element of human risk; faith in nature cannot always be supplemented by faith in man. Ignorance, bad management, dishonesty, extravagance often spoil favorable chances. The blind competition and vexatious opposition among rival enterprises sometimes ruins undertakings that by a spirit of co-operation and a reasonable combination might have been carried to success.

Instead of the present wasteful system of individual operations, there should be larger enterprises by which a whole district should be operated co-operatively under one central management, composed of the ablest engineers and political business men, or in some cases it might be undertaken by the local or general government.

Dr. Raymond in his report on The Mines of the West in 1869, in a criticism of the methods employed at the Comstock, so powerfully describes the cause of many mining failures, that his words are worth reproducing. He says, "One great cause of trouble is the fact that mining has not on the whole been profitable to individual adventurers. And of this fact the Comstock Lode has furnished a striking example. Nearly $100,000,000 have been extracted from that one lode within the past nine years, yet the aggregate cost to owners has been almost as much. The reason is simple. Unnecessary labor has been employed and vast sums of money wasted in extravagant speculations and ligitations, and the root of the whole evil lies in the system of scattered, jealous, individual activity, which has destroyed, by dividing, the resources of the most magnificent ore deposit in the world. Thirty-five or forty companies each owning 10 to 1,400 feet along the vein, and each almost without exception, working its own ground independently; 40 superintendents, 40 presidents, 40 secretaries, 40 board of directors, all to be supplied with salaries, or worse yet with perquisities, or, worst of all, with opportunities to speculate; an army of lawyers and witnesses, peripatetic experts, competing assayers, thousands of miners uniting to keep up the rate of wages; these things explain the heavy expense of Comstock mining. Aside from this immense drain of money amounting to 20% of the whole production, the labor actually performed has been, for want of united action, often useless. There have been tunnels enough run by different companies into the Comstock Lode, to make, if put together, the whole length of the Sutro tunnel. Hardly one of them is good for anything to-day. The Bullion Company, which has the deepest shaft on the lode, never had any ore, but has spent more than a million dollars in prospecting, while some neighboring mines, like the Little Kentuck, have been in bonanza for long periods. Now this division of a vein which gives the rich chimney to one owner and the barren intervals to another, is not conducive to economy. The result has been that both owners waste money. All the explorations in the barren mines of the Comstock could have been executed with the money flung away by the mines that have had, for a time, rich ore."

Alluding to these operations Dr. Raymond speaks of "the mischevious feeling that mining is half grab and half gamble; that the only way to make money at it is to dig out what rich ore you can get, and then find a fool to buy the property, or failing that to make a fool of that collective individual the public and to 'unload' yourself of your stock."

It is so generally the custom with those who write of mining to indulge in enthusiastic language and brilliant statements that I may be blamed for presenting to a Mining Convention a paper in which the boom element is so conspicuously wanting. But it may help the reputation of the mining community if we tell the truth occasionally, especially when it can do no harm, and it may help to overcome the popular prejudice as to the veracity of promoters, which is expressed in the adage, "he lies like the prospectus of a limited company."

While admitting the losses in mining, I have tried to call attention to its frequent gains, its occasional sudden fortunes and the fascination as well as usefulness of its ventures. I have wished to point out also that a good deal of the loss might be avoided by more careful and intelligent management and especially by the adoption of the systems of combination and co-operation that are so generally being employed in other industries and which are destined to ultimately replace the individual isolated method of work.

It might be worthy of consideration also whether a mining association might not undertake some practical operations as an object lesson to the world of how mining can be successfully conducted. If all the brilliant ideas and genius that scintilate in a convention's papers could only be applied to productive work the reputation of mining might be so enhanced that it would be more sought as an investment.

ASBESTOS CLUB.—The regular meeting of the members of this Club was held in the Club Room, Black Lake, Que., on Thursday evening, 31st January, when papers were read by Messrs. E. Wertheim, Chicago; H. J. Williams, Thetford Mines, and Dr. Wm. Glen, of the Baltimore Chrome Works, Baltimore. Dr. Glenn's paper we hope to reproduce in the next issue of the REVIEW.

Mineral Waters.

By MR. JAS. T. MCCALL. Montreal.

It may appear at first sight as if my subject was hardly within the range of those usually dealt with by the Quebec Mining Association, and I venture to think that very few miners in taking out licenses for mining, prospecting, or in purchasing mining rights on any property, would include a spring of mineral water among the valuable deposits they expected to find. A little reflection, however, will show us that natural mineral waters have been a source of great wealth and prosperity to those countries, and more particularly to those districts, in which they have been found. Springing up from the depths of the earth, charged in the most natural manner, and in the most delicate proportions with those chemical substances that give tone and vigor to the human system, these mineral springs must be regarded as of great value, to be placed on a level with gold and silver, iron, copper and lead, asbestos and mica deposits, which have been considered as forming the great mineral wealth of this province.

We all realize, I think, of what immense importance a supply of pure water is to any town or city. Blessed as we are, with a plentiful supply of fairly excellent quality in Montreal, we are not brought face to face with the difficulties which some other cities in Canada, Toronto for example, have had to contend with.

In reading over several papers in connection with my subject, it was noteworthy to find what a strong stand a great many eminent physicians take on this subject. They point out that to impure water supply can be traced the great epidemics of cholera, typhoid fever, diphtheria, as well as those lesser diseases which distress suffering humanity. Most of us will remember the experience of the City of Hamburg during the cholera epidemic on the continent two years ago. It was the contaminated water of the Elbe, the source of the drinking supply of that city, that was responsible for the devastation made among its inhabitants. The same can be said of the great majority of towns on the Continent of Europe. The dangers surrounding a journey through a foreign country, such as Italy, Germany or France, or other Continental States, are manifold, on account of the impure water supply, and to all who purpose making such a trip, let me advise them never to drink ordinary water. If their principles will allow of it let them drink beer or wine, but if they must drink water, let it be bottled mineral water.

A recent writer referring to the saying, "See Naples and die" claims that this originated through the dreadful water of that city finding so many victims.

The drinking of mineral waters for medicinal purposes dates very far back, and the famous wells of England used to be the fashionable resort of the wealthier classes during the eighteenth century. After a season of gaity and high living in London, the fashionable ladies and gentlemen went down to Bath or Buxton, or some other similar well, to have a course of the waters to wash away the ill humours and bad blood that had resulted from their previous style of living. This is now changed to a large extent, and the fashionable world go to the Continent, where such baths as Hamburg, Baden Baden, Carlsbad, etc., are thronged with people in pursuit of health.

It will thus be seen what a source of wealth these springs and baths are to the districts in which they are found.

Our association is at present purely a Quebec institution, and I will not, therefore, refer to points outside of it; my object now is to point out that we have in this province a vast wealth of mineral waters, as fine, if not finer, than any to be found on the Continent of Europe or in the United States.

My chemical knowledge is not sufficient to enable me to give you a scientific division of the various kinds of mineral waters found in this Province, but for my present purpose it is sufficient to divide them broadly into two kinds, medicinal and table waters. The division is not a very accurate one, for table waters are and must be of very great medicinal value, but the distinction is easily understood, and cannot be mistaken.

Let me first of all draw your attention to the medicinal waters, by which I mean those whose chemical ingredients are of so strong a taste or odor, or present in such quantities as to make their functions more especially medicinal than otherwise. Nearly every district has mineral springs of some kind, be they sulphurous, alkaline, or saline in their composition, but very few have ever attained more than a local celebrity.

Among these I would mention the following most important, Richelieu Water—a well owned by Mr. J. A. Harte, of Montreal. This is an alkaline water of great medicinal value in cases of acidity of the stomach. Its taste is not such as to make it unpalatable, although it is pretty high in salts.

Varennes—This is a strong saline water, of the same nature as St. Leon.

Abenakis—This is a strong saline water.

St. Genevieve—This spring is also owned by Mr. Harte, and may be considered a fairly strong purgative.

The Caledonia Springs are in the Province of Ontario, although pretty close to the Province of Quebec, so they are not within the scope of my paper, although in passing I would mention that there are three wells there, saline, sulphur and gas. This water has obtained considerable celebrity on account of its medicinal qualities, and the hotel at the Caledonia Springs is regularly frequented during the summer months.

I have brought up some specimens of these waters found in the Province of Quebec, and will be very glad to submit them to you for the purpose of testing.

The most famous of these, at least the one that has been brought most prominently before the notice of the public, is the spring at St. Leon. This is situated near Louiseville, on the Quebec section of the C.P. Ry. The principal ingredients are:

Chlor. Sodium, Chlor. Potassium, Chlor. Magnesium; Bi-carb. of Lime, Bi-carb. of Magnesium, with Lethium and the Iodides and Promides of Sodium.

These are present in such quantities as to warrant us in classing this as a fairly powerful water. (These are of course modified by other chemicals, such as bi-carbonate of iron.)

Prof. Baker Edwards, in writing in connection with the analysis, says.—

"This rare water combines marine chlorides, bromides and iodides, also rare alkalines, lithium, barium, strontium, very powerful alterative metals, their actions modified by the chalybeate, carbonates of iron and magnesium, all super-saturated with carburetted hydrogen gas so as to protect them from alteration by oxidation or air. Nothing rarer could be conceived."

The medicinal value of this water has been long recognized, and it has been reported on very favorably by a great number of well known physicians, especially for the relief of disorders in connection with the kidneys or intestines.

The St. Leon Water Co., have a large hotel at the Springs, and it is a favorite resort of Montreal and Quebec people, and is especially patronized by the French.

As far as I have been able to find out there are very few of the mineral waters of the Province that may be classed distinctively as "table waters." A table water must first of all be palatable. We are all quite willing to take medicine when we

require it, but when we are well we like what we drink to be pleasant to the taste. While this water must therefore be sweet to the taste and pure, in order to make it valuable, it must contain those rare minerals in such delicate proportions as to make the water a valuable tonic, and a corrective of the acidity of the blood, which is so often the result of the modern style of living.

A foreign water which has attained a world-wide celebrity on account of the possession of these qualities, is Apollinaris, which is drunk over the entire world, and in enormous quantities.

A more recent spring of a similar quality is the Johannis water, which is now being pushed very vigorously, and which appears to contain all the elements of a first class mineral table water.

The most recent discovery of a Canadian water of this description, is that known as "Radnor" water, and it is to this spring that I wish more particularly to draw your attention in this paper.

The spring, which is located at Radnor Forges, Champlain County, Quebec, was discovered on 8th September, 1893.

The circumstances which led to the discovery are worthy of mention. During the early part of the year 1893 the General Superintendent of the C. I. F. Co., reported there was an outbreak of what seemed to be a "skin disease" among the children of the village and neighborhood. The trouble seemed to be so general, that, in his opinion, there was some good cause for it. The company at once instituted a thorough investigation, sending Dr. W. H. Drummond to Radnor Forges to look into the matter. After a very full investigation he reported (this report being concurred in by the late Dr. Archibald Campbell) that, in his opinion, the trouble was to be attributed to the water supply, which at that time was obtained from the ordinary village wells. Samples of water were taken from almost every well in the village, and a thorough analysis made, with the result that the water was found to be heavily impregnated with iron, and affected by other impurities, the result of analysis bearing out the Doctor's opinion. A matter of note in connection with the investigation was that the Rev. Cure Prince of the adjacent village of St. Maurice, stated that during 28 years he had noted at least four outbreaks of skin disease, and these at intervals of four or five years.

After completing the above investigation, and finding that the waters of the subsoil could not be improved upon, even by piping water from a reasonable distance, the company finally decided to bore an artesian well. Operations were commenced in the centre of the village park. Borings were made at that point to a depth of about 354 feet, the strata through which the drill passed being first subsoil, then limestone, and then into gneiss rock, a granite similar to that of the Highlands of Scotland. At a depth of 100 feet a strong flow of water was secured, which on analysis proved to have so much lime and chloride of sodium that it was looked upon as unfit for domestic purposes. This spring was finally closed at a depth of 354 feet, and although the officers of the company were much disheartened by this, and by the fact that all former attempts at sinking artesian wells in that vicinity had proved failures, it was decided that one more attempt should be made. A location was selected on the company's property some distance away, at which the drill was set to work, with the result that at a somewhat greater depth in a valley, an extraordinary strong flow of water was found, apparently of great purity, its mineral qualities being from the first very marked but at the same time agreeable to the taste.

The strata through which the water passed were first subsoil, then somewhat porous shale rock, and lastly gneiss rock, similar in physical structure to that of the first location, but much darker in color. The shale is reported to have been very light, whilst the gneiss rock from which the water actually springs, is very close and hard.

A four inch wrought iron pipe was driven down into the gneiss rock, and through this the water flows to a height of about five feet above the surface of the ground. Strong pressure is indicated by the fact that from this four inch pipe the water can be lifted to a total height of twelve feet three inches through a one inch pipe.

The quality of the water seemed so good that the officers of the company decided to at once have a complete analysis made by the most competent authority in Canada, and Prof. J. T. Donald, Professor of Chemistry, Bishop's College, Montreal, was selected to make the analysis. From the very first Prof. Donald was favorably struck with the quality of the water. His report was as follows:

"MONTREAL, June 14th, 1894.

"I hereby certify that I have analysed the sample of Radnor Water received from the Canada Iron Furnace Company Ltd. and find the following results in 10,000 parts of water.

Chloride of Sodium	14.354
Chloride of Potassium	.211
Sulphate of Sodium	.210
Sulphate of Magnesia	1.262
Bromide of Sodium	.080
Bicarbonate of Sodium	1.697
Carbonate of Lime	2.940
Carbonate of Iron	Traces
Silica	.145
In 10,000 parts of water	20.899

"This analysis shows that Radnor Water is of the same class as Apollinaris and German Seltzer. Like those, it contains no excess of Sodium Chloride and Carbonate of Lime, and again, like these, it contains the valuable ingredients in such proportions that its use as a table water overcomes constipation and acidity of the stomach in a gentle and pleasant manner. And it is most important that the valuable Sodium Bromide, which is entirely wanting in the German waters named, exists in appreciable quantity in the Radnor Water, making it a most desirable tonic."

(Sgd.) J. T. DONALD.

This report was at once submitted by the Managing Director to the best authorities in Germany for their report. The following letters will show what a good opinion was formed of the water by the best experts in Germany:

Dr. E. Scott, of Frankfort-on-Main, Germany, a physician of high standing, writing under date June 23rd, 1894, says:

"The analysis of this water is very like Apollinaris, which it surpasses in its percentage of Chloride of Sodium, which is artificially added to the Apollinaris water to make it keep.

"We have in Radnor Water an agreeable drink, which can be used every day as a sort of beverage, but which also in cases of dyspepsia, typhus and kidney disease can be used with a beneficial influence, thus one is certain in drinking this water to have the advantage of not being affected with the harm-giving substances which are frequently to be found in ordinary drinking water."

Dr. Julius Lowe, Chemist of Frankfort-on-Main, the great German expert on Mineral Waters, says, under date June 21st, 1894:

"In comparing the analysis of Radnor Water with the analytical results of the springs of Seltzer and Apollinaris, I find that the Radnor contains in quantity many of the ingredients which are to be found in the Seltzer and Apollinaris water. The Radnor exceeds the Apollinaris water in its percentage of Chloride of Sodium; which is added to the Apollinaris water artificially.

"Supposing there is a sufficient yield of your springs it deserves, according to its composition, your whole attention, as far as value is concerned, and it justifies the expectation that the water of this spring can compete successfully with Seltzer and Apollinaris."

With regard to the actual flow, experiments with standard measures show the natural flow to be slightly over 30,000 gallons per day. Certainly the pressure is very great, and there is no reason to suppose that by putting on a steam pump the flow could not be increased, *i.e.* if it was found necessary to exceed the natural output.

The best test as to the permanency of the spring is that from the date of the discovery, 8th September, 1893, the water has not even for an instant showed a diminution of flow. Prof. Donald and others when interviewed in regard to this matter stated that this is about as good a guarantee of permanency as can be given.

As to the "keeping" qualities of the water, it may be mentioned that some of the water taken from the spring in its natural state has been kept in a glass for over a year, and it is as sweet to-day as when taken from the spring. The water being entirely mineral in character will "keep" without the slightest difficulty.

Since the discovery of the spring, and the use of the water by the people of the village, no sign of the sickness and trouble referred to has been seen. The water is in daily use in all their houses, and is known to be of the highest value in all cases of indigestion, rheumatism, etc.

The water placed on trial thus far has given the greatest possible satisfaction, and no better proof of its admirable qualities can be found than by testing it by the side of any of the most popular table waters. The delicacy, purity and flavor of "Radnor" water when thus compared leaves no question as to its quality.

Now in conclusion let me say that it is one thing to discover a spring of fine mineral water, and quite another thing to make people buy it and drink it. It is like a patent medicine, give it a good name, make it well known, and people will very soon ask for it. The splendid success that has been attained by such well known waters as Apollinaris, Johannis, and others, shows what can be obtained by persistently presenting to the public the merits of your spring. Make yourself sure by careful analysis and experiments that you have got the right thing, and plenty of it, and then spare no pains to let the public know this fact, and you will reap an abundant reward. There is at present room for a mineral water of the same nature as Apollinaris, for it would appear that there is actually more demand for it than can be supplied direct from the original spring.

I venture to prophesy for "Radnor" water a world-wide fame, founded not on advertising and puffing, but on the merits of the water itself.

The Geological Survey of Canada and Its Operations.

By R. W. ELLS, LL.D., F.R.S.C., Ottawa.

It has been suggested to me that, to those of our members who live in this city where the Geological Survey had its first location, as well as to many throughout the several provinces of our Dominion, some facts relating to the work of such a department, as annually carried out might be of interest. The question has been often asked, what is the work of the Geological Survey? what does its staff find to do year after year, and what great purpose does it serve in the country's progress and welfare? To discuss this subject fully would require a very long chapter, but I hope to be able to lay before you a few ideas regarding the general character of this work that may, to some extent at least, be an answer to the question propounded.

And first of all as to its history. The Geological Survey of Canada, whose operations have now extended to every part of the Dominion, has had an existence of fifty-two years, and while it may seem almost superfluous to devote any time to the story of its inception, it is possible there may be some present who are not perfectly familiar with the early struggle and disappointments, which attended the efforts of those who were desirous of seeing such an institution in successful operation, and who firmly believed in its great utility as a factor in the advancement of the interests of the country. As far back then as 1832 a petition, asking for pecuniary assistance in carrying on a geological and statistical survey, was presented by Dr. Rae to the Lieut.-Governor of the Province of Upper Canada; but, though strongly recommended by that gentleman, it was not even entertained by the committee of supply. In December of the same year the York Literary and Philosophical Society also forwarded a petition for the same purpose which met with a like fate. In 1836 a committee of several gentlemen was appointed by the government to report on a plan for a general survey of the province, which report was presented, but no further action taken in the matter. On motion of the committee of supply it was then resolved that an address be presented to Sir F. B. Head, the Lieut.-Governor for the time, with reference to the practicability of the desired Survey. This, however, failed to go any further, and in December of the same year, a Mr. Dunlop gave notice of an address to the King, praying for a grant of wild lands to defray the expenses of a geological survey, which application also met with the same fate as its predecessors, and the matter was thenceforth dropped till the union of the Provinces of Quebec and Ontario in 1841.

In that year the Natural History Society of Montreal through Mr. Benjamin Holmes and the Literary and Historical Society of Quebec through Mr. Henry Black, again petitioned for aid to carry out a Geological Survey. The consideration of these petitions was taken up by the government, and on the motion of the Hon. S. B. Harrison, the sum of £500 sterling, for the purpose of such a Survey was included in the estimates. As a result of this action, early in 1842, the advisability of appointing a geologist for the work was considered, and the matter was referred to Sir Chas. Bagot, who was then Colonial Governor for the time, to Lord Stanley, then Secretary of State for the Colonies, by whom on the recommendation of Sedgewick, Murchison, DelaBeche and Buckland, the position was offered to Sir Wm. Logan in September of that year.

Logan, who was in England at that time returned to Canada in the fall and proceeded to Kingston, then the seat of Government. Here the question of an assistant was discussed and, on the recommendation of DelaBeche, the services of Mr. A. Murray, a gentleman who had been educated for the navy but who had served for some time on the Ordinance Survey of Britain, were secured. Murray was already to some extent acquainted with Canada, having resided here for several years, and

served as a volunteer, also, in the rebellion of 1837. The personal acquaintance of these two men, who have rendered such signal service to this country from a scientific standpoint, began in the winter of 1842-43, and the friendship then established continued unbroken till the death of the former in 1875.

Limited as was the area of Canada fifty years ago as compared with the enormous extent of territory now included under that name—the inception and carrying out of a plan of survey such as Logan contemplated was not a thing to be lightly entered upon. Great portions of the country were accessible with difficulty, means of communication were slow and expensive, and the amount of money at his disposal, and the staff necessary for the work were lamentably small. With characteristic energy he addressed himself to the task, and soon formulated a scheme for the carrying on of the explorations required. In the spring of 1843 Logan, who had spent the winter in England, again returned to Canada, reaching Halifax in May, whence he determined to make the journey overland through Nova Scotia, New Brunswick and Quebec in order to obtain some preliminary ideas as to the structure of that section. It was on this trip that his first work was done in Nova Scotia, and particularly in connection with his famous Joggins Section, of which it has been truly said that "it forms a remarkable monument of his industry and power of observation." The remainder of the season was devoted to the study of the Carboniferous and underlying rocks of Northern New Brunswick and of Gaspe where a series of elaborate measurements were carried out similar to those of the Joggins Sections. The conclusions then arrived at by Logan with regard to the value of these so called coal fields in New Brunswick and Gaspé were to the effect that no deposits of that mineral could even be found there in workable quantity, and the views then expressed have ever since been accepted as definite, thus preventing the useless expenditure of capital in that direction.

While Logan was thus devoting his energies to the working out of the structure of the Eastern Provinces, Murray, his assistant, had been equally assiduous in his labors in Western Canada, and in the preface of the Geol. Can., 1863, Logan says that "he (Mr. Murray) has worked out nearly all that is known of the distribution of the rock in that division of the province." In addition to his work in the field Murray also accompanied Logan in the first great exploration of the Gaspe Peninsula in 1845, during which surveys were made of the Shickshock Range and of most of the larger streams that traverse the section.

The Geological Survey can now be said to have been fairly launched, though under circumstances not the most satisfactory. At the Session of the Legislature of 1845-46 the sum of £2,000 was voted for carrying on the work, and in the ensuing year this amount was granted for a period of at least five years. The bill upon which this grant was made was designed by Sir William himself and was to the effect that a certain number of competent persons should be appointed. "Whose duty it shall be, under the direction of the Governor in Council, to make an accurate and complete geological survey of the province and to furnish a full and scientific description of the rocks, soil and mineral, which shall be accompanied with maps, diagrams and drawings, together with a collection of specimens to illustrate the same; which, maps etc., shall be deposited in some suitable place, which the Governor in Council shall appoint and shall serve as a provincial collection, and that duplicates of the same after they have served the purposes of the Survey, shall be deposited in such literary and educational institutions of the Eastern and Western divisions of the provinces, as by the same authority shall be deemed most advantageous."

The first chemist appointed by Sir William was the Count de Rottermund, a student of Le Ecole Polytecnique, Paris; whose connection with the official staff was but brief as he voluntarily resigned the position in 1846. The vacancy thus created was speedily filled by the appointment of Dr. T. Sterry Hunt, who at that date was acting as chemist to the Geological Survey of Vermont. This appointment was a particulary happy one, and for nearly twenty-five years, in his capacity of chemist and mineralogist, Hunt built up, not only for himself but for the Canadian Survey, a reputation which is world wide.

With the exception of the department of Palaeontology the Survey was now comparatively well equipped and ready to carry on the purpose for which it was established. The staff was small but the material good, and exploration went rapidly forward. In 1847 Mr. Jas. Richardson was added, and in the course of over thirty years work, examined many portions of the Dominion from the Straits of Belle Isle to the islands in Queen Charlotte Sound on the confines of Alaska. Other persons have been added from time to time as the necessities of the Survey demanded or the funds as its disposal permitted. In the branch of palaeontology it was however found necessary for some years to send abroad for determination, many of the valuable specimens which were rapidly accumulating; and among those who rendered valuable services in this way were Prof. Jas Hall, of Albany, N.Y., and Messrs Jones and Salter of the English Survey. This difficulty was at length overcome by the appointment in 1856 of Mr. E. Billings of Ottawa, whose love of scientific work in this line was such as to lead him to lay aside his chosen profession of the law, and, at the request of Logan, to attach himself to his small but zealous band of workers. Of him also it may be truly said, that much of the great reputation the Survey has acquired, both at home and abroad, is due to his indefatigable labors. The appointment of Mr. Robt. Barlow, formerly of the Royal Engineers, as chief draughtsman shortly after completed the official equipment of the staff at that time. The work of exploration was carried on for some years by the employment of specialists who were elected to undertake the examination of particular mineral locations, and whose reports were of great value, only what was regarded as permanent employees of the staff who carried forward the work along certain regular lines laid down by the Director himself. The particulars and results of these explorations will be found in the preface of that great volume the Geology of Canada, 1863, in which the leading features of the Survey's operations to that date are admirably presented.

In connection with this volume and designed to accompany it, the great Geological Map of Canada and the adjacent Northern States was published in 1865; of which it may be rightly said that no more beautiful work of the kind has ever been presented by this or any other Survey; a work entailing an enormous amount of labor and reflecting the greatest credit upon all engaged in its compilation and in the delineation of the exceedingly complicated geological lines there laid down. This great work will always stand as the map *par excellence* and will always be pointed to with a feeling of pride, not only by the members of the Survey itself but by every Canadian who feels an interest in the successful carrying out of the study of geological science in our own country. During all these years of hard work in the field by the officers and staff, other matters involving quite as serious labor, were being presented from time to time. The great exhibitions at London, Paris and Dublin, to which the Survey sent large and characteristic collections, both of rocks and minerals, which set forth in an attractive and forcible manner the great natural wealth of the country was productive of much good, but involved an immense expenditure of time and energy. The museum and offices were constantly visited by scientific men from all parts of the world who might be passing through the city, as well as others seeking information on various points; and from the old workshop on St. James and St. Gabriel Streets, much work of very great importance in connection with the development of Canada's mineral resources was produced. But, in 1867, the Confederation of the Provinces opened new fields for the Surveys operations, and the somewhat small amounts hitherto granted were soon found to be inadequate to carry on the work over such greatly extended areas. In the meantime the Survey had lost one of its original members by the retirement of Mr. Murray, who at the request of the Newfoundland Government had undertaken the Survey of that colony. The staff had gradually been enlarged, but the great strain to which the Director had for some years been subjected began to tell upon him severely, and in 1869 Sir William Logan felt it incumbent upon him, in view of the greatly increased area to which the operations had been extended, and the interest he felt in solving certain puzzling problems of structure in the Province of Quebec in which he had for some years been especially interested, to lay aside the direct management of the Surveys and to seek a successor. His resignation took effect in that year, and with this date we may close the first stage of the Geological Survey operations. Dr. Selwyn, a gentleman of very extensive experience, not only in the Geological Survey of England and Wales, but as director of the Survey of the great Colony of New South Wales, was chosen as his successor, and with this appointment we may enter upon what one may style the second period in the Surveys history.

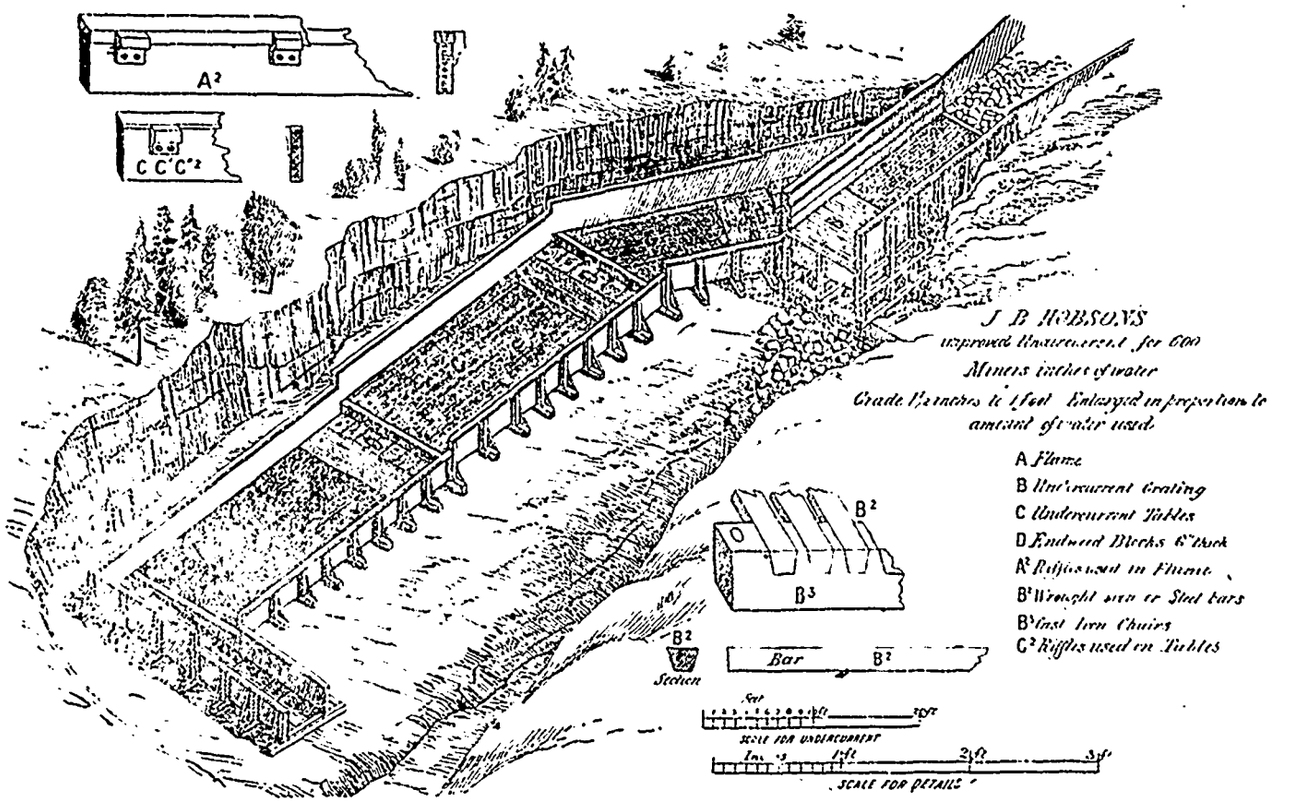
Hitherto the work had for the most part been confined to the Provinces of Ontario and Quebec. Henceforth it had to include in its scope not only the distant areas of British Columbia, the great plains of the North West Territories, the rugged masses of the Rocky Mountains and the wide expanse of the Peace and MacKenzie Rivers basins, but the Maritime Provinces of Nova Scotia, New Brunswick and Prince Edward Island as well. It can readily be seen therefore that the task now entered upon by Dr. Selwyn was one of no small magnitude, especially when we consider that of our own great western areas our information was of the most meagre kind, not only as regarded its geological structure, its mineral wealth, its agricultural capabilities, and its natural history and climatic conditions. New and more detailed investigations had also to be undertaken in the older provinces, in connection with the metamorphic and metalliferous rocks, and in the great country lying between Lakes Huron and Superior and the Hudson and James Bays. It is probably not saying too much, nor, I trust, will it appear to savor of adulation, if we state that probably no enterprise so great as the complete Geological and Natural History Survey of a country embracing over 3,000,000 square miles, was ever undertaken by by a staff so small in numbers or carried on with an expenditure so insignificant as was attempted by the Geological Survey of Canada. And it is well within the bounds of truth, if we say that to the work of the members is due, in very large part, much of the information we now possess as to the greatness of the country's resources, both agricultural and mineralogical, between the waters of the Atlantic and the distant shores of Labrador on the East and the distant shores of the Arctic Ocean and the boundary of Alaska on the north and west. It will scarcely be necessary to mention individual names in this connection. The various officers of the staff and their various fields of labor are too well known to require any special personal reference when addressing a Society such as this.

It would be impossible in the time at our disposal to give any detailed account of the work or the Survey during the last quarter of a century over such an enormous area, and we can only summarise the result of the investigations of the several parties in the briefest manner. Thus, in the East the carefully detailed maps of Cape Breton and Eastern Nova Scotia have been presented to the public and have received the highest praise. We have now also a very good general idea of the structure of the other portions of the province including the horizons and distributions of the great gold-bearing series which extends from Yarmouth on the west to Guysborough on the east. The structure of the great coal fields of Cape Breton, Pictou and Cumberland have been carefully studied, and the geological horizons of the ores of iron and manganese which are of very great importance in connection with the future development of the country, have been clearly and satisfactorily determined. The geological maps of both New Brunswick and Prince Edward Island have been completed and the complex question of structure in the southern part of the former province which for years was of an exceedingly puzzling character has been thoroughly solved. The outlines of the great central carboniferous basin, occupying an area of over 12,000 square miles in the province, have been carefully determined, and its presumptive value from the economic standpoint ascertained, while some of the most important work in Canada, in connection with the palaeontology of the oldest fossiliferous formations, has been and is still being carried out with the greatest care.

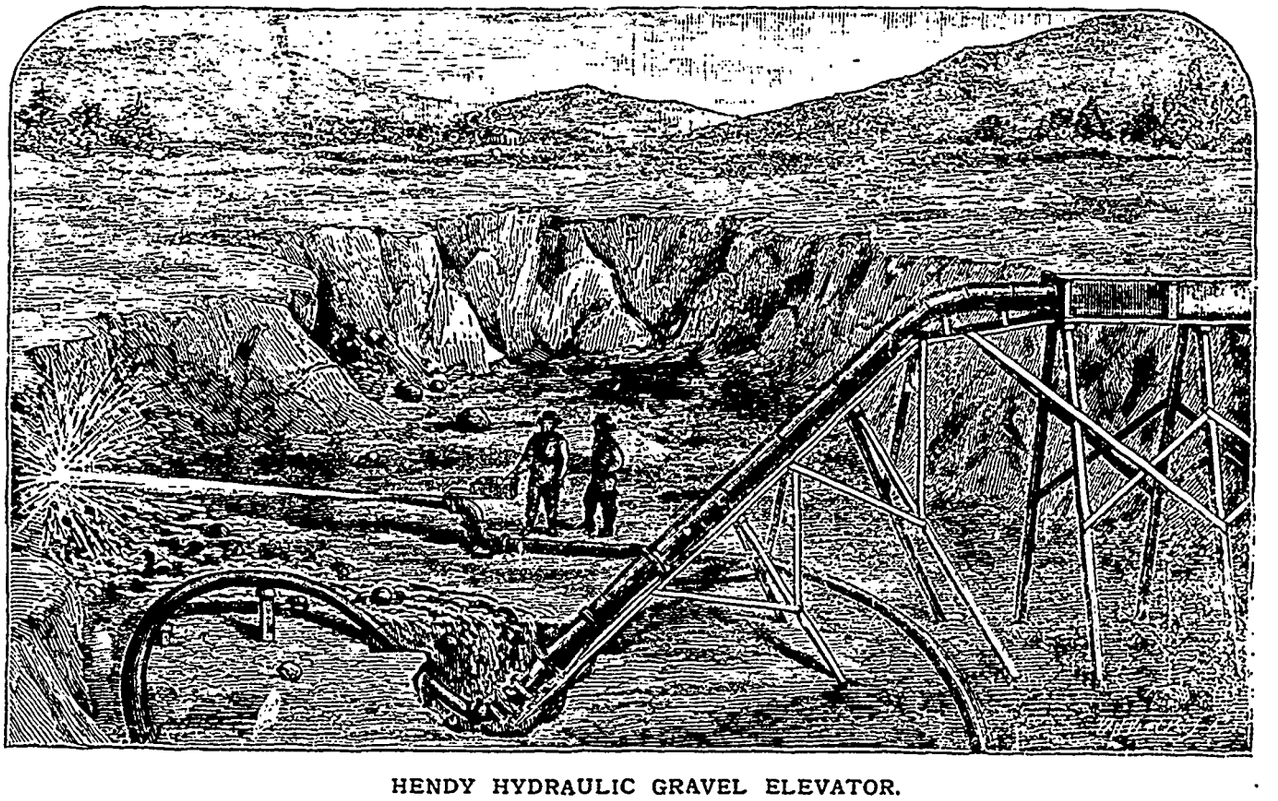
In Quebec East the great problem of the age and stratigraphical relations of the various members of the "Quebec group," a problem which for more than forty years has engaged the attention of geologists not only of Canada, but to some extent of the United States and Europe as well, has, it is hoped, been placed on a satisfactory basis of settlement. While to the north of the St. Lawrence the mysteries of the great region of the Mistassini have been cleared up, and great progress made in the study of the Laurentian rocks north of the St. Lawrence and Ottawa rivers. The great wilderness country between the Ottawa and James Bay has been traversed in many directions along the great natural avenues of lake and river, by which alone this otherwise pathless area can be explored. Concerning the great extent of country about the Hudson and James Bays as well as of the great inland plateau of Labrador, we have now very clear ideas, not only of its geology and mineral wealth, but also of its fauna and flora, and of its adaptability for settlement; while much of its topography has been carefully mapped by means of instrumental surveys.

The economic problems of the occurrence of iron, gold, phosphate, asbestos, copper and mica have also been investigated and much valuable information relative to their distribution, their geological position and the manner of their occurrence has been obtained. Some of these have already appeared in the publications of the Survey or in the Bulletins of the several scientific societies in Canada and the United States. In Ontario while a large amount of detailed work has been carried on in the older and more settled portions of the province tending to the more accurate determination of the better known formation and to the determination of the economic mineral wealth, much careful work of a very high order has also been done in the area north of Lakes Huron and Superior and further west, where some of the great questions as to the age and origin of the fundamental or lowest rocks of our systems, are now in a fair way of being definitely settled. The geological relations of the copper bearing series, of the great deposits of iron ores and of the gold bearing rocks of the Lake of the Woods areas, and the horizon and distribution of the nickel ores of the Sudbury district have been among the questions of the greatest economic nature. In the more settled portions of the provinces the distribution of the gas bearing strata, and the problems of the origin of the gas itself have been carefully studied, and the assertion of the great American gas expert, Ashburner, that no deposits of natural gas would ever be found in workable quantity in Canada has been thoroughly exploded.

To be Continued.



APPLIANCE FOR SAVING FINE GOLD.



HENDY HYDRAULIC GRAVEL ELEVATOR.

The Auriferous Gravels of British Columbia.

By JOHN B. HOBSON, M.E., Vancouver.

The auriferous gravels of British Columbia, like those of Central California, may be divided into two classes; first, the shallow or modern placers; second, deep or ancient river placers. These terms indicate the characteristic difference that exists between the two classes of placers.

SHALLOW OR MODERN PLACERS.

These placers are superficial deposits of auriferous gravel and alluvium, formed by the modern streams that drain an auriferous region, and are designated as river, bar, bench, gulch, creek or ravine diggings, according to their topographical position.

The placers of the modern rivers of California are practically exhausted. Those of British Columbia are not by any means exhausted.

The shallow placers known as bar, creek and gulch diggings, have been, so far as known, extensively worked since the Fraser River and Cariboo gold excitements about 1857.

The most accessible of the above named placers have been pretty well worked out in the districts I have examined.

But the vast accumulations of auriferous gravel on the benches along the Fraser, Quesnele, Horsefly and other modern streams examined are practically unexplored. These can be worked by hydraulic process wherever water can be secured and all other necessary conditions are reasonably favorable.

The deep placers of the modern streams, that is to say, the auriferous gravels lying below the water level of the modern streams, have been worked to some extent in the vicinity of Barkerville, but immense areas remain to be explored, and will in all probability be profitably worked in the future by aid of modern appliances.

The deep modern placers can be exploited either by shaft, and worked by what is known in California as the drifting process, or by the hydraulic elevator process. In other words a shaft is sunk to bed rock, and the bottom stratum of auriferous gravel is breasted out, hoisted to the surface, washed in ordinary sluices and the gold recovered.

Wherever an abundant supply of water can be obtained and delivered at the mine under sufficient head or pressure, as it is called by California miners, the auriferous gravels lying below drainage can be successfully and profitably worked by the hydraulic elevator. Figure 4 represents a mine in operation by hydraulic elevator process.

THE DEEP PLACERS OF THE ANCIENT RIVERS.

The deep placers of the ancient river system of the tertiary as seen in British Columbia, are similar in character, but so far as I have been able to determine, far more extensive and richer in their gold tenure than those of the most favored districts in Central California, where gravel deposits which contain from three to five cents per cubic yard in gold are considered rich and yield as profit from twenty to fifty per cent. of the gross output when worked by the hydraulic process.

Figure 1 is a sketch showing a geological section of an ancient river channel deposit of auriferous gravel in California, and shows the method of exploitation and working by the hydraulic process.

The top gravel A is usually free, and yields to the force of the hydraulic streams, and is easily worked out through the sluices in tunnels E, F and G.

The blue gravel stratum B is usually indurated to such a degree that it becomes necessary to disintegrate it by bank blasting before the gold can be liberated and recovered. This is accomplished by driving a system of drifts under the bank and exploding large quantities of powder therein – one hundred thousand pounds of powder have often been exploded in one blast at some of the larger hydraulic mines in California. By this means immense quantities of the richer gravels are disintegrated and very profitably worked.

The bottom stratum D is in places indurated to such a degree of hardness that it cannot be worked by hydraulic process without loss of a large percentage of the gold inclosed in the indurated mass which goes to the dump in lumps. When this condition occurs, the bottom or rich stratum on the bedrock is drifted or breasted out, worked in stamp mills in the same manner as quartz, and the gold recovered by amalgamation.

Similar conditions accompany some of the deposits of the ancient rivers of British Columbia as those illustrated in figure 1. Figures 2 and 3 represent geological sections at the Cariboo Hydraulic mines.

Water is abundant in all the districts I have examined, and can be brought on to the deposits in shorter canals and at much less expense than is possible in California.

In California there is invested one hundred millions of dollars in hydraulic mining enterprises, and prior to the inhibition of that industry, on account of damage done by debris to agricultural lands and navigable streams, the annual product in gold amounted to about twelve millions of dollars, about one-half of which resulted in profits.

The auriferous deposits of California remaining unworked are estimated at 2,108,875,000 cubic yards. The gold tenure of these gravels vary from one to thirty cents per cubic yard, and the total gold content estimated at about $500,000,000.00.

I have seen in British Columbia, included in the Yale, Lillooet and Cariboo districts, three times the area of auriferous deposits that are known to exist in the whole of the State of California.

The British Columbia gravels that I have examined, and that may be considered available for hydraulic working, yielded results varying from one cent to $1.50 per cubic yard, and as a whole average richer than any I have seen in California.

In some properties examined, I sampled streaks, some of which were on bedrock and others 150 feet above the bedrock, that yielded prospects varying from $2 to $36 per cubic yard. We have no such rich deposits in California.

The exploitation and equipment of hydraulic mines is expensive, and large sums of money are required to provide water supply and hydraulic plant, to get the mines opened and placed on a paying basis.

For this reason great care should be exercised by those intending to engage in such enterprises. Competent engineers should be employed to investigate the source of water supply, determine the available gradient for sluices, dump for debris and the gold tenure of the gravel. The absence or insufficiency of either of the first three of these conditions means the failure of the enterprise to prove remunerative.

A company of gentlemen in Montreal have undertaken the equipment of two large hydraulic mines in Cariboo, the Horse Fly Hydraulic Mine and the Cariboo Hydraulic Mine, which will soon be on a basis for profitable production.

I do not hesitate to predict that the day is not far distant when the gold output from the auriferous placers of British Columbia will not only surprise Canadians, but will astonish the civilized world.

I will refer briefly to some of the principles involved in the working of hydraulic mines, and to the origin of the hydraulic process in California.

The exhaustion of the shallow placers led to the discovery of the deeper deposits of the ancient river system. The shallow placers were, of course, rich like those of Cariboo, and, as they were exhausted, the miners attacked the deeper deposits to work their shallow edges. Only a small supply of water was required, and the great richness of the bed rock stratum and concentrated edges or rims made the work profitable to individual labor, with the easily obtained and limited supply of water; but as the depth of the superincumbent mass of poorer top gravel increased, the results decreased and the individual miner was forced to abandon his effort and depart for shallower and richer fields.

This was the condition of California in 1857. This is the condition of the auriferous regions of British Columbia to-day—the shallow placers exhausted—the deep placers unexplored. Vast areas of the best auriferous earth in the world awaiting the energy of the prospector to explore and locate, and the courage of capital to develop and place on a basis for gold production.

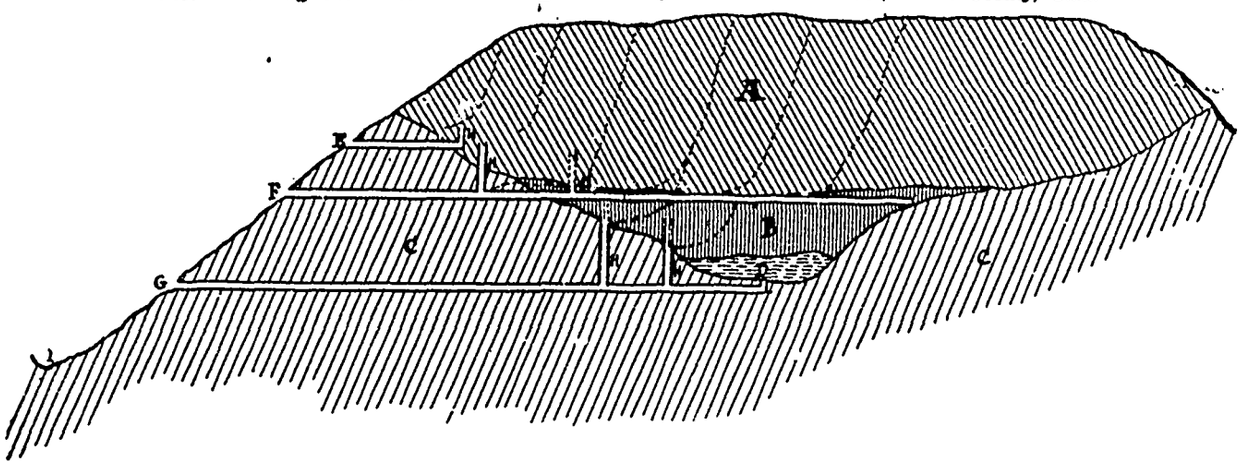
The gravel banks or deposits of debris and alluvium of the ancient rivers are the most favorable form of deposit for the operation of hydraulic mining, owing to the even distribution of the gold throughout the mass of gravel and the great depth of material.

As the early or pioneer miners exhausted the rich shallow placers in the ravines and gulches, they turned their attention to the deposits of the ancient rivers, working off their thin edges with the limited supply of water, but sooner or later abandoned the attempt, as the amount of the material which they could remove in a day with a small quantity of water, without pressure, would not pay; they had, however, discovered two important facts, viz: That their want of success was mainly due to the want of a large supply of water delivered under pressure to enable them to remove

Table Showing Results of Working a few Well Managed Mines in California.

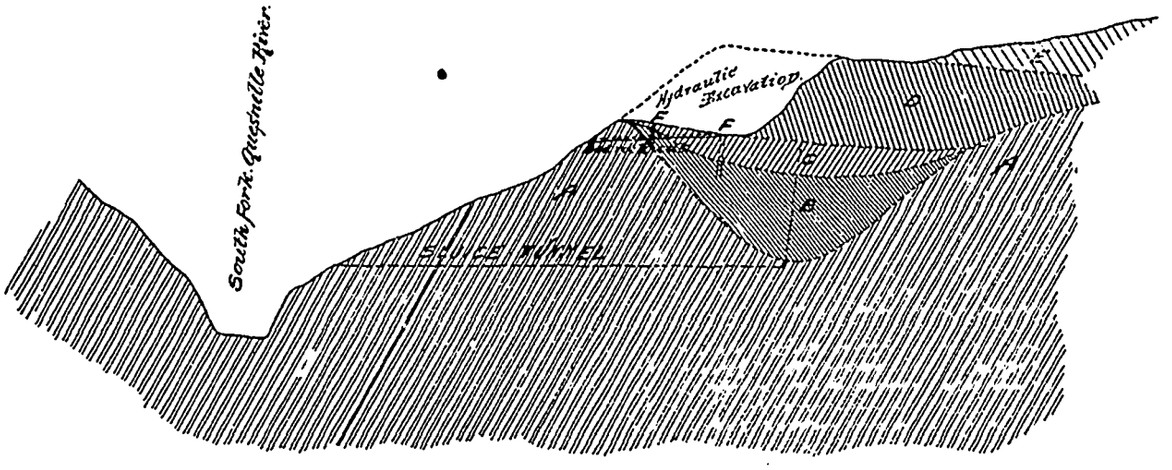
Name of Mine	Locality.	Quantity water used in miners inches.	Height of Bank in feet.	Head or pressure of water in feet.	Grade of sluices in inches to 12 feet.	Cubic yds. of gravel moved per inch of water used in 24 hrs.	Average yield in cts. and fraction of cents per cubic yard.	Age yield in cents & fraction of cents per inch of water used in 24 hours.	Cost of min'g. per cubic yard in cents and fraction of cents.		Total cost of moving per cubic yard in cts. and fractions of cents	Net profit per cubic yard in cents and fraction of cents.	Net profits in cents and fraction of cents per miners inch of water used in 24 hrs.	Remarks.
									Water	Labor &c				
French Hill	Stanislaus Co.	2150	30	70	3½	1 1/100	12	13	1/8	5 1/10	5 1/8	6 1/10	6 1/10	This Company owns water which costs about 1 cent per inch
North Bloomfield.....	Nevada Co.	3000	260	300	6½	4 17/100	6 1/8	27 1/8	1 7/100	2 14/100	3 11/100	3 41/100	24 31/100	This Company owns water which cost 3 cents per inch.
Independence Hill....	Placer Co.	500	150	375	12	24	3	72	1 1/100	1 9/100	1 1/8	1 1/8	36	Both these companies purchase water at 10 cents per miners inch per 24 hours.
Big Bonanza.....	Placer Co.	1500	Top Gravel 250	300	8	14	5	70	1 1/100	1 13/100	2 1/8	2 1/8	35	

Sketch Shewing Section of Gold Bearing Gravel Deposits of Ancient River, Placer County, Cala.



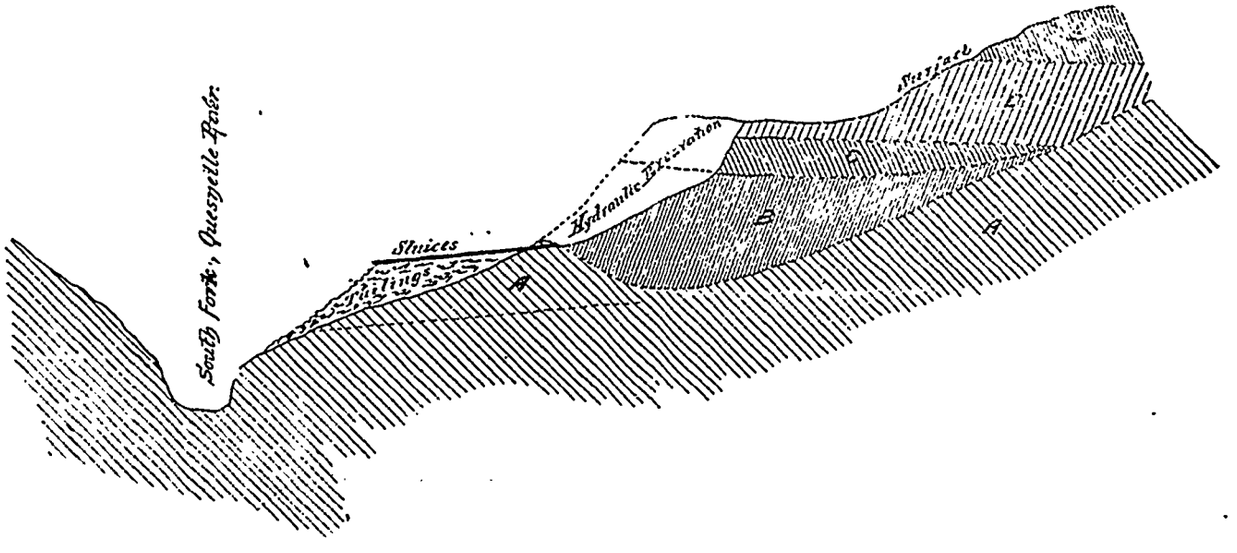
A—Auriferous Top Gravel
B—Cemented Blue Gravel
C—Hard Slate Bed Rock
D—Channel of Ancient River
E—First Sluice Tunnel
F—Second Sluice Tunnel for working Top Gravel
G—Third Sluice Tunnel for working Blue Gravel
H, H, H—Shafts connecting Hydraulic Pit with Tunnels
I—Bed of American River
Dotted Lines—Hydraulic Excavation

Sketch Showing Geological Section on Line Across Workings in the China Pit, Cariboo Hydraulic Mine, B.C.



A—Bed Rock
B—High Grade Auriferous Gravel
C—Indurated Boulder Clay
D—Low Grade Auriferous Gravel
E—Boulder Clay rearranged in Places.

Sketch Showing Geological Section on Line Across Workings South Fork Pit, of the Cariboo Hydraulic Mine, B.C.



A—Bed Rock
B—High Grade Auriferous Gravel
C—Indurated Boulder Clay
D—Low Grade Auriferous Gravel
E—Boulder Clay rearranged in Places
F—Prospect Shafts

large quantities of material. As before stated, miners also discovered that as the quantity or volume of water employed was increased, as also the pressure under which it left the delivery pipes, they accomplished better results, and that under favorable circumstances, gravel which contained only a few cents per cubic yard could be made to pay handsomely, and therefore every effort was made to secure these conditions. Out of these efforts has arisen the modern system of hydraulic mining, which I will briefly endeavor to explain.

HYDRAULIC MINING.

Hydraulic mining is accomplished by utilizing the power of water, and the gradient afforded by the fall or difference of level between the auriferous deposits and the dumps into which the debris resulting from the mining operations must be deposited.

The power of the water depending on its volume and the head or pressure under which it can be delivered at the working floor of the hydraulic excavation, it is therefore most essential that the water ditch or canal should be at a high elevation above and as near as possible to the deposit of gravel to be mined. The first condition insures a great hydrostatic pressure, and the second a reduction in the length and cost of the sheet iron or steel conveying pipes.

It has been demonstrated that one thousand miners' inches of water can be discharged under a head or pressure of 300 feet through a six inch nozzle, with a velocity of about 140 feet per second, and in a volume of about 1050 pounds during the same period of time.

Such a volume of water, in the form of a jet uninterruptedly impinging upon a bank of auriferous earth or gravel, having, as it does, about one-tenth of the velocity of a projected cannon ball, must necessarily do great execution, and produces the caving of an ordinary gravel bank without the aid of explosive blasting.

The greater the gradient given to the conveying or mining sluices, the greater will be the duty of the water employed to remove the auriferous material from the excavation to the dumps.

The separated gold is caught between the riffles placed in the mining sluice bottoms, and held there by the use of mercury until it becomes desirable or necessary to recover it therefrom. When the amalgamated gold is cleaned up from the sluices, it is retorted to distil over and recover the mercury and the remaining gold retort, as it is called, is melted into bars and sent to the mints for comage.

Gold-saving appliances, called under currents, are now in general use in California for recovering fine flour gold that could not be recovered in the ordinary riffled sluice.

Figure 5 represents an hydraulic mine in operation.

Figure 6 represents an improved under current.

As it is proposed to remove immense masses or quantities of gravel, only utilizing an infinitesimal portion of the same, it is first necessary to see that there is abundant room to dump below the mine the vast quantities of debris to result from the entire working of the mine, for if this debris was permitted to accumulate near the end of the sluices, it would soon choke and cover the gold-saving appliances. It next becomes necessary to ascertain the quantity of water available, and the head or pressure under which it can be delivered at the mine.

The amount of work that can be accomplished depends greatly on these two contingencies; it is self-evident that to remove a large amount of material composed of sand, gravel, cobbles and rock, a considerable quantity of water is necessary, and if it is not obtainable, the operations of hydraulic mining cannot be carried on successfully. The amount of water used for operating an hydraulic mine varies greatly in different localities, viz: from 200 inches to several thousand inches daily, 500 to 1,500 inches being considered a fair volume to be discharged through one machine or giant, while the work accomplished by the quantity of water used is greater as the pressure under which it is discharged in the mine, and the grade of the sluices for conveying away the gravel increases.

As water used by miners is always measured by the inch, and all calculations of the value of gravel are best estimated by the duty of an inch of water, it becomes necessary to fully understand what an inch of water is, as well as its power to remove gravel under different conditions. The standard of measurement varies slightly in different mining districts, but the usual method of measuring water now in use in California is to discharge the water through a four-inch opening while the water in the measuring box stands four inches above the top of the discharge opening; thus an opening 125 inches long and four inches high will discharge 500 miner's inches, one inch being equal to a discharge of about 2230 cubic feet in 24 hours. As an illustration of the advantage of estimating the value of a bank of gravel by its yield in gold per cubic yard, and the number of yards of gravel removed in 24 hours per inch of water used, where the water was used under different heads and the sluices under different grades, see the annexed table showing the results of the working of a few well managed hydraulic mines in California.

By reference to the table, it will be seen that the mine yielding the least amount of gold per cubic yard gives the largest returns to its owners, for the reason, as the table shows, that the water was delivered at the mine under the greatest head, and the sluices for running away the gravel have the heaviest grade. It is evident that the value of the gravel per cubic yard is not a good standard, and for this reason the power of a definite quantity of water and a heavy grade in the sluices have been substituted to accomplish the desired result.

If grade for sluices, dump for debris, and a sufficient quantity of water are available, it is then worth while to ascertain whether the gravel will pay to wash, and under this head it will be easy to show, by reference to many operations on a large scale, that the cost of mining and washing a cubic yard of gravel may be brought to exceedingly low figures, but it is almost impossible to say what it should contain to be remunerative, as so many elements and conditions enter into the calculations.

The price of water sold to miners in California for hydraulic mining varies from ten to twenty cents per inch per twenty-four hours, and this item must always influence the result, as it is the main one, but at the same time the actual cost of water to the ditch owner is not more than from two to five cents per inch, so that the ditch owners can afford to work gravel on their own account that would not yield more than one or two cents per cubic yard, considering other conditions, such as grade for sluices and dump for debris being reasonably favorable.

It is hoped that this brief sketch, which deals only with the principles employed and not with their individual application, will give an intelligent idea of hydraulic mining, which promises to become an important industry in British Columbia.

Had I the time, Gentlemen, I would willingly enter more into details of working and equipment of deep gravel drift and hydraulic mines.

I thank you for your patience and attention, and hope to have the pleasure of meeting your Association at some future time.

Notes on Hydraulic Mining in British Columbia.

By Dr. G. M. Dawson, C.M.G., Director, Geological Survey of Canada.

[During the past summer Dr. Dawson visited the more important new works of this kind in British Columbia, of which a description was given, as well as some discussion of the geological conditions and age of the auriferous gravels, in an address to the members of the association of which the following is a synopsis.]

Although hydraulic mining has long been practised on a small scale, particularly in the vicinity of the old gold mining camps in the Cariboo district, it is within the past two years only that really extensive operations of this kind have been initiated. Of these the most important are the Cariboo Hydraulic Company, operating on the south fork of Quesnel river, the Horsefly Hydraulic Company, on the river of the same name, and the Van Winkle Hydraulic Company, near Lytton, in the Fraser valley.

The two first mentioned companies are under the management of Mr. J. B. Hobson, to whose practical knowledge and advice based upon long experience in California the renewed interest in mining in the Cariboo district is largely due. Both of these companies will be in full operation next spring, and it is anticipated that they will be closely followed by many other enterprises of the same kind. All these should be undertaken, however, only after thorough prospecting, for although the Cariboo district abounds in streams and lakes at many different levels, the initial expenditure in obtaining a sufficient supply of water with the requisite head is generally very considerable. In order to give an idea of the character of the operations now in progress, the following particulars relating to the Cariboo and Horsefly companies may be cited.

The property of the Cariboo Hydraulic Mining Company is situated on the south side of the south fork of Quesnel river, about three miles above the village of Quesnel Forks. It comprises several claims, and is believed to cover about 8,500 feet of an old high channel of the river, separated from the modern deep and canon-like river gorge for a considerable part of its length by an exposed rocky ridge, known as French Bar Bluff. Near the lower end of the property, on Dancing Bill Gulch, successful hydraulic mining on a small scale and with imperfect appliances has been carried on for a number of years by a Chinese company. At a distance of about 3,000 feet further east, on Black Jack Gulch, a good deal of work had been done by the South Fork Company, but without effectively reaching the richer gravels, which are below the level of the rim rock where this has been cut through. Short ditches have been made by both these earlier companies, and the exposures in their hydraulic pits afford most of the information obtainable as to the character of the deposits.

A ditch with a total length of seventeen miles and a capacity of 3,000 miner's inches has now been laid out by the present company and will be completed in the spring. This is to derive most of its water from Polley's Lakes, situated in the hills to the south-eastward. It is also I believe ultimately proposed to bring an equal volume of water from Moorhead Lake by means of a second ditch, which will be thirteen miles in length.

At the lower, or "China Pit," the bed rock of the old channel where cut by the present river bank is believed to be approximately 134 feet above the river. The head of the train of sluices near the working face is 200 feet above the same datum, while the sand box at the top of the bank is at a height of 489 feet; giving a head of water equal to about 289 feet, with ample fall for the dump, which is made direct into the river. Two monitors of five and five and a-half inches diameter of nozzle respectively, are established in this pit. Mr. Hobson estimates that the old Chinese company removed in all about 150,000 cubic yards of the bank, from which, it has been ascertained, $135,000 of gold was obtained, without the employment of mercury, or at the rate of about 90 cents per cubic yard. The scanty water supply available in advance of the completion of the main ditch enabled a run of only forty-seven hours to be made in the early summer. The mean volume of water employed was 2,000 inches, and the yield was 302 ounces.

The floor of the pit of the Old South Fork Company is about 200 feet above the present river, and the bed rock run has been found in test pits at a depth of about 30 feet below this floor, while above it on one side of the gully, is a nearly vertical face of clay and gravels about 200 feet in height. The head of water from the sand box to the present bottom of the pit is about 246 feet; but as already stated the rim rock has not yet been cut through to the full depth of the old channel. It is proposed to begin active work here in the spring.

The Horsefly Hydraulic Company's claims are situated on the Horsefly river at a distance of about six miles south of Quesnel Lake. The river was notably rich in this particular part of its length, the bars had all been worked over by Chinamen some years ago. The source of this gold was found by Mr. McCallum to be the old gravel deposit now being worked by the Company.

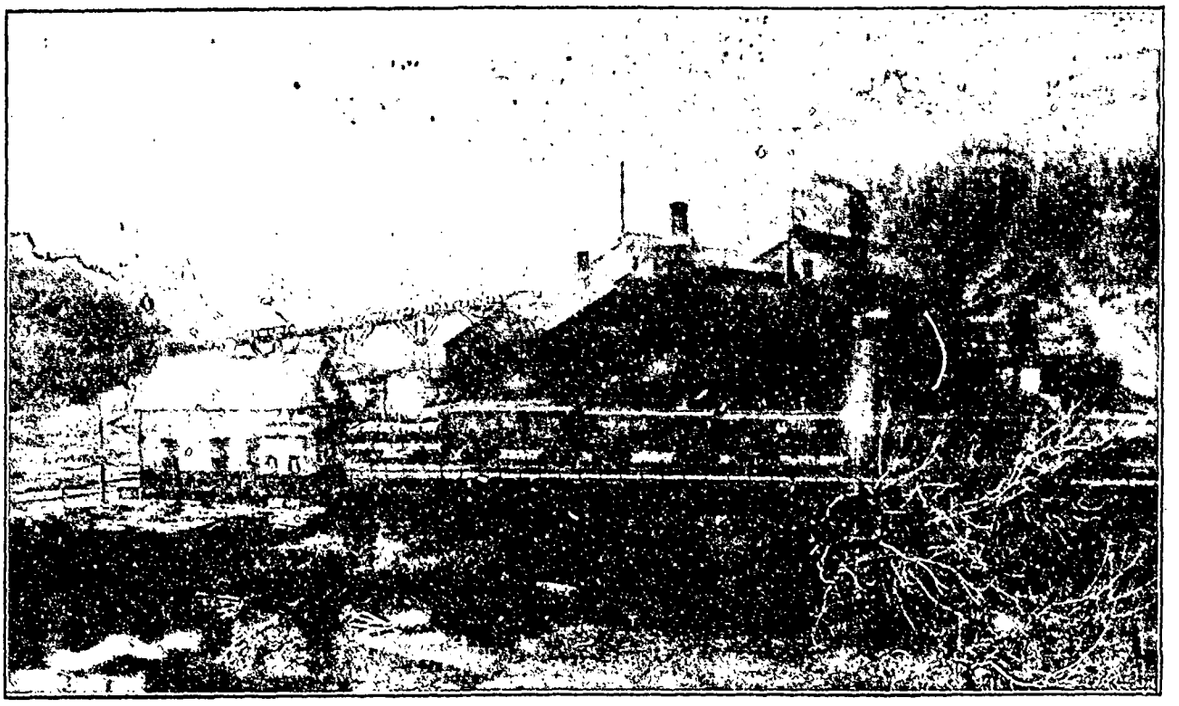
By the hydraulic system now successfully completed, water is brought from Mussel creek, a southern feeder of the Horsefly by a ditch and pipe line aggregating over eleven miles and a half in length. The ditch is about ten miles long, with a capacity of 2,000 miner's inches. The pipe line is steel, 30 inches in diameter, in two lengths aggregating 8,300 feet. There is also about 600 feet of flume. From the sand box the water is led to the pit by two lines of 22 inch pipe, each of which is intended eventually to supply the monitors. Water is delivered from the main ditch with a head of 168 feet and from the pooling reservoir with a head of 106 feet. The bed rock, constituting the floor of the pit, is about 90 feet above the level of the river and the working face (60 feet in height at its highest part) at the time of my visit, was about 560 feet back from the river bank. The dump is formed in the river itself, which is a moderately rapid stream, capable, (particularly in high water) of removing a large quantity of debris.

Respecting the actual average gold content of the gravels as worked, much has doubtless been ascertained since my visit, some $13,000 being reported as the result of the last clean up. The preliminary run made by the Company was estimated to have dealt with 21,333 cubic yards of gravel. It produced gold to the value of $5,000, or at the rate of about 25 cents per cubic yard, but about a third of the area then worked had already been drifted on bedrock by the original discoverer, rendering it probable, in Mr. Hobson's opinion, that the unworked ground would average about 40 cents. A small percentage of platinum occurs with the gold at this place.

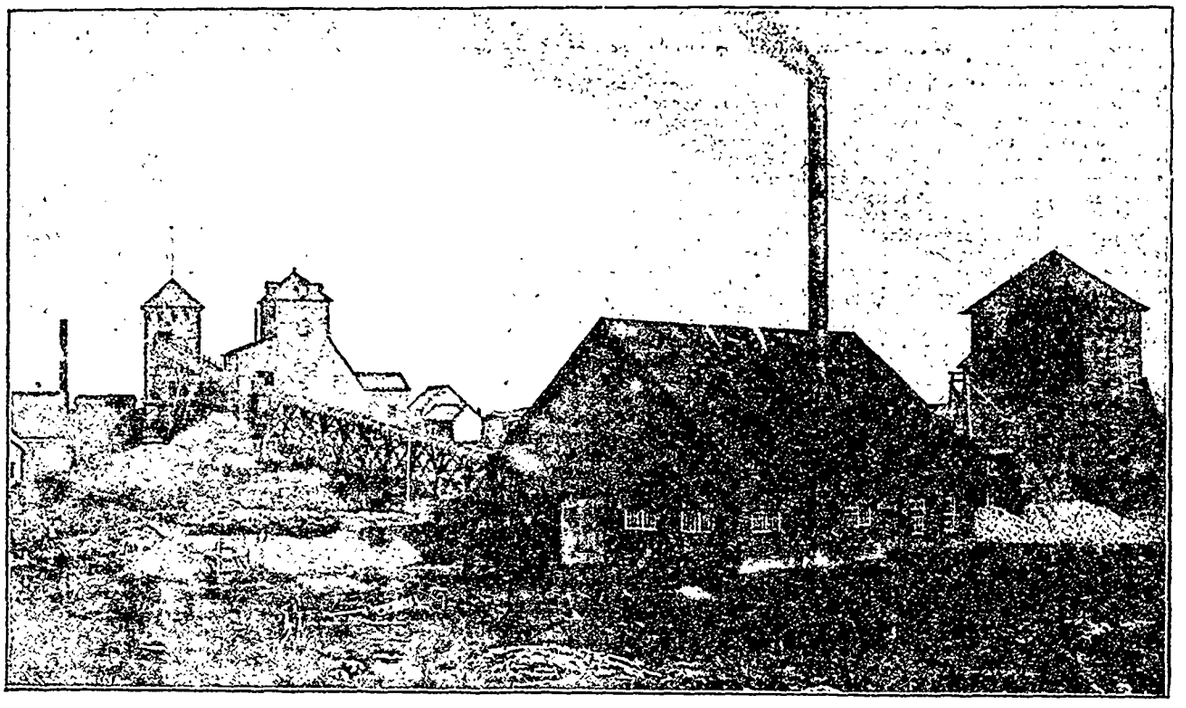
The ground being worked by the Van Winkle Company is situated on the west side of the Fraser river about two miles above Lytton. It consists of a series of terraces rising in steps from the river toward the bases of the mountains. The first of these is about 100 feet above the river, the second some 60 feet higher, while others occur at various still greater heights. The first has taken the form of a great isosceles triangle, of which the apex touches the river, the base being about 1,200 feet distant. The yield in gold has not yet been found to be so good as the rich character of the old flat worked over here many years ago appeared to indicate it would be, but the prospecting carried on in advance of the work shows richer ground.

The water employed is brought along the upper terraces by ditch from a branch of Stein Creek and then down to the work by an 18-inch pipe-line 1,500 feet long. The working head is about 350 feet and about 1,600 inches of water is employed.

The auriferous gravels at Horse-Fly are probably of Pliocene Tertiary age and are overlain by boulder-clay, referable to the glacial period. Those in the Cariboo



FRONT VIEW CAPELTON CHEMICAL AND FERTILIZER WORKS.



ALBERT MINES—Nos. I, II and III SHAFTS.

Company's pits are in part inter-glacial and in part pre-glacial, but probably all newer than the Horse-Fly gravels. The deposits near Lytton which are being worked by the Van Winkle Company are in the main still more recent, consisting chiefly of the river benches or terraces, by which the Fraser Valley is lined, and which have been formed by the gradual cutting down of the river itself after the close of the glacial period.

The geological conditions of occurrence of auriferous gravels in British Columbia, even as already known, are somewhat complicated and as work progresses great additions to our knowledge may be expected. The circumstances differ considerably from those met with in California, because of the general action of glaciation to which British Columbia has been subjected. The older gravels, where not covered by a basaltic capping, are often buried under boulder-clay, while above the boulder-clay or between two deposits of this kind, are to be found extensive masses of later gravels. The study of the facts relating to the glacial period are therefore here likely to have an important bearing on the economic problems of the gold placers and the tracing out of the old auriferous drifts.

The Albert Mines and Capelton Chemical Works.

By Mr. S. L. Spafford, Capelton.

These mines and works are situated at Capelton, Que., and owned by the Nichols Chemical Co., of New York city, successors to G. H. Nichols & Co. The ore occurs in the pre-Cambrian formation.

Veins are the filling of cracks or fissures; these cracks or fissures may either extend through the earth's crust and divide it for long distances, or they may reach down only to a limited depth or be confined to single strata, so veins are exceedingly various in extent. They may be many rods in width or they may be very thin. Strata having been faulted, so veins also may have their faults and displacements. The subterranean movements that produce joints and fractures in rocks may give origin and peculiarities to veins. Faults may divide veins not only into parts that are little displaced, but into portions that are shoved hundreds of feet above or below, which of course is very perplexing to the miner.

Fissures, that have been filled gradually without eruptive aid, are veins of infiltration, and those through the agency of igneous eruptions are contact veins. The latter is considered the most prominent in depth. There seems to be a diversity of opinion as regards the formation of the veins at Capelton and Eustis, but let that be as it may, the work done by the Nichols Chemical Co. and the Eustis Mining Co. have proven the deposits to be of enormous extent.

There are a large number of ore deposits in the Capelton district, all of which are found running in a north-east by south-west direction.

About 32 years ago prospecting was first commenced at Capelton, and soon after that mining operations were commenced on lot 2, range 9, and at shaft known as No. 5 Hartford, which is now operated by the Eustis Mining Co.

My notes concerning the mines will now refer specially to those owned and operated by the Nichols Chemical Co. Their workings consist of shafts Nos. 1, 2, 3 and 4. The present depth of No. 1 is 2,100 feet on the slope of the vein, which averages about 30 degrees from the horizontal. When the above company first commenced operations sixteen years ago, this shaft was only 300 feet deep. No. 3 shaft is about 400 feet deep and No. 4 is about 700 feet deep. The longest level in the latter is a little more than 650 feet, following a productive vein all of that distance, except for about 50 feet where a cross course disturbed the lode, forcing the vein to the left, or back into the foot that distance. The cross course causes a displacement of the vein on the horizontal, forcing it either to the right or left. It is a matter of great importance to the miner to know in which direction he will find the vein. If approaching the cross course from the west it is usually a left hand throw, but there is no rule that can be depended upon.

The method of mining is by sinking the shaft about 8 by 12 feet in advance of the other workings. Levels are then extended on the vein and the ground is blocked out by sinking winzes or raising from a lower level to one above it. In distance apart these levels are from 65 to 100 feet, thereby giving very high and long stopes.

In No. 1 shaft the deposit has a length of about 300 feet, and varies in width from 2 feet at the ends to 45 feet at the widest place. Slides have been met with in different places. These faults merely caused displacements of the vein, the most prominent being an upthrow of 20 feet. The vein is also crossed by a very large trap dyke, which does not in any way disturb or affect the vein.

The selvage being wavy causes irregularity in the width of the vein. The dip, which is to the south-east, is very irregular also. In some places it is almost perpendicular, while in others it is nearly horizontal.

Large pillars of ore are left standing in suitable places to support the roof of the mine. Usually the ground is firm, but occasionally the heavy blasting loosens bands of slatey rock which are kept in place by heavy and very large timbers.

The bottom part of the mine is very free from water. The surface water is caught in large cisterns near the surface. The pumps used were manufactured by Guild & Garrison of New York. The water being strongly charged with copper in solution, which is very destructive to iron, it is necessary to have the water end of the pumps made of bronze, and the piston, piston rod etc., made of brass. Three inch cast iron pipe is used for conducting the water to the surface.

The battery of tubular boilers at No. 1 shaft consist of seven set parallel with each other. Four of them are 80 horse power each, one 60 horse power, and two 50 horse power each, making a total of 480 horse power. For steam purposes bituminous coal is used entirely.

Two Air Compressors, one a compound Norwalk, main 20 x 24 in. cylinder, the other an English duplex 16 x 36 in. cylinders furnish the compressed air for drillling. There are three large air receivers, the largest being 6 feet by 30 feet, and the air is carried from them down the shaft in 5 inch and 4 inch pipes where it is at different points diverted in smaller pipes to the many different workings where power drills are in operation. Ingersoll-Sergeant and Rand power drills are used.

The hoisting engine is a double friction winding engine, 20 x 24 in. cylinders, 250 horse power, speed 700 feet per minute, with two drums 6 feet in diameter, each drum has a powerful spur wheel keyed on drum shaft, which meshes the driving pinion on engine shaft.

The hoisting rope used on these drums is made of the best plough steel, breaking strain 30 tons. It is 1 in. diam. has 6 strands with 19 wires in each strand and hemp centre.

Automatic dumping hoisting skips are used, which are made of heavy steel plate, and have a capacity of 3 tons.

The machinery in the concentrating plant is driven by an 18 in. x 24 in. single straight line engine, having a driving wheel 24 in. by 10 feet.

The plant also has a 400 h.p. surface condenser, the circulating water being supplied by a compound pump, having an 8 in. suction and a 6 in. discharge.

The head house is 75 feet high. The ore discharges out of the skips on to a series of bar screens, after which the very largest pieces pass through a 15 in. x 30 in. ore breaker. The ore of proper size for hand picking passes from the screens on to a travelling picking table, 4 ft. wide by 32 ft., which is driven by an 8 in. belt. A few boys stand on each side of the table and pick out the rock while the table is in motion conveying the ore and discharging it into two 6 in. x 20 in. ore breakers, and these break it down to proper size for transportation. The fines, which include all that pass through a one inch screen, is conveyed by elevator to a revolving screen, which separates the fines from the half inch and larger. The latter for further sizing down is put through the Cornish rolls which are 15 in. x 30 in., and it is then conveyed to the last revolving screen, delivering each size to their own jigs. The concentrating plant produces three sizes of ore, viz:—lumps, smalls and fines.

Shafts No. 3 and 4 are each equipped with two 75 horse power tubular boilers, and each has a 75 horse power friction drum winding engine. The two air compressors at No. 1 supply all of the compressed air required. The distance between No. 1 and No. 4 is about 1,500 feet.

The hoisting and concentrating machinery was supplied by Mr. Earl C. Bacon of New York.

The ore is transported from the mine by wire rope tramway to the stock sheds near the Boston and Main siding. The tramway in use was patented by Mr. Hodgson. Its construction consists of an endless wire rope, one inch diameter, and 9,400 feet long, running on grooved sheaves, 24 in. diameter, which are secured on the cap piece of the bents or supports. In order to make the grade as regular as possible the bents are from 15 ft. to 50 ft. high and they are 100 feet apart. At each end of the line there is an 8 ft. sheave around which the rope runs. The buckets in which the ore is carried are made of wrought iron and each holds 350 lbs. At each terminal there is a fixed rail. The box heads or saddles which carry the buckets, have two small wheels on the side, and when the bucket arrives at either end the wheels ride on the fixed rails and the bucket can be filled or dumped while the rope keeps in motion. The buckets are hung on a wrought iron hanger which is secured to the box heads. The loading end of the line is about 500 ft. higher than the discharge end. The speed is controlled by a 15 h.p. engine which is geared to the pinion or driving sheave shaft. The capacity is 200 tons in 10 hours. The coal consumed at the mine is also conveyed by this tramway.

The owners of the mines have always utilized the whole ore product, the first treatment being converting the sulphur contents into Sulphuric acid.

Brimstone was first used for sulphuric acid making but since cupreous pyrites has come into market, brimstone is to quite an extent driven out of sulphuric acid works. The sulphur in pyrites must be driven off before the copper can be obtained, consequently its sulphur will probably always be cheaper than brimstone.

Pyrites for sulphuric acid making was first used in 1818. Considerable difficulty was experienced in lighting the kilns because it was attempted from below. It was discovered by accident that lighting them from the top was the quickest way and since then that method has been used.

It is said that in 1614 the apothecaries produced sulphuric acid by burning sulphur in moist vessels with access of air. The price of acid at that time was $6.00 per pound or $12,000 per ton. In the year 1740 acid making was carried on near London and the price was reduced to 45 cents per pound.

In 1746 Dr. Roebuck of Birmingham introduced the first lead chambers. In France the first lead chambers were erected by Holker in 1766, while in Germany they were not introduced until the year 1820.

Chemical works were first constructed at Capelton in the year 1887. The works were designed by Mr. J. B. F. Herreshoff of New York City. The main buildings are 175 feet long by 75 feet wide and 3 stories high. These buildings being very wide made it necessary to use the truss roof, which is covered with slate supplied from the quarry near Richmond Que.

The kilns are constructed of fire bricks and have cast iron fronts, each burner being independent of the other. The percentage of sulphur in the ore controls to quite an extent the quantity of ore which can be burned per superficial foot of grate surface.

Usually the results are from 30 to 45 pounds per square foot in 24 hours. The ore should be used neither in too large nor in too small pieces. If the pieces are too large the sulphur would not properly burn out, and then would remain green cores in the interior of the cinders. In the other case if the pieces are too small they prevent the proper access of air.

The oxygen of the air being transferred to sulphur dioxide (So_2) through the interposition of the acids of nitrogen and with the aid of a vapor (steam) produces sulphuric acid as a final product. The substances coming into question here, except the final product are in the state of a gas or a vapour. For reaction it takes a certain time, therefore there must be a large chamber space given so the gas can remain for some time. The gases and acids being very strong, quickly destroy wood of any kind, anb it is necessary to construct all acid chambers of lead.

The Glover Tower, which in its special structure is patented by the Nichols Chemical Co., occupies an intermediate position between the kilns and chambers. It is a rapid and economical concentrator, besides being valuable for dinitrating.

Pans are used for concentration of the sulphuric acid. The final products are oil of vitriol and extra concentrated or 98% acid. The former comes largely into use for refining oil and the latter for mixed acid making is an important factor.

To suit the requirements of the trade the product is shipped either in carboys, iron drums or tank cars. To retain its transparentness oil of vitriol must be kept free from dirt.

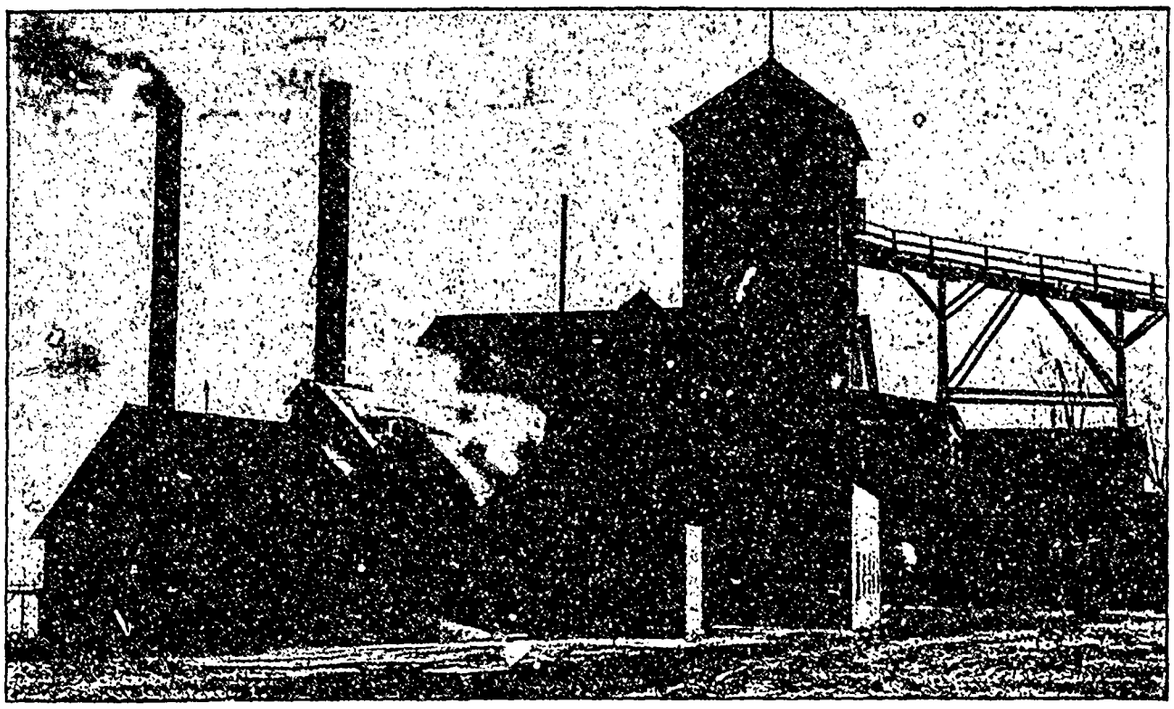
In the superphosphate industry sulphuric acid is also largely employed.

With the agriculturist, if production is to be cheap it must be rapid and plenteous. We all know the progress of unaided nature is slow, but as we are familiar with the elements essential to plant growth, the farmer may assist and hasten the natural processes. Canadian phosphate which comes from the Buckingham district is used at Capelton for manufacturing fertilizers.

The phosphate is first dried, then ground to a fine powder in the Griffin mill. This mill employs in its construction the principle of a rigid roll, on a suspended shaft running against a ring or die. This rigid roll on a revolving shaft has freedom to swing outward against the die by the use of a universal joint. By centrifugal pressure there is great force brought to bear on the material being pulverized between the roll and die. This mill will grind about two tons per hour. After being ground the apatite is dissolved with sulphuric acid, after which ammonia and potash is added to make the complete fertilizer. It is then put through the disintegrator and then screened again.

We manufacture five different brands or grades of artificial fertilizers. The Capelton and No. 1 brand as superphosphates, and the Reliance, Victor and Royal Canadian are complete fertilizers. The goods are shipped in sacks 200 pounds each, and in conformity with the law the brand and guaranteed analyses is plainly printed on each sack.

The Herreschoff water jacket smelting furnace is used for extracting the copper in the burned cinders. The capacity of the furnace is 50 tons per day. The matte produced is shipped to Laure Hill, Newtown Creek, L.I. The buildings are lighted by electricity; the mines and the chemical works each have their own dynamo.



ALBERT MINES FRONT VIEW No. I CONCENTRATING MILL.

GENERAL VIEW OF HYDRAULIC WORKINGS.

On the Origin of Gold Nuggets.

By A. Liversidge, M. A., F. R. S.*
(Professor of Chemistry in the University of Sydney.)

(Continued from page 252.)

"There is a tradition prevalent in all the shallow placer gold mines of the south, and in those of some other districts, to the effect that gold *grows* from the *seed* gold which is not extracted, so that every few years the tails of the old mines are reworked, generally with a profit; the quantity separated each time, according to the local tradition, being in proportion to the length of time the material has remained undisturbed." This admits of an easy explanation, although Prof. Egleston does not offer one, viz., that the gold is, of course, not wholly removed by the ordinary processes of extraction, and some, although a smaller amount, is almost certain to be obtained by each successive treatment, moreover the material becomes more broken up by the further handling and weathering, and more gold is thus set free, both mechanically and probably by chemical changes also.

He then cites, page 64, experiments of his own similar to Wilkinson's, Newbery's and many others, to show that gold is precipitated from its solution as chloride by petroleum, cork, peat, leather, leaves, &c. The petroleum threw down long crystals of gold resembling Chester's hexagonal crystals, and the peat a mamillary mass resembling the form of nuggets.

He then tried, p. 65, the solubility of gold in solutions of salts, ammonium sulphate and chloride, potassium chloride and bromide placed in sealed tubes with spongy gold for eight months gave no reaction; on heating them for five hours at 150° to 200° C only the potassium bromide gave a reaction.

Pure sponge gold was sealed up for three months with ammonium sulphide with no reaction; but both potassium and sodium sulphides gave black precipitates and a strong reaction for gold was given by the liquid in each case; the ammonium sulphide heated for six and a half hours at 145 to 150 C was unchanged but reacted strongly for gold; the solution of potassium sulphide also reacted and the glass was much attacked, further there was a black precipitate of gold; the sodium sulphide acted much more feebly. Other salts and solvents were used but with no very striking results.

He states, p. 72, that "the same conditions which cause the solution of the gold in certain cases cause also the solution of the silica." And "many of the causes which produce the precipitation of the gold would also cause the reduction of soluble sulphates to insoluble sulphides, the gold being retained within the mass. This would account for the almost constant presence of gold in pyrites."

"No single agent is so powerful a solvent of gold as chlorine. Very few drainage waters are free from some compound of it, and no soil is without the nitrogenous materials necessary to set the chlorine free, and therefore capable of attacking the gold and rendering it soluble." . . . . The readiness of filtration through the relatively easily permeated gravel causes the gold to precipitate so rapidly that there is no time for any but a mammillary deposit, which in vein deposits the extreme slowness of the deposition allows the gold to assume the crystalline shape."

Melville Attwood, E. M., in a paper, "On the Source or Origin of Gold Found in Lodes, Veins or Deposits," (Report of the State Mineralogist of California, 1884, Vol. viii., p. 773), quotes that "M. Laur, 'On the Origin and Distribution of Gold in California,' communicated to the Academy of Sciences, Paris) mentions having found metallic gold in deposits, evidently derived from some hot springs"

M. A. Daubree, in his "Les aux souterrains a l'epoque actualle," (Paris, 1887, p. 33), says:—"Plusieurs geologiques (MM. J. P. Laur, A. Phillips et Egleston) ou cru reconnaitre qu' en Californie de l'or se dépose encore actuellement, particulierement dans des graviers. On prétend aussi avoir trouvé ce metal dans l'eau de Louéche et plus récement, d'apres Gotll, dans l'eau de Gieshubl et dans celle de Carlsbad."

Posepny "Zur Genesis der Metallseifen," (Oesterr. Zeits. f. Berg. und Huttenwesen, 1887, xxxv.) is of opinion that the formation of large masses of gold in the vein are more easily accounted for than in alluvial deposits.

E. Cohen, "On the Genesis of Alluvial Gold" (Jahr. f. Min., 1889, i., Ref. 430-440 from Mit. Ver. f. Neuvorpommern u. Rugen, 19, 198) is of opinion that the greater part of alluvial gold is derived by the disintegration of older deposits, but that separation from solution also occurs in a subordinate manner.

Mr. H. P. Washburn in a paper entitled "A Theory on the Formation of Gold into Specks and Nuggets" (Trans. N. Z. Inst., 1889, p. 400) opposes the hypothesis that nuggets have been formed *in situ* in alluvial deposits.

COMPOSITION OF VEIN AND ALLUVIAL GOLD.

In the preceding references there are several statements as to the greater purity of alluvial gold over vein gold, and this is by many assumed to be a proof that the nuggets and other forms of alluvial gold have had a different origin to the vein gold and that the alluvial gold has been deposited in the way suggested by Selwyn and other writers.

If we examine some of the assays of vein and alluvial gold, we shall see that there are differences but that they are not very material, and further, the vein gold is sometimes richer than the drift gold.

Selwyn and Ulrich (P. P. G. and Min. of Vict., 1866), p. 42, refer to the greater richness of alluvial gold.

D. C. Davis, F. G. S., "Metalliferous Minerals and Mining" (London, 1880, p. 50), in speaking of "the gold bearing drift of the Sierra Navada says, the particles of gold are found of larger size and contain more silver at the bottom than at the top of the ancient drift, and are worth less by two shillings and sixpence per ounce. It is supposed that their difference in quality is caused by the larger size of the fragments below resisting more effectually the action of sulphuric acid which, set free by the decomposition of pyrites, has eaten the silver out of the smaller grains at the top of the deposit.

He also says, p. 36, gold is most plentiful in it (drift in the Urals) where the drift is most largely charged with iron;" and Brough Smyth, in a Report of the "Gold Mines of the S. E. Portion of the Waynaad, &c.," (London, 1880), states that "the gold obtained in the Waynaad, is unequal in fineness, that from the soils being of the best quality. It has been observed in other countries that the finer the particles of the gold procured from alluvial deposits the higher is the quality."

P. Nisser, "On the Geol. Distribution of Gold with Special Reference to some Auriferous Rocks in South America," (Trans. Phil. Institute, Vict., iv., 1860, read 30th March, 1859) points out (p. 17) that in the Province of Antioquia, North Grenada, the gold from the vein stones differs very greatly from the alluvial gold: the former averaging 14½ carats fine, and the latter eighteen to twenty-two carats. He states that W. Birkmyre found that vein gold from Clunes, Victoria, was poorer than the alluvial gold, and that the same thing was observed by other assayers; and he finally concludes that since the South American alluvial gold differs so much from the vein gold that it must have had a different origin.

Bernard Von Cotta, in his treatise, "On Ore Deposits," New York, 1870, in speaking of the placer deposits of the Urals, says that the gold is generally more or less argentiferous, the amount of silver varying according to G. Rose's examinations between 16 and 38·74%. It has been sometimes thought that the placer gold was purer (less argentiferous) than that extracted from deposits *in situ*, but G. Rose has shown that such is not the case in the Ural Mountains. He found that the amount of silver was very variable in both cases, although the highest amount of silver was found in gold from veins, which contained even in the same lode very variable quantities."

Mr. Geo. Foord, F. C. S., of Melbourne, could find no difference between the quality of the internal and external portions of nuggets; but in one case he found a vein which was of a greenish-yellow in the centre, from the larger amount of silver present in that part of the gold.—Brough Smyth, "Gold Fields and Mineral Statistics of Victoria," p. 359-60.

Mr. Birkyre, p. 371 of the same work, points out that the "Welcome" nugget weighing one hundred and eighty-four pounds, nine ounces, gave him 23 car. 3½ grs. gold or 99·20 %, or it was nearly as rich as the finest gold dust, viz., 23 car., 3½ grs.

The following analyses of gold from the North Transvaal, (E. Cohen, Jahr. f. Min., 1889) show a slight difference between the vein and the alluvial gold; but much importance cannot be attached to it:—

	Residue.	Ag.	Au.	Cu.	Fe.	Total.
1. Vein gold.	.02	5.16	94.48	.25	trace	99.91
2. Alluvial gold.	.78	6.49	91.38	.09	"	98.74
3. "	.07	5.64	95.16	.	"	99.87
4. "	.07	4.57	94.87	.11	"	99.62

1. Vein gold, Button's Reef, Marabastad, North Transvaal.
2. Alluvial gold, Button's Creek, derived from above.
3. and 4, Alluvial gold, in flakes and grains.

EXPERIMENTS.

Freshly fractured pieces of the following sulphides were placed in cylinders of the photographer's gold toning solution (fifteen grains of the double chloride of gold and sodium in fifteen ounces of water) viz: iron pyrites, molybdenite, mispickel, galena, copper pyrites, blende, argentite, &c.

In some cases the sulphide reduced the gold at once and became gilt or coated with the reduced gold, either as a bright coherent deposit or else as a dull ochre-colored one. Successive quantities of the gold solution were added from day to day as it became colorless, and in this way quite thick and strong deposits of gold were formed on the sulphides.

In the case of the molybdenite, MoS_2, the gold deposit was at first lustrous and metallic, but as time went on it became of a dead brown aspect, although this under the microscope was seen to be made up of brilliant metallic points of light. Blue and white oxides of molybdenum separated out.

The deposit on the mispickel was not compact and coherent like that on the molybdenite, galena, and other minerals, but loose and easily rubbed off.

The deposit on the iron pyrites was also bright and metallic looking at first but as it thickened it became dull and ochre-like in color.

The deposit on the galena was similar to the above; under the microscope, the surface, as in other cases, is seen to be minutely mammillated, and it is on that account that to the unassisted eye, the gold has a dull brown or ochre color.

The preceding experiments are not unmbered because they are merely qualitative ones, but the next series of experiments were quantitative; weighed pieces of pure sheet gold were put up with various organic reducing substances; sulphides and other naturally occurring substances which I thought might form a galvanic couple, and which would throw down the gold from solution upon the plate as in the electroplating process.

A.—WITH A GOLD NUCLEUS AND ORGANIC MATTER.

In the following experiments, pure gold specially prepared by the late Dr. Liebius, senior assayer of the Sydney Mint, and assaying 1000 was rolled out into fillets of $\frac{1}{33}$ inch thick, so as to expose a large surface and yet be strong enough to handle, these were heated in a cornet crucible to burn off impurities and then boiled with nitric acid, and well washed to get rid of any sulphur of other contaminations from the gas flame. The nuggets and specimens of native gold used as nuclei were also cleaned in the same way. The fillets were next weighed and placed in stoppered glass cylinders with a solution of the sodium chloraurate, supplied for photographic purposes, and made up of the usual strength of a fifteen grain tube of the salt to fifteen ounces of water.

The reducing substances were similar to those used by Wilkinson, but as will be seen with results just the reverse of what he obtained, *i.e.* the gold foil or other nucleus weighed less instead of more after the experiments.

Experiment 1. A water worn nugget was used as a nucleus the dust of the air was allowed to fall in, and the experiment was continued for one hundred and sixty-eight days, with an occasional addition of gold solution as the liquid in the cylinder became colorless from the reduction of the gold. Although a good deal of gold was precipitated on and around the nugget none of it was adherent, and on re-weighing it was found to have lost ·002 gramme.

Experiments 2 and 3.—A plate of pure gold was used as a nucleus in each case, and the solution was exposed to the air as above; one plate lost ·0042, and the other ·0038 gramme.

Experiment 4, with cork.—The gold solution was left in a stoppered cylinder with a slice of clean, new cork, until the yellow color of the solution had disappeared, showing that all the gold had been removed from it. Some gold was precipitated at the bottom of the cylinder, some on the sides, and a little floated as films on the top, there was also a small quantity of gold precipitated on the gold plate, but this was non adherent and came away on washing the plate in a jet of water. This plate underwent no change in weight.

NOTE.—All of my experiments were carried out in full daylight, and not in the dark like those by Wilkinson, Egleston and others.

Experiment 5, with Swedish filter paper.—The yellow colour soon disappeared from the solution, and the paper acquired a purple colour. The gold plate lost ·0036 gramme in weight.

Experiment 6, with phosphorus in ether.—The solution soon became colorless, and a black precipitate of gold was thrown down on the bottom of the cylinder and on the gold plate. Floating films of gold also formed on the surface. On washing the gold plate with a jet of water all the gold deposited on it was washed away, and on drying and weighing it was found to have lost ·0004 gramme.

Experiment 7.—In this case a freshly broken jagged fragment of gold in quartz was used as the nucleus instead of a gold plate, but cleaned with the same care. Cuttings from a cedar pencil and some scraps of paper were added, these acted in the same way as the cork and were "mineralized" by the reduced gold; the gold and quartz nucleus lost ·0021 grammes in weight.

Experiment 8.—Paper and wood were used as in experiment 7, with a nucleus of jagged gold set free from quartz by means of hydrofluoric acid; the nucleus lost ·0013 gramme.

Experiment 9.—Similar to experiment 8 with a necleus of native gold from Sandhurst (Bendigo). This showed a loss of ·0001 gramme.

On incinerating the cork, ceder, &c., which had been used for reducing the gold, the residue retained the original form, but much shrunken and :s has been observed by others, the microscopic structure of a cut section presents the appearance of burnished gold from the pressure of the knife.

No.	Nucleus.	Reducing matter.	Original weight of nucleus.	Weight of nucleus after experiment.	Difference in gms.	Number of days.
1.	Nugget	Dust from air.....	3.4920	3.4900	.0020	168
2.	Gold foil...	" " "	1.5152	1.5110	.0042	168
3.	"	" " "	1.1713	1.1675	.0038	168
4.	"	with cork	1.1410	1.1410	None	273
5.	"	with filter paper. .	8500	8464	.0036	273
6.	"	Phosphorus in ether	9330	9326	.0004	273
7.	Gold in quartz....	paper and wood...	1.7630	1.7609	.0021	58
8.	Gold from "	" " " ...	2.8487	2.8474	.0013	58
9.	" " "	" " " ...	6574	6573	.0001	58

The above experiments all show that instead of the nucleus or nugget of gold increasing in weight and size in the presence of organic matter, there is a decrease which is just the reverse of the effects obtained by Wilkinson, Daintree, and others.

The loss in weight of the nucleus may have been due to the removal of small quantities of impurity in the gold used as a nucleus, the native gold would of course contain silver and other impurities, but the gold foil was regarded as particularly pure by the late Dr. Leibius of the Sydney Mint, by whom it had been assayed. This will be the subject of further experiment, the point of chief interest at this stage is that the nuclei did not show any increase in weight.

(To be continued.)

ONTARIO MINING INSTITUTE.

Proceedings of the Kingston Meeting on 3rd and 4th January—A Large Addition to the Membership—Many Papers of Interest Discussed.

The second ordinary meeting of the Ontario Mining Institute opened in Carruther's Hall, on Thursday morning, 3rd January, Dr. W. L. Goodwin, Vice-President, in the chair.

THE SECRETARY read the minutes of previous meeting, which were confirmed; also a letter from the President, Mr. James Conmee, M.P.P., regretting inability to be present.

Federation.

THE SECRETARY submitted the Report of the Mining Society of Nova Scotia on a scheme for the federation of existing Canadian Mining Associations.

MR. HAMILTON MERRITT also presented the report of the Committee of the Institute which had been forwarded to the Quebec and Nova Scotia Societies.

After considerable discussion the Report of the Mining Society of Nova Scotia was in the main approved, but the clause anent subscriptions was referred to a subcommittee comprising Prof. Goodwin, Prof. Nichol, Mr. A. Blue, Director of Mines, and the Secretary, to report at a later stage of the proceedings. This committee after due consideration recommended the following amendments to the consideration of the Quebec and Nova Scotia Societies:—"That each of the Societies in the Federation shall pay the expenses of printing and illustrating its own portion of the Proceedings of the Institute, the rate per page not to exceed one dollar and a half." (Or as an alternative.) "The Societies in the Federation shall each pay an annual subscription towards the expenses of the Institute of such an amount as may be determined upon at each annual meeting, but the contribution from each society shall at no time exceed in amount the sum of three dollars per capita."

Meetings and Student Membership.

THE SECRETARY tabled a notice of motion to amend the Constitution and By-laws so that two meetings of the Institute should be held in each year, instead of three as at present; also, so as to create a student membership at a nominal fee.

Legislation re Mining Engineers.

MR. HAMILTON MERRITT moved the appointment of a committee comprising Prof. Goodwin, Dr. Coleman and Mr. Merritt, to report upon the advisability and feasibility of legislation for the registration in the Province of duly qualified mining engineers. It was highly desirable, he thought, that where such educational institutions existed in Ontario as the School of Mining and the School of Practical Science, something should be done to prevent or to minimize the practice of quacks in the profession. It seemed to be the rule in Ontario that where people were engaged in an occupation in which life and limb were endangered they should be required to conform to a certain standard of qualification. The matter had been under consideration and had been discussed in Nova Scotia. Personally he thought that mining engineers had as much right to protection as doctors, dentists and lawyers.

MR. B. T. A. BELL thought that the motion might be tabled for discussion as to ways and means at a future meeting. While in sympathy with the principle involved he could not see how legislation would improve matters. He could mention cases in which the biggest frauds had been perpetrated by mining experts who had all the letters in the alphabet behind their names. Some of the ablest and most competent mine managers were men who had never seen a school of mines or taken a degree. A science course would never compensate for the absence of honesty or common sense.

PROF. NICHOL having seconded Mr. Merritt's motion, it was put to the meeting and carried.

New Members.

The following were elected to membership:—

Mr. John Donnolly, Kingston.
Mr. B. H. Klock, Klock's Mills.
Mr. W. G. Kidd, Kingston.
Mr. Wm. Mason, Kingston.
Prof. Dupuis, Kingston.
Mr. Fred. Burroughs, Napanee.
Prof. Carr Harris, Kingston.
Mr. Bruce Carruthers, Kingston.
Mr. T. L. Walker, Kingston.
Mr. J. Newlands, Kingston.
Mr. E. Musgrove, Kingston.

The morning session then adjourned.

AFTERNOON SESSION.

The members re-assembled at three o'clock, Mr. W. Hamilton Merritt in the chair. Dr. Goodwin opened with an excellent address on "Nature's Concentration of Minerals," which we hope to reproduce in a future issue, together with the discussion that followed.

Diabase Dykes in the Sudbury Region.

MR. T. L. WALKER, M.A.

During the past few years the rocks of this region have received considerable attention. At the time of the construction of the Canadian Pacific Railway in 1884, Professor Bonney (1) of London visited the district and made a careful microscopic study of the rocks found near the railway lines. His attention was directed chiefly to the metamorphic rocks of the Huronian belt. In 1890 the late Professor G. H. Williams was entrusted by the Canadian Geological Survey with the microscopic study (2) of a collection of Sudbury rocks. This collection had reference principally to the rocks associated with the copper-nickel ores. Baron Von Foullon (3) of Vienna spent a few weeks during 1890 studying these rocks in the field, especially with a view to ascertaining the relative ages of the different rocks.

The so called Sudbury region is composed of a belt of Huronian rocks striking north-east and south-west. The rocks to the south-east and north-west of this belt are chiefly granites and gneisses. The Huronian belt is here made up of hornblende schists, quartzites and slates, while associated with these and possibly of later age are areas of granite and greenstone. Theselatter rocks generally occur in lenticular areas whose longer axes agree with the strike of the Huronian rocks. The rocks to be considered here are the youngest in the district, and are found generally in dykes of diabase, which frequently have a strike nearly at right angles to the members of the Huronian belt.

One of the best representatives of this dyke series may be seen crossing the railway track several times between Sudbury and Murry mines. Its course can be easily followed for about three miles. The most eastern exposure is a little more than a mile from Sudbury where it cuts through feldspathic quartzites which are regarded as characteristic Huronian rocks. About a mile farther along the journey to Murray mines, just near a pit from which clay has been taken for furnace purposes, another good exposure occurs, but at this point the rocks intersected by the dyke are the greenstones with which the nickel ores of the district are commonly associated. A curve in the railway leaves the dyke on the north side, but it may be well seen again, at the village of Murray mines, just where the colonisation road, after passing east through the village, turns south-eastward to Sudbury. In this instance the rocks intersected are granites which Bell regards as of Laurention age, but which instead can be shewn to be younger than even the nickel-bearing greenstones which he regards as not older than Huronian. This dyke is again exposed just west of the smelter at Murray mines. Here the dyke cuts through the greenstone area with which the Murray mines deposit is connected. All the exposures of diabase along the Canadian Pacific Railway between Sudbury and Murray mines, are portikns of the same dyke. Thus in following up this dyke for a distance of three miles it is seen to be of later age than any of the other rocks of the district. A second diabase dyke crosses the Canadian Pacific Railway one mile east of Worthington station. Its general direction is north-west. A third dyke crosses the railway about one quarter of a mile east of Worthington station and shews about the same general direction as the others. Many other examples occur, some of which are said to have other directions, but all those examined by the writer, have a general north-westerly direction. In width they vary from a few feet to fifty yards.

One thing characteristic of these dykes is the ease with which they are acted upon by hydro-chemical agencies. Near the Village of Murray Mines, the Government road passes for some distance between high walls of granite, which have become prominent by the weathering out of the diabase. The nickel bearing greenstones resist the action of atmospheric influences much better, and are generally greenish on weathered surfaces. In this they stand in contrast to the rocks under discussion, which become quite rusty on exposure. Spheroidal weathering is characteristic. When well exposed the diabase seems to be made up of ball-like masses, varying in size from a few inches to several feet in diameter. Decomposition is seen in the separation of concentric layers. Good exposures of this weathered rock often resemble walls built of cobble stones. With a view to understanding the reason for this concentric weathering, a thin section was made of a ball about three inches in diameter. No radial or tangential arrangement of any of the constituent minerals could be noticed. Mineralogically the centre of the ball did not differ from the portions nearer the surface. If these ball-like forms originated from the molten magma by crystallization beginning at independent centres, which afterwards became the centres of the balls, then we would expect the central portions to contain the more basic minerals. The microscopic examination of the large section did not confirm this anticipation. This structure has been regarded as due to contraction on cooling after solidification. Spheroidal weathering is very frequent in diabase. One of the exposures on the Canadian Pacific Railway, just east of Worthington station, shews phenocrysts of plagioclase from one to two inches long. This porphyritic phase is confined to a margin of from four to six feet along the wall. The rocks intersected show contact action, since, for three yards from the junction with the diabase the states are broken into rhombohedral fragments. Just behind McGregor's house at Murray Mines a similar action is shewn. The granite, along the contact with the diabase, is shattered into layers parallel to the contact. Adjoining the diabase these layers are about one-third of an inch wide; the width of the successive layers gradually increases till a maximum of two and a half inches is reached at about two feet from the contact. A section from one of these layers of granite, shewed, under the microscope, that considerable limonite had been developed, and that the feldspar was somewhat kaolinised. Besides, the quartz grains appear to have been shattered by the heat;

(1) Quart. Jour. Geol. Soc., vol. 44, p. 32.
(2) Geol. Survey Canada. Report of Progress 1891, F, p. 59.
(3) Jahrb. d. k. k. geol. Reichsanstalt 1392, p. 276.

they are seen in groups having nearly the same orientation as though larger grains had been broken up into several fragments which now form one of the groups of grains with nearly simultaneous extinction. No glassy borders were observed on the diabase, but this may be due to the ease with which the rock decays. In one instance a dyke was examined which shewed a trench ten inches wide and about twice as deep, along the line of contact. This was probably caused by the comparatively rapid decay of a glassy border, but there was no opportunity of obtaining fresh specimens of the dyke quite close to the contact. Near the border the rock is fine grained, but within a few inches it becomes almost as coarse as at the centre of the dyke.

Mineralogically considered, the plagioclose is the most abundant. It is generally quite fresh, but at times somewhat kaolinized. Idiomorphic much twinned crystals are characteristics. From a measurement of the angles of extinction in thin sections it appears to be one of the most basic members, such as labradorite. The relative proportions of lime and soda found in the general analysis of the rock point to its being a feld-par containing very much more lime than soda, such as we have in the case of labradorite. Wandering extinction and zonal structure are very frequently observed. In some of the slides prepared from the dykes near Worthington the feldspar crystals in a few cases contain slender inclusions, probably of glass, arranged with their longer direction parallel to the contact between the successive twinning lamellae. The twinning is commonly according to the albute law, but a combination of the albite and pericline laws is not infrequent. In one section from the dyke near Murray mines, twinning was seen combining the albite, pericline and baveno laws. Being the earliest of the silicates to crystallize, we have the ophitic structure beautifully developed by the idiomorphic lath-shaped forms of the plagioclose. The quantity of pyroxene varies. In the exposures near Murray mines about one-quarter of the rock is pyroxene, while at other points on the same dyke and also in the dykes near Worthington the pyroxene does not form more than one-eighth. It is noted that where there is most pyroxene there is least olivine and *vice-versa*. The total quantity of olivine and pyroxene is nearly constant—the one increasing as the other decreases. The olivine occurs in pale greenish yellow grains which are generally somewhat rounded, and are a little younger than the feldspar, but older than the pyroxene. In a few cases the olivine has given rise to serpentine and fine grains of magnetic iron ore. The pyroxene shows no definite outline. Cleavage can be very seldom observed. It is reddish brown to violet in color and faintly pleochroic. In none of the large number of sections examined could alteration of the pyroxene be seen. The iron ores are in part magnetite and the rest is probably ilmenite. They occur in irregular grains, showing no alterative products, and are generally associated with the olivine. Very slender apatite needles are abundant and intersect all the other minerals. A few scales of strongly pleochroic brown mica, a little cloritic substance, an occosional minute speck of a brassy sulphide and a few particles of quartz complete the list of minerals. Considering the general freshness of the rock it is easiest to regard the quartz as primary.

A careful chemical analysis was made of specimens from an exposure of the dyke on the Canadian Pacific Railway near Murray Mines. The result of this analysis is shown in Column I. Column II. shows an analysis by Mr. W. F. Hildebrand (4) of an olivine gabbro from Pigeon Point, Minnesota. III. is Teall's (5) analysis of diabase from Cauldron Snout, Durham, England.

(To be continued.)

Mining Society of Nova Scotia.

Discussion on Coal Cutting Machinery—*Continued.*

MR. W. BLAKEMORE.—In reply to Mr. Dick, I might say that the Messrs. Stanley of Neweaton have in their catalogue a cut of a double header, for driving levels up to 12 feet wide, and also a machine for cutting through the ribs for ventilation. In driving levels with Stanley headers it will always be a question of speed, and of necessity, often regardless of cost, and in my former paper I simply stated what the man on the machine had per foot.

At Caledonia Colliery we had a band of hard splint running from 1 to 1½ inches, situated 22 inches from the pavement, which was cut through without any perceptible difference in the working of the machine; and in several instances we got both up in the roof stone and into the pavement, and it was simply a question of having enough cutters for any ordinary stone, which would come in anything like regular layers, but I understand and would think that ironstone balls would give the cutters a hard blow, and that they would be liable to break or jump out of the wings.

The question of water makes little difference to the working of the machine, in fact having the level wet would be of considerable advantage, as it absorbs the dust which is made in cutting the circle, and which otherwise causes considerable trouble to the men in breathing.

In regard to the question of any coal cutting machine after the pattern of the Ingersoll and Harrison machines, I am very much in favor of the percussion type in room and pillar workings.

The following will, I think, answer Mr. Dick's question as to the relative time in shifting the two types of machines named. The only Jeffrey machine which did any work in Cape Breton was at the Gardener mine, and among some data of work performed by this machine I find that it required from four to ten minutes in shifting from cut to cut. This seems reasonable when you consider that the Jeffrey machine weighs 3,050 lbs., and is on runners similar to a sleigh and has to be pinched with a crowbar from cut to cut; while the Ingersoll and Harrison machines are mounted on wheels and can be easily handled, so that practically the time moving from cut to cut does not count.

In reference to my statement that any man of ordinary intelligence can work the Ingersoll or Harrison machine, I am giving a short account of our starting coal cutting machines at the Sterling Colliery, and I most certainly join issue with Mr. Dick's authority as to the percentage of men standing the shock of the percussion machines. This was a matter to which I gave considerable attention during the summer of '93 at Caledonia Colliery, and in no instance do I remember of any of our men giving up a machine on this account, or that any of our men lost weight by working the machines.

During the summer, Dr. Black, of Halifax, visited Caledonia Colliery and was very anxious to see the machines at work. During his inspection I brought this theory to his notice, and he made particular enquiry into this from the men themselves, and in every case was assured that they had suffered no ill effects from this cause.

For the consideration of your readers who may be interested in increased outputs, I am giving the following account of machine work at the Sterling Colliery:—

We commenced machine work at the Sterling pit on the 13th of August, and the first week got 530 tons, second week 644 tons, third week (in Sept.) 1,269 tons, and in 17 days of October we cut 3,622 tons from our machines.

I also give the quantity of coal cut by one of our machine men:—Aug. 16 to 31, 339 tons: Sept. 1 to 15. 316 tons=655 tons for one month; and this man had never operated a machine until the date mentioned.

(4) W. S. Bayley—Bull. 103, W. S. Geol. Sur.
(5) Zirkel—Lehrb d. Petrographie. Vol. II., page 635.

Nova Scotia Gold Output, 1894.

The following official returns have been received since our statement of November:

Name of Owner.	District.	Months.	Quartz Crushed. Tons.	Yield of Gold. Oz.	Dwts.	Grs.
W. A. Sanders	Cariboo	Aug. & Sept.	316	184.	17.	0
Mooseland Gold Mining Co	Tangier	Aug. & Sept.	84	21.	14.	0
Antigonish Gold Mining Co	Stormont	May to Sept.	2,435	584.	2.	0
Country Hr. Gold Mining Co.	"	Jan. to Sept.	2,424	841.	4.	1

CORRESPONDENCE.

Rapid Tunnel Work.

Sir,—In the November number of the REVIEW you cited "Rapid Tunnel Work", done by the East River Gas Co., New York. The conditions were the following:

Rock.	Heading.	Drills.	Best day shift work.	Total week's work.
Hard Hornblende. Gneiss.	10½ x 8½ ft.	Four 3½"	48½ feet.	101 feet. =9014 cub. feet.

This is undoubtedly very rapid work, but let us compare it with another one executed by the Mine Engineering Firm, Rud. Meyer in Muhlheim a/R Germany, for the "First Transilvania Gold Mining Co." in Boicza Trans.

Drills used were four 3¾ inch Meyers air drills mounted on *one* Meyers Universal two column drill carriage.

Rock.	Heading.	Length of Tunnel.	Time used.	Best month's work.
Solid tough. Trachyte and amygdaloid.	10.17 x 9.18 ft.	6,575 feet.	524 days.	449.6 feet.

Average per week: 101.5 feet=9476 cubic feet, or 5.18 feet of 10½ x 8½ feet of tunnel in favor of the latter work. I do not know what the best day's work was but the above figures compare very favorably with the East River Co's work, if it does not show quicker work, especially if we consider the very stringent mining laws in Germany and Austria in regard to underground works, also the carrying along of a water trench 19.6 x 19.6 inches. 55,000 lbs. of dynamite were used, and no accident occurred.

Since the finishing of this tunnel two years ago the firm has driven several other long drifts with its still further improved air drill and compressor, and has beaten the above mentioned work, but these can not be compared here so well side by side with the East River Gas Co's work, as the drifts were smaller. The German mining laws do not permit the blasting down of the whole face of the tunnel, or drift breast, nor the drilling of such deep holes as used in this country for this kind of work, which tends to a considerable saving of time and a greater efficiency of the blasts, besides the narrower space of the drifts or levels does not permit the crew to move as easily about in carrying off the loose rock.

F. HILLE, M. E. and Ch.

PORT ARTHUR, 2nd Jan. 1895.

Complimentary.

Sir,—Although not enjoying a personal acquaintance with you, but being a member with you of the Mining Society of Nova Scotia, I cannot refrain from expressing to you herewith the great satisfaction it is to me, and I think to all members of our worthy Society, to feel and to know that our official expounder, the CANADIAN MINING REVIEW, is ever ready and alert to place before the reading public a truthful statement of facts and solid intelligent information regarding projects liable to mislead any one who may be or is likely to become interested in the mining industry of the Dominion of Canada, especially the Lower Provinces, which are of so great importance to all of us.

The fact of so much misrepresentation in the past by speculative individuals and irresponsible companies is one of the greatest drawbacks to-day from the progress and development of our mining industry.

My expressions herein stated were drawn forth, particularly at this time, by reading the leading article in the December issue of "THE MINING REVIEW" and the company's prospectus to which it refers.

Personally my interests are with gold mining but truth is unchangeable with all matters.

Yours, etc.,

BOSTON, 4th Jan., 1895. C. FRED. HOWE.

COMPANIES.

Ontario Peat Fuel Co., Ltd.—The annual general meeting of shareholders of this company is called for 30th January, but as the directors are desirous of submitting plans and specifications of the proposed changes to be made in buildings, machinery, etc., for the production of moss-litter, it is likely an adjournment will be made until 21st February.

Tulameen Mining Co.—This is a new company with an authorized capital of $30,000, formed to operate hydraulic mining in British Columbia. The promoters are Wm. Hogg, Vancouver, W. B. Stephens, Montreal, A. Fleck, C. Berkley Powell and W. Harris, C. E., Ottawa.

Bellingham Bay Hydraulic Mining Co.—Formed under the Foreign Companies Act, B. C., with head office at Fairhaven, Whatcom Co., Wash., to conduct mining operations in British Columbia.

Slocan Surprise Co., Ltd.—Registered 27th December, 1894, under the Foreign Companies Act, B. C., with an authorized capital of $225,000, and head quarters in Chicago; to mine and smelt ores in the Province of British Columbia.

Hall Mines, Ltd.—The second annual meeting of shareholders of this company was held at the offices of the company in London, E.C., on 19th ulto. We quote the following from the report to the shareholders, "As soon as the purchase of the property was completed the first matter the Board took into consideration was the advisability of sending an expert out to the mines to report upon the whole property and to advise the Board as to the best method of opening up and working the same." Accordingly Mr. Charles Harvey, the company's consulting engineer examined the mine in September and on his report the directors decided to adopt a policy of simply prospecting before going to any great expense for machinery and laying down of tramway. Mr. J. J. Jordan was appointed mine manager. The following machinery was put in :—Portable engine and boiler, compressor, diamond drill, crusher, sorting table and "in view of the necessity of a tramway from the mine to the proposed site for concentrating works, the directors introduced a bill into the Provincial House of Assembly at Victoria for the necessary powers to expropriate land for this purpose, and this bill has been passed. Your chairman inspected the company's property during his recent visit to British Columbia has reported that the favorable impressions previously formed by him from what he had heard and read about this mine were fully confirmed by his own observations which have convinced him that the Hall mines enterprise is a thoroughly *bona fide* undertaking and gives encouraging prospects of profitable results." The expenditure at the mine was £11,971 3s.4d ; and in London, £4,223 5s.5d. ; the total outlay for the year amounting to £25,456 14s. 11d. On the other side of the balance sheet we find :—Ore sales realized £5,360 14s. 2d. ; value of ore on dump at formation of company still unrealized, £7,345 16s. ; tools and stores in hand, £1,337 18s. etc., leaving a balance in excess of expenditure over income to date, against which there is a stock of ore in dump at the mines awaiting treatment £11,402 0s. 9d.

General Mining Association, Ltd.—We are officially advised that the coal disposals of this company for the year 1894 were : 211,000 tons *round ;* 12,000 tons ; or a total sale of 223,000 tons.

Thompson River Hydraulic Mining Co., Ltd.—During the year this company acquired their leases on Tranquille river, about 12 miles from Kamloops ; built a dam, flume and ditches, and put in a plant capable of moving 2,000 yards per day. Owing to early frost only a partial clean up was obtained, but the company succeeded in proving a portion of their ground, being 40 feet above the water level, which gave about 50 cents per yard. Work will be resumed in March.

The Lillooet (Cariboo) Gold Mine, Ltd., has been registered with a capital of £40,000 in shares of £1. Directors : F. S. Barnard, M.P., Victoria, B.C.; A. E. McPhillips, Victoria ; C. T. Dunbar, Lillooet, B.C. ; Reginald Northall Lawrie, London, Eng. ; Robert Horne-Payne, London, Eng. Head office : 54 Old Broad street, London, E.C. Has been formed to acquire and develop gold claims in British Columbia, and in particular certain hydraulic claims at and about the village of Lillooet, Fraser river, and known as the Irving, Jensen and Macdonald & Hurley, Robson and Welton claims. The lands are held under Provincial Government leases and comprise altogether about 480 acres The Macdonald & Hurley claim has been worked since 1890, and with only 200 miner's inches of water, very limited means, and primitive methods of development, such results as the following being obtained : "Mr. A. W. Smith, M.P.P., certifies that he bought gold from the claim as follows :—From 1890 to 1892, value $4,179; in 1893, value $1,500. Mr. C. A. Phair, (Government Mining Recorder), certifies that he bought gold from the claim between 1890 and 1893, value $725. Mr. A. Macdonald certifies that he sold gold from the claims in 1893 in Montreal and Ottawa, value $1,200. Mr. Angus Beaton, who managed the work on the adjoining claim, certifies that with six months' work and 200 miner's inches of water, it yielded $6,700 in 1893. The other claims have been worked by Chinamen, who claim to have averaged $4 to $5 per day, but no absolute record of these results is obtainable. A thorough examination and careful prospecting of the claims are recommended before shareholders are committed to a heavy outlay upon works.

The Golden Lode Mining Co., Ltd.—The officers of this Nova Scotia Gold Company are : H. H. Bell, *President :* A. M. Jack, *Sec.-Treas. ;* F. S. Andrews, J. T. Burgess and A. A. Hayward, *Managing Director.*

New Glasgow Iron, Coal and Ry. Co., Ltd.—Official returns furnished the REVIEW show the furnace record for the year ended 31st December to have been :—Total pig iron made, 28,142$\frac{8}{2240}$ tons of a value at furnace of $295,500.90 ; ore charged, 60,817 tons of a value of $121,634 ; fuel charged, 42,378 tons of a value of $104,516 : flux charged, 22,928 tons of a value of $22,928. 450 persons employed.

Cariboo Hydraulic Mining Co., Ltd.—At this company's property on the South Fork of the Quesnelle river, B.C., eight miles of ditch have been constructed ; capacity, 3,000 miners' inches ; nine miles more to build to complete system. Plant partly installed as follows :—2,000 feet of 22 inch and 18 inch pipe ; two hydraulic giants, having 7 inch nozzles, under 300 ft. head ; sluices, distributors, etc., in place. One preliminary washing made in early spring, using water for only 47 hours, but mining work only begun. $5,161.85 in gold dust was recovered during the progress of the work. From 50 to 250 persons employed last year.

Horsefly Hydraulic Mining Co., Ltd.—On this company's claims on the Horsefly river, Cariboo district, B.C., water system has been completed, consisting of 11 miles of ditching and 1½ miles 30 inch steel pipe, with diversion dam, gates flumes and pooling reservoirs complete. Capacity, 1800 miners' inches. Portions of plant installed consist of 2,000 ft. 22 inch and 18 inch pipe ; two hydraulic giants with 7 inch nozzles, sluices, etc., in place. Water was used on claim 17 days with incomplete supply, for purpose of opening pit and in preparation for work to begin next season. $13,674.61 in gold dust was recovered during the progress of the work.

Slough Creek Mining Co.—On this claim on Slough Creek, Cariboo district, B.C., the work of development was begun by drilling prospect shafts with a Chapman hydraulic jetting machine across the valley for the purpose of determining the location of the old channel. By this means a cross section of the valley from surface to bedrock has been secured. The old channel was located at a depth of 245 feet, and a working shaft is now being sunk. A drain tunnel has also been constructed 2,150 ft. long. Machinery sufficient to complete the work of development is now *en route*, aggregating over 20 tons. An average of sixteen persons were employed in 1894 and this number will be increased during 1895 as required.

Tennycape Manganese Mining Co., Ltd.—Owing to the depression in business the shipments of manganese during the past season have been very small, amounting to about 100 short tons. A great deal of development work was done on the property, and the outlook for ore and market is reported to be encouraging.

Dominion Coal Co. Ltd.—H. M. Whitney, Pres., F. S. Pearson, Consulting Engineer and J. S. McLennan, Treasurer, have just returned to Boston from one of their periodic tours of inspection in Cape Breton. The recent visit has been one of unusual interest as whilst here the directors in company with D. McKeen, M. P. their resident manager and the chief officials were able to run the first train over their new line to historic Louisburg, and also to open their fine suit of general offices just erected at Glace Bay. The past season's work was reviewed and pronounced on the whole satisfactory and extensive plans made for construction on surface and development in the mines with a view to raising 1,500,000 tons next season. The surface works include new boiler ranges at Reserve, Stirling, International and Gowrie. New bunkheads at Dominion No 1, Hub and and Reserve. Extensions of the endless haulage system at Reserve, Gowrie, International, Stirling and Caledonia and other general works of less magnitude. Mr. H. F. Donkin, C. E. will superintend the surface construction works and in the absence of Mr. McKeen (who has gone south for a three months trip for the benefit of his health) the assistant manager Mr. W. Blakemore, M. E. bas been intrusted with the general charge of the mines, etc. as Mr. McKeen's deputy. We trust the latter gentleman will return with his health fully restored.

International Asbestos Mining and Manufacturing Co., Ltd.—The following circular has been issued by this Company :—"You are hereby notified that the subscriber, Receiver of the International Asbestos Mining and Manufacturing Company, has received an offer from John L. Armitage of three thousand dollars and a waiver of a claim which said John L. Armitage has or claims to have against the said International Asbestos Mining and Manufacturing Company for fifteen thousand dollars for all the factory plant and machinery at Newark, New Jersey, and the Asbestos mine in Canada, and that the subscriber, as Receiver, will report said offer to the Court of Chancery at the Chancery Chambers, in the City of Newark, on Tuesday, the 22nd day of January, eighteen hundred and ninety-five, at ten o'clock in the morning of that day, and recommend to the Chancellor at that time the acceptance of said offer of said Armitage, and ask for direction to convey the property to him. If you desire to object to the confirmation of a sale to said Armitage, you are requested to attend at the time and place above mentioned."

The Cariboo and Kootenay Prospecting and Mining Co., Ltd.—Development on the ten silver claims owned by this Company and located in the Lardeau district, B.C., is to be proceeded with this season. So far the operations of the company have been confined to a placer claim on Lardeau Creek. The creek is to be dammed and a large flume put in.

Silver Wolverine, Ltd.—This English syndicate, owning property in the Port Arthur district, Ont., and now in liquidation, will pay a supplemental dividend at an early date, and creditors who have not yet proved their claims are requested to do so before 2nd March next by communicating with Mr. C. J. Stewart, 33 Carey street, Lincoln's Inn, London, W. C. The liabilities are £772 and the assets available for dividend £14.

The Natural Gas and Oil Company of Ontario, Ltd., is applying for Ontario charter for the purpose of acquiring in the County of Essex lands or interests therein in which to sink wells for natural gas, oil and other minerals. Head office, Walkerville. Authorized capital, $500,000, in shares of $50. Directors : Hiram Walker, Detroit ; S. A. King, Kingsville, Ont. ; Thos. Reid, Walkerville, Ont. ; C. M. Walker, Walkerville, Ont., and Hiram A. Walker, of Walkerville.

Lake Girard Mica Mining System.—Our correspondent writes : This Company's Phosphate King mine, in the Township of Templeton, is being developed with remarkable success. Originally opened for mica, from which a fair quantity of merchantable sizes have been obtained, operations have uncovered one of the largest bodies of high grade apatite found in the history of Canadian phosphate mining. The

main shaft is now 70 feet deep and shows in the bottom a mass 10 feet in width, 45 feet in length, and still continuing without any sign of exhaustion or pinching with the walls. The mineral is all high grade, of pink and dark green colors, and so far but little impurity is associated with the deposit. Twenty-one persons are employed. About 1,200 tons have been mined since the 1st of January, and contracts for its sale have been made, we understand, with Mr. J. S. Higginson of Buckingham. A hoisting and drilling plant is to be put in the spring.

The Taylor Hydraulic Air Compressing Co., Ltd., has been incorporated under Dominion charter with a total capital stock of $500,000, head-quarters at the city of Montreal; to acquire the invention patented under the Canadian letters patent of invention No. 46,092 and to manufacture and sell the same. The applicants for incorporation are:—Charles Havelock Taylor, mining engineer; Henry Millen, gentleman; Walter Tylee Ross, real estate agent; Joseph Rowet Fair, accountant; Roderick Livingstone Murchison, advocate; Robert William Sutherland, accountant; and Hooper Mallet, clerk, all of the city of Montreal; and William Heber Campbell, of Belleville, barrister; James Gerald Fitzgibbon, of Norwood, banker, and Duncan Turner Ritchie, of Kelvinside, Glasgow, Scotland, gentleman.

Quebec Mining Association Smoking Concert.

Instead of the annual dinner which hitherto has been a feature of the annual gatherings of this body, a smoking concert was substituted this year, which proved a thoroughly enjoyable and successful affair. The event took place in the New Club Room, Windsor Hotel, on Thursday evening the 10th inst. There was a large attendance. Mr. George E. Drummond, of the Canada Iron Furnace Co., presided. A feature of the evening was the capital selections of the McGill Banjo and Glee Club, which were heartily applauded, and the unique entertainment provided by Mr. George R. Smith (Bell's Asbestos Co.), in his character sketch, "Why are we here?"—a humorous satire on the proceedings of scientific societies, which completely convulsed the audience. Mr. Heney, the reader of the McGill Glee Club, provided a good deal of fun by his excellent sketches of the French Canadian *habitant*. Other features of an admirable programme were the musical selections of Messrs. Haycock, Ingall and F. Cirkel, and the "Personal Reminiscences" of Mr. S. P. Franchot and Mr. Woltmann of New York. Shortly before midnight the company adjourned to the Ladies' Ordinary, where an excellent supper and a few toasts concluded the entertainment.

A Monster Wrought Steel Colliery Winding Drum.

A new conical wrought steel winding drum has just been completed by the well known English firm of engineers Messrs. H. Daglish & Co., of St. Helens. It is 33 feet on its maximum diameter and 18 feet on its minimum, 6 feet wide on the maximum diameter, and 15 feet 9 inches wide over the sides. The drum is built on three cast iron bosses, 9 feet in diameter, made in halves, with planed points and secured by strong bolts, each boss being bored to 21 in. diameter and secured to the crank-shaft by four keys. The centre boss is fitted with eight pairs of arms made of flat steel bars, 8 in. by 1½ in. in section and fitted into suitable recesses prepared on the boss and bolted thereto; the bars are also bolted to a ring of plates at the maximum diameter, 16 in. by ½ in., and secured to the periphery plates by double angles. The outer bosses are fitted with discs of steel plates, 18 ft. in diameter, forming the sides of the drum, strengthened with suitable angle rings. The skeleton frame of the drum is formed of 16 main frames made of steel bars of T section, 6 in. by 5 in. by ½ in., with diagonal braces of similar section and strong gusset plates at the intersections. There are also 16 intermediate frames made of steel bars of T section, 5 in. by 4 in. by ½ in., and strengthened in a similar manner to the main frames. Additional bars of angle steel, 3 in. by 3 in. by ½ in., are fitted between the main and intermediate frames and on these, riveted to each at every intersection, is built a scroll of grooved steel of special section to receive the rope, 2 in. in diameter. Between the coils of the scroll is riveted on each frame a cast steel distance piece so as to form a continuous support to the scroll from the minimum to the maximum diameter. The outer periphery of the drum is plated with steel plates, ½ in. thick, riveted to the main and intermediate frames, with side flanges formed of angle steel, 5 in. by 4 in. by ½ in., and in the centre a groove of channel steel, 12 in. by 3½ in. by ½ in. is riveted to receive the brake blocks. The whole of the frames and side discs are secured to the side bosses by turned bolts and between the bosses are eight pairs of cast iron quill stays, with eight through bolts, 2 in. in diameter, tightening the whole structure firmly together. The engines have 45 in. cylinders by 7 ft. stroke, the load, we understand, being 4 tons of net coal and the depth of pit 763 yards.

SALE OF MINING LANDS.

IN THE HIGH COURT OF JUSTICE,
(Queen's Bench Division.)

In the Matter of the Winding Up Act and Amendments thereto; and in the Matter of the Austin Mining Company (Limited).

SEALED TENDERS addressed to Peter Larmonth, Liquidator of the Austin Mining Company, Ottawa, Ontario, will be received up to two o'clock in the afternoon, on Monday, the Eleventh day of February, A.D., 1895, for the purchase of mining locations A, B and C, on the north side of Echo Lake, in the Garden River Indian Reserve, as laid down on a plan thereof dated September 3rd, 1874, fyled in the Indian Branch of the Department of the Interior at Ottawa, containing six hundred acres more or less.

There are said to be valuable mines of copper on this property.

This property will be sold subject to the standing conditions of sale of this Court, and the highest or any tender will not be necessarily accepted.

For further particulars, apply to Peter Larmonth; Messrs. MacCraken, Henderson & McKay, Barristers; and Messrs. Gormully & Orde, Barristers, Ottawa.

Dated the ninth day of January, A.D., 1895.

(Sgd.) R. B. MATHESON,
Master at Ottawa.

CONDITIONS

OF

Obtaining Government Drill to Explore Mines or Mineral Lands.

Owners or lessees of mines or mineral lands in Ontario may procure the use of a Government Diamond Drill, subject to the provisions of the Rules and Regulations relating thereto, upon giving a bond for payment to the Treasurer of the Province, of costs and charges for (1) freight to location, (2) working expenses of drill, including labor, fuel and water, (3) loss or breakage of bits, core lifters and core shells, (4) wear or loss of diamonds, (5) other repairs of breakages and wear and tear of machinery at a rate per month to be estimated, and (6) an additional charge of $50 per month after the mine or land has been shown, through use of the drill, to be a valuable mineral property.

Of the aggregate of costs and charges above enumerated, excepting the sixth item, forty per cent. will be borne by the Bureau of Mines in 1894, thirty-five per cent. in 1895, thirty per cent. in 1896, and twenty-five per cent. in each year thereafter until the end of 1900. All accounts payable monthly.

For Rules and Regulations *in extenso* governing the use by companies and mine owners of Diamond Drills, or other information referring to their employment, application may be made to ARCHIBALD BLUE, Director of the Bureau of Mines, Toronto.

A. S. HARDY,
Commissioner of Crown Lands.

Toronto, October 17, 1894.

MINING LAWS OF ONTARIO.

ANY person may explore Crown Lands for minerals.

Mining lands may be taken up as surveyed locations or staked claims.

Locations range from 40 to 320 acres.

Claims range from 10 to 20 acres on vein or lode.

Locations may be acquired in fee or under leasehold.

Price of locations north of French River, $2 to $3 per acre, and south of it, $2 to $1.50, according to distance from railway.

Rent of locations first year 60c. to $1 per acre, and subsequent years 15c. to 25c. per acre.

Rent of claims, $1 per acre each year.

Claims must be worked continuously.

Royalty on ores specified in the Act, 2 per cent. of value at pit's mouth less cost of labor and explosives.

Royalty not charged until seven years from date of patent or lease, nor (as provided in s. 4 (3) of the Mines' Act, 1892), until fifteen years in the case of an original discovery of ore or mineral.

Original discoverer of ore or mineral on claim entitled to stake out a second claim.

Crown Lands sold under provisions of mining laws in force prior to 4th May, 1891, exempt from royalty.

Copies of the Mines Act, 1892, Amendment Act, 1894, may be had on application to

ARCHIBALD BLUE,
Director Bureau of Mines.

TORONTO, May 25th, 1894.

IN PREPARATION. TO BE ISSUED IN JANUARY, 1895.

. . . 5th ANNUAL NUMBER . . .

FIFTH YEAR.

FOR 1895.

Mining, Engineering . . Iron and Steel Trades Companies Manual . .

EDITED AND PUBLISHED BY

B. T. A. BELL, Editor of the Canadian Mining Review,

Secretary General Mining Association of the Province of Quebec, Honorary Secretary the Mining Society of Nova Scotia, Secretary Ontario Mining Institute.

This, the Fifth Edition of the Manual, will contain a careful digest of information, compiled up to date, respecting the history, organization and operations of all Canadian Mining and Quarrying Companies, Blast Furnaces, Rolling Mills, Iron and Steel Works, also of all the Rod Mills, Wire Mills, Cut Nail and Horse Nail Works, Car Axle Works, Car Wheel Works, Car Builders, Locomotive Works, Cast and Wrot Iron Pipe Works and Bridge Engineering Establishments.

In one Volume—600 Pages; Cloth; Royal Octavo.

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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.

School of Practical Science,

TORONTO, CANADA.

THE DEPARTMENTS OF INSTRUCTION ARE . . .

1 Civil Engineering (including Sanitary Engineering).

2 Mining Engineering . . . .

3 Mechanical and Electrical Engineering.

4 Architecture . . . . .

5 Analytical and Applied Chemistry.

The regular course for the Diploma of the School, in each of the above departments, is three years in duration.

A Post-Graduate Course has been established, consisting almost entirely of laboratory work, which leads to the degree of B.A. Sc. in Toronto—Special Students are received in all Departments.

The Session continues from October 1st to May 1st.

SUMMER SCHOOLS FOR PROSPECTORS AND MINERS

And others interested in Mining, have been established at Sudbury and Rat Portage, and a Winter School of a similar character, but covering a more extended course, will commence in the SCHOOL OF PRACTICAL SCIENCE, TORONTO, on JANUARY 8th.

Properly equipped **ASSAYING, ENGINEERING AND CHEMICAL LABORATORIES** are provided for the use of students of the various departments, and the museum contains collections illustrating **MINERALOGY, LITHOLOGY, METALLURGY AND PALÆONTOLOGY.**

For further information regarding the regular Courses and the Prospectus of the Winter School for Prospectors,

APPLY TO THE SECRETARY,

L. B. STEWART, D.L.S.

SCHOOL OF PRACTICAL SCIENCE, TORONTO.