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The Canadian Mining Review

Established 1882

Vol. XIV.—No. 2 | 1895—OTTAWA, FEBRUARY—1895. | Vol. XIV.—No. 2.

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.

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.

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. 2 FEBRUARY, 1894. VOL. XIV,, No. 2

Nova Scotia Mineral Revenue, 1894.

Through courtesy of Mr. W. H. Brown the indefatigable accountant of the Department of Public Works and Mines, we are able to furnish our readers with the official returns of the amounts received from the various mineral sources of revenue in Nova Scotia during the fiscal year ended 30th September, 1894, in comparison with the year 1892, and the nine months ended 30th September, 1893. It will be remembered that in 1893 the financial year was changed so as to terminate on 30th September, instead of 31st December, as formerly.

These tables are of the greatest value to the public, and naturally entail in their compilation an immense amount of labor on the accounting staff, which only those who have anything to do with matters statistical can appreciate at its full value.

SOURCE.	Year ended Sept. 30th, 1894.	Year ended Dec. 31st, 1892.	9 mos. ended Sept. 30th, 1893.
Prospecting licenses (gold)	$ 7,856 00	$ 7,371 98	$ 3,767 00
Rents (gold lease applications)	1,752 00	1,926 00	1,262 35
Gold rentals	2,599 00	1,653 50	1,443 00
Gold royalty	7,517 01	8,199 42	5,721 11
Licenses to Search	5,190 00	5,040 00	15,720 00
Leases—Minerals other than gold & silver	2,300 00	1,925 00	2,250 00
Rentals do do do	5,340 00	3,030 00	2,460 00
Coal royalty	209,330 52	135,962 80	142,058 25
Iron royalty	168 60	180 50	120 16
Fees	604 75	408 10	404 00
Totals	$242,657 88	$165,697 30	$175,205 87

MEMO. showing amounts received by the Department of Mines, Nova Scotia, during year ended Sept. 30th, 1894, also for the nine months ended Sept. 30th, 1893, from the various sources in connection with minerals, other than gold and silver in undermentioned counties.

LICENSES TO SEARCH.

	9 mos. 1893.	Year 1894.
Cape Breton	$5,950 00	$1,530 00
Cumberland	2,670 00	1,320 00
Inverness	1,740 00	900 00
Pictou	1,490 00	330 00
Antigonish	570 00	120 00
Victoria	870 00	210 00
Richmond	1,890 00	120 00
Other counties	540 00	660 00
	$15,720 00	$5,190 00

Decrease in 1894, $10,530.

LEASES OF MINERAL OTHER THAN GOLD AND SILVER.

	9 mos. 1893.	Year 1894.
Cape Breton	$1,200 00	$1,050 00
Cumberland	150 00	300 00
Pictou	300 00	350 00
Inverness	350 00	450 00
Other counties	250 00	150 00
	$2,250 00	$2,300 00

Increase in 1894, $50.

RENTALS—MINERALS OTHER THAN GOLD AND SILVER.

	9 mos. 1893.	Year 1894.
Cape Breton	$ 600 00	$1,950 00
Cumberland	690 00	1,560 00
Pictou	780 00	870 00
Inverness	180 00	390 00
Colchester	30 00	150 00
Other counties	180 00	420 00
	$2,460 00	$5,340 00

Increase in 1894, $2,880.

COAL ROYALTIES.

	9 mos. 1893.	Year 1894.
Cape Breton	$82,011 39	$114,111 57
Cumberland	33,350 65	46,938 22
Pictou	26,316 33	48,241 00
Other counties	379 88	39 73
	$142,058 25	$209,330 52

Increase in 1894, $67,272.27.

IRON ROYALTY—Pictou County, 1893, $120.16; in 1894, $168.60.

MEMO. showing the amounts by Counties received by the Department of Mines, for the year ended Sept. 30th, 1894, in connection with gold.

PROSPECTING LICENSES.

Guysborough	$3,174 50
Halifax	2,132 50
Lunenburg	674 50
Queens	657 00
Hants	401 00
Victoria	386 00
Yarmouth	133 50
Other counties	297 00
	$7,856 00

RENTS (GOLD LEASE APPLICATIONS).

Guysborough	$ 690 00
Halifax	542 00
Hants	190 00
Queens	136 00
Lunenburg	96 00
Yarmouth	62 00
Victoria	30 00
Othor counties	6 00
	$1,752 00

GOLD ROYALTIES.

Halifax	$4,172 26
Guysborough	2,013 36
Hants	870 87
Queens	305 50
Lunenburg	83 72
Yarmouth	71 30
	$7,517 01

GOLD RENTALS (YEARLY PAYMENTS ON LEASES).

Halifax	$ 841 50
Hants	528 00
Guysborough	473 00
Queens	281 00
Lunenburg	276 00
Colchester	95 00
Yarmouth	69 50
Victoria	35 00
	$2,599 00

CANADIAN PIG IRON STATISTICS, 1894.

The Following Table has been Compiled from Returns kindly furnished by the Officers of the Respective Companies Fc the Year ended 31st December last.

Company.	Situation of Furnace.	Quantity Pig Iron Manufactured.	Value at Furnace.	Total Ore Charged.	Fluxing Material Used.	Fuel Charged.			Persons Employed
						Coke.	Coal.	Charcoal.	
Londonderry Iron Co. Ltd.....	London, N.S	10,252 2/3	$123,033	22,299	7,639	11,475	4,282	.. ..	225
N. Gl'gow Iron, Coal & Ry. Co. Ltd	Ferrona, N.S	28,142 2/3	295,500	60,817	22,928	42,378	.....	.....	450
Canada Iron Furnace Co. Ltd.. .	Radnor, Que	7,900	190,000	17,500	1,750	.....	.....	756,000	600
Pictou Charcoal Iron Co. Ltd....	Bridgeville, N.S.....	1,720	.....	3,600	440	.....	.....	200,000 (bush.)	120
J. McDougall & Co.....	Drummondville, Que..... ...	No report furnished. About 5000 tons charcoal iron estimated.				. ...	.....	....	

NOTE—Londonderry Iron Co's returns cover only six months operations, furnace being relined Canada Iron Furnace Co's number employees include other operations of this Company.

NOVA SCOTIA COAL DISPOSALS, 1894.

From Returns furnished "The Review" by the Courtesy of the Officers of the Respective Companies for the Twelve Months ended 31st December.

Company.	Nova Scotia.	New Brunswick	Quebec.	P. E. Island.	United States.	West Indies.	South America.	St. Pierre Miquelon.	Newfoundland.	Mexico.	Bunker Steamer.	Other Countries	Employees.	Engines.
Dominion Coal Co. Ltd	163,911	28,202	553,781	11,746	53,894	7,409	521	2,620	58,954	1,527	49,163	..	14,490	43,849
Cumberland Ry. & Coal Co. Ltd.	123,795¼	126,057¼	98,913½	....	36,205	....	..	....	...	....	....	.	....	.....
Intercolonial Coal Co. Ltd.	100,508	7,240	80,687	15,339	3,059	1,052	536	....	....	....	....	270	4,873	11,449
Acadia Coal Co. Ltd	126,836	7,199	5,129	25,950	....	....	.	144	....	....	....	..	5,514	25,631
Canada Coals & Ry. Co. Ltd	11,894	56,558	15,800	401	7,347	....	.	....	....	....	....	595	1,648	8,381
Cape Breton Colliery	6,036	898	900	2,331	....	....	..	...	3,915	...	....	..	313	2,098
General Mining Association Ltd.	Given in aggregate below.			....	....	....	..	....	....	....	....	..	....	.....

RECAPITULATION.

Company.	District.	Disposals, 1894.	Remarks.
		Tons.	
Dominion Coal Company	Cape Breton.....	990,067	Includes employees and engines.
Cumberland Railway and Coal Company.....	Cumberland County.....	384,971	Does not include employees and engines.
Intercolonial Coal Company	Pictou County	224,743	Includes employees and engines.
Acadia Coal Company.....	do	226,442	Includes employees and engines.
Cape Breton Colliery.....	Cape Breton	17,086	Includes employees and engines.
General Mining Association	do	223,000	Does not include emp. yees and engines.
Canada Coals and Railway Company.....	Cumberlan' County.....	102,031	Includes employees and engines.
Total for the 12 months ended 31st Dec., 1894.. ..		2,168,340	

Mr. R. T. Hopper, Montreal,

Managing Director Anglo-Canadian Asbestos Company, Ltd.

The New Director of the Geological Survey.

After twenty-five years faithful service, Dr. A R. C. Selwyn, C.M.G., has been superannuated and Dr. George M. Dawson, C. M G, has received the appointment of Director of the Geological and Natural History Survey of Canada. Although yet but a comparatively young man, Dr. Dawson has earned an enviable reputation as a geologist and a scientist, his latest and perhaps most important public service, being that of a British Commissioner on the Behring Sea Commission.

He was born in Pictou, N. S. on 1st August 1849 and is the son of Sir William Dawson, the venerable ex-principal of McGill University, Montreal, whose researches in geology are well known. He received his early education in Montreal, but did not enter the University except as a partial student, in consequence of delicate health. In 1869 he entered the Royal School of Mines, London, and took its full course of study extending over three years. Here he devoted special attention to geology and palaeontology, under the able tuition of Ramsay, Huxley and Etheridge, and to chemistry and metallurgy in the laboratories of Frankland and Percy. He held the Duke of Cornwall's scholarship, given by the Prince of Wales; he also took the Edward Forbes medal for palaeontology and the Murchison medal in geology. On returning to Canada he was engaged for a year in mining surveys in Nova Scotia and in lecturing in Morin College, Quebec.

The first work of any importance in which he was engaged was in 1873, when in the capacity of geologist and naturalist to Her Majesty's North American Boundary Commission he investigated the country in the vicinity of the boundary line between Canada and the United States from the Lake of the Woods to the Rocky Mountains. The information thus gathered was, at the end of the Commission's work in 1875, published in the form of a report entitled "Geology and Resources of the Forty-ninth Parallel," and this amongst other things gave the first detailed account of the Souris coal fields, though some of the sections along the Souris bed had previously been visited by Dr., afterwards Sir James, Hector. The economic results of this were important as setting at rest the question of a fuel supply for the prairie country. In July of the same year began his connection with the Geological Survey, with which he has ever since been identified. His first important trip in his new appointment was to British Columbia where, until 1879, he was engaged in the exploration and geological survey of the Province. This has been the scene of his labors ever since, with very little exception, and the knowlege obtained of the geological structure, and the geological mapping of British Columbia, so far as it has gone, is almost entirely due to the energetic work of Dr. Dawson. From that time until 1882, he continued his labors in that Province and in the North-West Territories. In the latter year he went to Europe, where he travelled extensively, visiting mines, metallurgical works, museums, etc. His most arduous journey after his return was with the Yukon expedition, of which he was selected by the late Hon. Thos. White to take charge: a very complete report of which has recently been published by the Geological Survey. The route he chose for himself, although of a most difficult nature, was taken as that most likely to afford the most information regarding the geology of the vast and virtually unknown tract of country he was about to explore. His journey was 1,300 miles in length, from the mouth of the Stikeen river, by way of the Dean, Upper Liard, Pelly and Lewis rivers back to the coast. Nearly the whole distance was traversed by following the rivers; some of these had in former years been used by the Hudson's Bay Company, but they had long been abandoned as a trade route, and were at the time of his expedition almost unknown geographically. The difficulties encountered were very great,—boats had to be built at several points, and one portage of fifty miles was made through the woods in crossing from the drainage-basin of the Liard to that of the Yukon,—but all were surmounted and the expedition successfully accomplished its work.

Details of Dr. Dawson's travels throughout British Columbia and the North West will be found in the reports of the Geological Survey. He is the author of fifteen separate reports, of which the following may be referred to as of most importance: On the Queen Charlotte Islands, including as an appendix a monograph on the Haida Indians (1878). On an exploration from Port Simpson on the Pacific Coast to Edmonton on the Saskatchewan (1879). On the Region in the vicinity of the Bow and Belly Rivers (1882-4). On the Physical and Geological features of part of the Rocky Mountains (1885). Notes to accompany a Geological map of the Northern portion of the Dominion of Canada (1886) Author (with Dr. Selwyn) of Descriptive Sketch of the Physical Geography and Geology of Canada (1884). Author (with Dr. W. F. Tolmie) of Comparative Vocabularies of the Indian Tribes of British Columbia, with an Ethnological map (1884). It is unnecessary to particularize the numerous and valuable original scientific papers on the geological, geographical and ethnological observations made in the course of his explorations and contributed to various scientific journals; their value is well known and fully appreciated.

EN PASSANT.

The annual general meeting of the Mining Society of Nova Scotia will be held in the rooms of the Society on 13th proximo, when an interesting programme will be submitted. The annual dinner of the Society will be held in the evening.

Mr. Charles Fergie, M.E., Manager of the Drummond Colliery, who has been spending a few months well earned holiday among his people in England, is expected home by the beginning of the month.

Mr. Henry S. Poole, M.E., A.R.S.M., General Manager of the Acadia Coal Co., and Mr. David McKeen, M.P., Resident Manager of the Dominion Coal Co., Ltd., have gone for a three months' holiday on the Mediterranean.

The Kingston Mining School was formally opened on Friday, 4th ulto., when a large company witnessed the operations of the small Nissen mill, Frue vanners, Blake crusher and other plant recently installed by enterprise of the governors of Queen's University. Writing to the Robb Engineering Co., which furnished one of their excellent engines and boilers, Principal Grant says: "The Ontario Mining Institute held its quarterly meeting here last week, and we took that occasion of formally opening the mining laboratory; and your engine and boiler were both voted satisfactory. As a Nova Scotian, I was delighted that we had so much of our machinery from Nova Scotia, and as this is the only mining laboratory in the country I was delighted that you had contributed to its equipment." By the way our manufacturers of mining machinery can aid the operations of this deservedly creditable educational institution by donations of working models of their special lines of mining machinery and any such is certain of cordial acknowledgment from Dr. Goodwin, the Director.

Mr. John Blue, C. & M. E., President of the General Mining Association of Quebec, has invited the mining students at McGill to spend a few weeks at the Eustis mine, an example which might very well be imitated with advantage to the extension of mining education in Canada by other of our mineral operators.

Mr. R. T. Hopper, whose portrait we have pleasure in reproducing on another page, is one of the pioneers of the Canadian asbestos industry, having been one of the first on this side to discover the great commercial value of the mineral and to demonstrate its superiority in competition with the Italian product, which then monopolized the European market.

He ultimately succeeded in promoting the formation of the Anglo-Canadian Asbestos Company, Ltd., an English syndicate which has operated successfully for a number of years an important territory of mineral land at Black Lake, Que., and which, under Mr. Hopper's careful, judicious and enterprising management, occupies to-day a foremost place among our dividend paying asbestos mines. Mr. Hopper is also a director of the Montreal and Kootenay Mining Company, Ltd., operating silver-lead claims on Kootenay Lake, near Ainsworth, B.C., and of the English Portland Cement Company, Ltd., whose works and quarries are at Marlbank, Ont. In addition to these enterprises Mr. Hopper has been intimately associated for many years with the phosphate and mica industries of Quebec and Ontario. He takes a lively interest in the welfare and doings of the Quebec Mining Association, of which he has been an officer and an active worker since its organization.

Apropos of Captain Adams' remarks before the Quebec Mining Association, it might be added that the Dolcoath tin mines in Cornwall, on an outlay of about £45,000, has paid dividends to the amount of upwards of £910,000. The shares, on which £9 12s. 6d. each had been paid, were now worth upward of £70.

Mr. James Conmee, M.P.P., President of the Ontario Mining Institute, has, we are glad to learn, been re-elected member for Algoma in the Ontario Legislature. This is as it should be, for, apart altogether from politics, with which happily the REVIEW has no concern, Mr. Conmee is a good fellow, who has a live interest in Ontario mining affairs, and who may be relied upon always to do his best for the industry in the Legislature. We extend our congratulations.

The Grand Trunk coal contract one of the largest railway contracts of the year has gone at very low prices. The deliveries include 400,000 tons at Suspension Bridge, 85,000 tons at Montreal, 40,000 tons at Brockville, 35,000 tons at Chaudiere Junction, 30,000 tons at Portland, and 50,000 tons at Detroit, Although the greatest secrecy is maintained by the officials of the company the result of the deal is approximately as follows: —At Montreal, Dominion Coal Co., 50,000 tons, Intercolonial Coal Co., 35,000 tons: at Chaudiere, Cumberland Ry. and Coal Co., 35,000 tons: at Portland, Reynoldsville coal from the Rochester and Pittsburg Iron Co., at about $2.80: at Brockville, O. W. Shipman, at about $2.60: the 400,000 tons at the International Bridge was purchased at about $1.45, or say 15 cents under last year, but the distribution is kept a close secret at this moment.

The annual general meeting of the Ontario Mining Institute, which according to constitution should be held in Toronto 6th March, has by resolution of Council been postponed to Wednesday and Thursday the 10th and 11th of April. In addition to the election of officers and other business, a number of papers will be read, including contributions as follows:—"Modern Machines and Appliances for Concentrating Works," by Mr. F. Hille, M.E., Port Arthur; "Investment in Mining Properties," by Mr. J. J. Kingsmill, Q.C., Toronto; "Electricity in Mining," by Mr. Rosebrugh, of the School of Practical Science; Dr. Ellis, of the School of Practical Science, and others.

We learn that through the generosity of Mr. W. Bruce Carruthers of Kingston, a scholarship of the value of $350.00 per session has been founded in the School of Mining to be awarded to the most deserving student of mining engineering.

Mica as a decorative element has often been suggested, says an exchange. A celebrated Bavarian decorator, Fr. Nauset, says that he made his first trials with the liquid mica, and the effects obtained came fully up to his expectations. Mica is white, more or less transparent, and has a gloss similar to silver. It does not cover sufficiently and needs ground. Therefore, if a silver gloss is wanted, the ground has to be laid in with clear white distemper color. After the distemper color is dry, have it glazed over with the liquid mica, reduced by fifty per cent. of water or more, using a soft camel's hair brush. If one coat does not answer, it can be done over. When the coat of mica is dry, ornaments can be put on. If it appears too light a netting may be stenciled on. If other than silver grounds are wanted, add distemper colors in small quantities to the liquid mica as furnished by the manufacturers, mix well on the pallette, and when mixed reduce by water ready for the brush. Then give one or two coatings to the ground. If the liquid mica is used colored, the ground should be colored to match.

At a recent meeting of the Yorkshire College Engineering Society, a paper upon "The Theory and Practice of Coal-washing," was read by Mr. J. Clark Jefferson, Wh. Sc. The lecturer commenced by pointing out that the removal of clay, slate and other earthy matters from coal led to increased efficiency of the fuel, and that the money thrown away by the consumer in paying coal price for the ash in 1 ton of coal unwashed is more than the cost of washing that quantity. It therefore follows that clean coal is actually cheaper at the higher price necessary to cover the cost of washing it. The description of the different classes of coal-washing machines which followed showed that all washing operations differ only in the manner in which the water is employed. The different modes of washing are—the fall of the material in still water; separation under the influence of an upward and a downward current; separation by means of a horizontal current and by means of an inclined bed, leading to a sliding or a rolling transport of the material; lastly, by the influence of a rotating fluid. From theoretical considerations, it was pointed out that in jigging machines the rise of the water was advantageous, but a rapid fall was distinctly disadvantageous; also that rotary separators were the worst of all machines for washing coal. It was also shown that if the operation was effected under the influence of a rapidly-recurring upward movement of the fuel through stationary water, so that each interval of time was under one-fifth of a second, then the clay would separate from the coal; also the separation was shown to be independent of the size of the particles when screened for the market.

Here's a pretty story from Johannesburg:—"A most extraordinary accident happened in the public street lately, no reference to which has appeared in the daily papers. As is well known, the road metal employed by the Sanitary Board for making the streets is a hard waste stone obtained from some of the mines. Whilst the steam-roller was at work the other day, the driver suddenly experienced a tremendous shock, being thrown into a dazed condition; and the heavy engine was thrown back at least a foot. It must have passed over a portion of an unexploded dynamite charge. Had any lighter vehicle passed over the charge it must have been blown to pieces."

At a recent meeting of the Société d'Encouragement, in Paris, M. Osmond, the well-known metallurgist, brought to the notice of members the results of his recent experiments in the field of metallography, and presented a method, capable of being practically adopted in works, of making a microscopic analysis of steel. The method comprises, independent of the preparatory polishing, three operations—(1) a polishing in bas-relief on parchment, with a small quantity of brown, red and water; (2) an attack-polishing, on parchment, with sulphate of precipitated lime and an infusion of liquorice root; (3) an attack or application of tincture of iodine or azotic acid. These three operations permit of five constituents being traced in steel, of which two are known and have been well defined, a third known but not well defined, while the other two have hitherto remained unknown. These five constituents are;—(1) "Ferrite," or the iron itself, fairly pure; (2) "cementite," or carburet of iron conforming to the formula Fe_3C; (3) "sorbite," which

accompanies the cementite, and where the carbon appears to be in the state of carbon due to hardening; (4) "martensite," the principal constituent of hardened steels, consisting of small crystals of iron containing the carbon due to hardening in solution, (5) "troostite," which comes next to martensite in hardened steels. These five constitutents, between which certain transition forms are found, join together in multiple combinations and in building up the complex structure of steels. Experiments made by M. Osmond, with four different steels, each having a larger content of carbon than the other, show how these combinations vary. (1) With the degree of heat; (2) with the degree of heat in hardening, (3) with the rapidity of the cooling. From the experiments made, the inference is drawn that the different conditions of thermic treatment of the steels leave behind in the structure of the cooled metal characteristic indications of sufficient precision to enable the manufacture to be accurately carried on to the desired specification. M. Osmond supported his conclusions by a number of enlarged micro-photographic slides projected on the screen, showing the aspect of the different steels in their different conditions.

The British Board of Trade has just issued a volume of "Instructions to Surveyors" respecting surface ventilation of coal cargoes. These instructions are to be acted upon by the surveying staff whenever the principal officer of the distaict finds it necessary to order a coal laden vessel to be detained owing to insufficient surface ventilation, or to defective construction of the cowls or the deck fittings. The following are among the chief provisions of the instructions Surface ventilators for coal laden ships should be made entirely of wrought iron Ventilators are to be fitted with cowls. In cases where the cowls are attached to the weather deck alongside a raised forecastle, poop, or bridge house, the lower edge of the cowl should be six feet above those erections The openings for ventilators in the upper deck, poop, or forecastle should be fitted with frames or lids, the lids, when not in use, being stowed on edge or in any other suitable way inside the lower portion of the ventilators In vessels with more than one deck, substantial wrought iron pipes should be led in from the ventilators on the upper deck, poop, or forecastle to the compartments in which the coal is stowed. The ventilators should always be placed in sheltered positions, and means should be provided for st wing the cowls, etc., when, from heavy weather it is found necessary to unship them from the portions secured to the deck A table is given showing the minimum diameters of the weather deck ventilators up to 24 in diameter The surveyor must warn those in charge of the ship of the danger that may follow the presence of gas in the forecastle, cabins, &c., through leakage, and should caution masters that taking naked lights or striking matches in holds or places below the deck is always a most reprehensible practice, and in coal-laden ships especially is attended by very great danger. With respect to coal bunkers, in the case of "present use" bunkers, the covers of which are usually left off, the surveyors need not insist on the provision of ventilators, unless there are particular reasons rendering them necessary. As regards "reserve bunkers," however accumulations of coal-gas are sure to occur if the bunker openings are closed, and ventilators should, therefore, always be provided. Suitable plugs and covers or other efficient appliances should always be provided for closing the apertures of ventilators in bad weather.

The reduction of the refractory earths, such as alumina, glucina, &c., or a quick manufacture of small quantities of their alloys, must have often been a question of serious drawback to demonstrators whom the oxyhydrogen flame refused to satisfy. An electric furnace for the lecture table has been patented in England by a Mr. H. N. Warren, and is being supplied to the universities. It consists, so far as the furnace is concerned, of an outward jacket of caloric cement, through the bottom of which passes a plumbago tube, while a rod of the same material is inserted through the top of the furnace, and so regulated as to allow of the arc produced to play upon the compound placed in the cavity. Connected to the furnace is a small plant of special construction and capable of evolving a voltage of 100 deg. intensity, or can be readily arranged for amperical value as required. Nearly every ibstance brought within the cavity is at once reduced and a corresponding button of metal obtained, the furnace also being arranged with a side communication, whereby a small arc is obtained for the reduction of minerals. In this instance, the mineral to be tested is first finely ground and made into a paste with solution of pyroxlin and afterwards rolled into a small stick; on bringing the same into contact with the flame from the carbon points reduction at once takes place, with the production of a metallic bead; the electric plant is also arranged entirely automatic, and the furnace can be put into action instantaneously.

At a recent meeting of the Institution of Civil Engineers, London, Eng., Mr. E. B. Wain, contributed an interesting paper on "Colliery Surface Works." As an instance of the development of mining operations during the past twelve years, the North Staffordshire coal field was cited, where the output had been increased 40 per cent., and this was due to the fact that there was hardly a colliery in the district the plant of which had not been considerably improved during the period referred to. It was of the highest importance that the works should be concentrated as far as possible, so as to permit efficient supervision and to reduce the staff of mechanics and general laborers. An example was mentioned of a colliery, where in 1876 six small and scattered plants were at work on the property and were raising less than one-half of the material now being obtained from two shafts. Where practicable the railways should be arranged so as to allow a gentle descent for wagons to and from the screens, if the nature of the ground would not admit of this, endless ropes working between the rails were of great service. The subject of screening and picking apparatus would in itself afford material for a lengthy paper, the author therefore only briefly noticed some of the types of screen in general use. The writer was of opinion that it was not advisable to undertake new work of importance in colliery workshops, but to use them simply for the purpose of making such repairs as might be necessary. The economy of fuel in colliery work had received too little attention in the past, the boilers being often supplied with inferior coal or slack which had been considered unsaleable. The amount of coal consumed in colliery work was probably not less than 5 per cent. of the total output of the kingdom, and as slack had now become more valuable, colliery engineers were beginning to give greater attention to the questions of compound working, expansion-gear, condensation, and balanced loads.

Some interesting facts respecting the curvature of diamond drill holes have been brought out by Mr. J. Parke Channing in a paper before the Lake Superior Mining Institute. While drilling a series of fan holes to test the formation of one of the Michigan ranges Mr. Channing found that cores from holes started downward at an angle of 45° did not correspond with the calculated stratification at the supposed position of the bottoms of the holes. Concluding that the angle must have changed, he proceeded to test this by the method of lowering glass tubes containing hydrofluoric acid and noting the angle of the etched ring. The first trial not wholly conclusive, indicated that at a depth of 531 feet the hole had flattened 15°. After experiencing trouble with different forms of apparatus, the results being vitiated by the hydraulic pressure driving stoppers in and compressing the air, or forcing in water through the plugs and diluting the hydrofluoric acid solution, successive experiments giving no test, Mr. Channing had special tubes made, 1 inch in diameter, 5 feet long, with ground glass stoppers. These also failed at first, the water working in through the ground joint. The final and successful method was in brief as follows:—The vacant end of the core barrel was plugged tightly with wood; the upper end of the tube warmed and the stopper heated in a little paraffine; the tube placed vertically; 1 inch of

20° acid carefully poured in, hen 1 inch of water; the stopper fitted in, the tube, still vertical, was put in the core shell and the latter screwed into the barrel. The apparatus was then lowered with the rods, care being taken to touch the bottom of the hole gently. Experiments as to the time necessary to leave the tube in the hole showed that two hours were as good as twenty four, but that one hour was insufficient. The angle of etching was read by clinometer. It was also proved that the rods would turn freely with considerable curvature. In some of the deep holes the point was 60 feet higher and 50 feet farther than if drilled straight. Lateral deviation could not be tested by a tripped compass, on account of local irregularities of attraction. The cause of the holes flattening was found to be that with a new bit on an old core barrel the upper end of the latter had an extra clearance and tended to press down, thus gradually raising the direction of boring. In another part of this issue we reproduce a sketch of Mr. Channing's apparatus.

The De Beers Consolidated Mines (South Africa) during the past twelve months produced diamonds which realized £2,820,172. The total expenditure amounted to £1,690,584, leaving a profit of £1,129,587; and after paying two dividends of 12½ per cent., there was a balance of £726,666 to carry forward. The value per load of material removed was £1 1s. 10½d.

In a lecture on blasting explosives, given at the Society of Arts, Professor Vivian B. Lewes, of the Royal Naval College, Greenwich, made some interesting remarks upon the cause of explosions in dusty mines free from fire-damp. He pointed out that until quite recently explosions in mines were always attributed to the accidental ignition of mixtures of air and methane, to which the name of fire-damp was given, and undoubtedly this cause was the prime factor in this class of disaster, and the introduction of such precautions as safety-lamps at once brought about a considerable reduction in the number of explosions taking place. It was found that explosions in mines might be brought about—first, by the ignition of a mixture of methane and air, in which the former rose above a certain percentage; secondly, by mixtures of air, coal-dust and methane, in which the amount of the last mentioned may be excessively small; lastly, by mixtures of coal-dust and air. In cases recently investigated powder was the blasting agent used, and such powder as was employed for this purpose gave, amongst the products of combustion, nearly half the volume of permanent gases in the condition of carbon-mon-oxide, methane and hydrogen. The experiments and investigations in various colliery explosions made it abundantly manifest that no explosive should be licensed for use in mines unless it could be absolutely proved that it gave off no inflammable products of combustion. He urged the absolute necessity of legislative enactments at once forbidding the use of blasting powder in any coal mines, no matter how free they might appear to be from fire-damp, or from dust; and if they examined the returns made as to deaths caused by gunpowder, and other explosives in mines for the year 1892, it would be clearly seen that the exclusion of gunpowder in handling alone would do away with 80 per cent. of the accidents, whilst if explosives of the Sprengel class were employed accidents due to the explosives used would be practically eliminated from the mining death-roll, and it was only a question of time as to when England would follow the action of France and Germany in altogether prohibiting the use of blasting powder in dusty mines.

A hand boring machine for making advance bore-holes in the seam, and thus facilitating the bringing down of coal, is made by Heinrich, Sellerbeck & Co., of Oberhausen, Rheinland. The spindle with its mitre gear is carried by a channel iron joist, one end of which is inserted in the floor of the seam, while the other is carried by a log clamped to timbers laid against the roof, and further strengthened by suitable struts. The forward feed is given by a screw easily operated by the man who turns the boring rod. The cutting end is made in the shape of an auger, and the various lengths of rod are connected by joints screwed with the Whitworth thread, which the firm has found to be the best and most practical, giving the rod the greatest amount of stiffness. It is asserted that if a free space for working about 1½m. (say 5 feet) high, be left over the machine, an advance of 2 to 2½m. may be made in the hour, and a man new to the work can become an experienced *Bohrmeister* after drilling the first hole.

Asbestos has been recently announced to be magnetic. Pieces of asbestos millboard were, it is said, attracted to a strong electro-magnet and, moreover, proved to be capable of being permanently magnetised. This property of asbestos is attributed to the oxide of iron it contains, although the proportion of this substance is exceedingly small.

At a general conference of representatives of the various collieries in South Wales and Monmouthshire, held at Cardiff, the report of the Commission appointed to consider the subject of explosives in mines was brought forward. The points reported upon were:—(1) The strength and cost of high explosives as compared with ordinary gunpowder; (2) the effects of high explosives in producing small coal as compared with ordinary gunpowder; and (3) the comparative safety of the above mentioned explosives. After a very careful consideration of the tests, the Commission unanimously arrived at the following summary of conclusions:—1. That we consider carbonite a safe and effective explosive for blasting hard top or bottom, such as rock or clift. 2. That for blasting in the coal we consider that the meal gunpowder, with the ammonia preparation, is as safe as any of the high explosives used, at present whilst it retains in every respect the properties of ordinary loose powder for spreading and not crushing the coal. 3. That carbonite, when used in the coal, produces a large quantity of small coal in the immediate vicinity of the explosion or back of the hole. The report was received with general satisfaction, and the Commission was awarded a vote of thanks.

Mr. E. C. Potter thus explains the use of flux in the blast furnace: "The office of flux is to remove the earthy impurities of the ores. For this purpose limestone is usually employed. The way in which this is accomplished is rather an intricate chemical reaction, but stated as simply as possible the reaction is as follows: The principal earth associated with the ore is common clay, or silicate of aluminum, as it is chemically called. This material, as every one knows, is quite infusible and hence impossible to remove by the mere application of heat. It is a chemical fact, however, that by the addition of lime to the silicate of aluminum, forming the double silicate of lime and aluminum, this double silicate, being quite fusible, and being lighter than the metallic iron, floats upon its surface, and is thence drawn off."

Messrs. E. H. Sargent and Co., Chicago, U. S. A., have introduced an improved assay furnace, which consists of an almost square sheet iron frame, 23 in. high, 14 in deep and 16 in. wide, lined with firebrick in sections, the interior being smooth and straight from top to bottom. The cover, which is of cast iron, is ridged to lessen the danger of cracking. The muffle door, also of cast iron, is fitted with a circular opening filled with mica, so as to enable the operations to be seen when the door is closed. The draught doors are also of cast iron, and are provided with steel openings to further regulate the draught. Circular holes in all four sides of the bottom serve to keep the furnace cool. The muffle rests equally upon the firebrick in front and in the rear, leaving a space of 1½ in. between the end of the muffle and the brick to allow the passage of fumes. There is also a space of 4 in. on each side of the muffle for fuel. The furnace will take a muffle 12 in. long 6 in. wide and 4 in. high. Its total weight is said to be 155 lbs.

A Committee of the North of England Institute of Mining and Mechanical Engineers has been investigating the subject of flameless explosives. After careful investigation and experiment, the following conclusions have been deduced:

1. All the high explosives (ammonite, ardeer powder, bellite, carbonite, roburite, and securite) ere less liable than blasting powder to ignite inflammable mixtures of air and fire-damp. These explosives, however, cannot be relied upon as ensuring absolute safety when used at places where inflammable mixtures of air and fire-damp may be present.

2. The variable results following upon the detonation of high explosives appear to be due in some measure to defective admixture of, or variation in, the proportions of the ingredients used in the manufacture of the explosive.

In view of the changes from time to time made in the proportions and constituents of high explosives, it seems desirable that this information should be afforded by the manufacturers to the users of the explosive.

3. In the storage of high explosives it is desirable that every care should be taken to ensure their being maintained in a proper condition. It is also certain that these explosives alter in character with age.

4. It is essential that similar examinations of the working places and precautions which are in force in mines where blasting powder is used, should be rigidly observed when a high explosive is employed.

5. In selecting a high explosive for use in a mine, it should not be forgotten that the risk of explosion is only lessened and not abolished by its use.

6. All the high explosives on detonation produce evident flame.

7. The emission of flame from a blown out shot of a detonated high explosive is not prevented by the quantity or length of stemming used.

8. In the case of a charge of a high explosive which has missed fire, if a short length of stemming (proved up to 8in.) has been employed, the charge can be detonated by another cartridge of the explosive and additional stemming being placed in the hole in front of the original stemming.

A most ingenious method has been used in England for ascertaining the constituents of air during an explosion. A charge of blasting powder was fired from a cannon suspended in a shaft, the air of which was proved, by careful chemical analysis, to be absolutely free from any trace of combustible gas. In order to get some idea of the condition of the air inside the pit during the explosion, samples of air were taken and were analyzed. Two brass tubes were fastened to the rope that was used to lower the cannon, one 20 yards from the bottom, the other 40 yards from the bottom. These tubes were so arranged and constructed that the explosion, as it passed the tubes, unsealed the outlet pipe, and the escaping water sucked in a sample of air, which was trapped by a special arrangement and kept in the tube until the rope could be wound up. By this method it was intended that the sample of gas taken should represent that state of the air whilst the flame was passing or directly afterwards. The tube nearest the bottom, as the following analysis shows, did partly collect the gas in the above condition. The tube at the top, however, commenced to act prematurely, and was probably started by the sound wave which preceded the explosion. This tube simply contained ordinary air. The following is an analysis of the gases found in the lowest tube:

	Per cent.
Oxygen	3.9
Nitrogen	75.9
Carbon dioxide	12.1
Carbon monoxide	8.1
	100.1

This ingenious arrangement was due to Mr. W. J. Orsman, and it is probably the first successful attempt which has been made to get a sample of gas during the progress of explosion; and there is not the slightest doubt that the presence of such an amount of carbon monoxide converts mixtures of coal dust and air into a highly explosive body. As the explosion takes place, and as the carbon monoxide already produced is oxidized to carbon dioxide by the action upon it of water vapor present, and also by its direct combustion with oxygen, the hydrogen of the water vapor is set free, whilst the heated coal dust also yields certain inflammable products of distillation to the air, and partial combustion also of the coal dust gives a considerable proportion of carbon monoxide once more, and these, driven rapidly ahead of the explosion, form, with more coal dust and air, a new explosive zone, and so by waves and throbs the explosion is carried through the dust laden galleries of the mine.

Repairs to Rock Drills.

General Mining Ass'n. of Quebec—Discussion Continued on Paper by Mr. A. Sangster.

By Mr. John E. Hardman, S.B., M.E., Halifax.

I have perused Mr. Sangster's paper with much interest and have looked in the discussion which followed for some categorical statement which would show the actual cost per month (or per year) per drill for repairs, or for renewal of parts. Not finding this I propose to give some figures, which are the result of three years working of a Rand drill plant at the mines of the West Waverley Gold Co., Ltd., Waverley, N.S.

The number of drills in the plant is five, three being No. 2 L.G., and two No. 3 L.G. During the last year a 32 slugger (the equivalent of a No. 2 Little Giant) has replaced one of the No. 2 L.G.'s and I shall make reference to this substitution later.

Of this number of drills, three have been in constant use, at an average, the aim being to always have one drill of each number in the shop in perfect repair, so as to substitute it without loss of time, in case of any accident to a working drill below.

The total cost of repair parts during this period of three years ('92, '93 and '94) has been $275.05 or an average per drill per year of $30.65. But at the end of these three years there is but one drill in the lot of five that is fit for service. At a careful estimate about $18.00 would be necessary to make this drill serviceable for another year; so that to the amount of $275.85 should be added, *at the least*, the cost of four drills, say $800.00, making a total of $1075.85. To be yet more accurate we must add a portion of the cost of the fifth drill, which is serviceable for a time yet, say $150.00, making a cost of $1225.85 for five drills for three years, or $136.20 per year per drill.

In view of these figures it certainly would appear that Mr. Blue's suggestion that the manufacturers should sell the drills at "something like 25 or 50% on the cost" and then send them, after six or eight months use, to the scrap heap, is the most practical and economical from the user's standpoint. For it must not be forgotten that the above figures do not include the labor of the blacksmith or machinist who removes the broken or worn parts and fits the new ones, and cleans and oversees generally the drills of the plant; only the first or market cost of the repair pieces, and of the shop in reboring, etc., etc., are included in the figures given.

As a matter of convenience (which may also be interesting to some members of the Association), I have had calculated the cost per drill per year for each of the various renewal parts we have been required to use.

Name of Part.	Cost per Drill Per Year.	Name of Part.	Cost per Drill Per Year.
Piston packing rings	$0 55½	Slide valves	$0 22
" springs	0 13⅓	Valve seats	0 50
Ratchet	1 00	Rockers	1 44½
Pawl	0 59½	Rocker pins	0 89
Pawl springs	0 08	Throttle valves	0 72
Pawl studs	0 14	Feed screw	0 39
Rotating bars	1 22¼	Jamb nut	0 02
Rotating nuts	1 11	Feed nut	1 95
Buffer yoke	0 05½	Shells	3 88
Cylinder Buffer	0 11	Split stuffers	0 66
Chuck bolt nuts	0 22	Step clamp bolt	0 44
Chuck keys	0 33⅓	Arm clamp bolt	0 42
Chuck bushings	4 22	Hose end fittings	1 29

In this list it is seen that "chuck bushings" easily stand first, with "shells" a good second. An explanation of this is not easy; many of our chuck bushings at first were very brittle and broke easily. Since getting a better bushing the wear must be attributed largely to the sharp cutting quality of quartz dust. Mr. Geo. R. Smith's remark that the life of a drill depends largely upon the operator and also upon the rock to be drilled, will be endorsed by every drill user.

As an instance I may allude to an installation of Rand drills put into one Oldham mine some few years ago, the repairs to which have amounted to less than $10.00 per drill for the whole of that time. The difference between the cost of these repairs and those at Waverley is chiefly due to the difference in the nature of the rock encountered. It is also due in part to the fact that we work at a higher air pressure in Waverley than in Oldham, the guage underground in Waverley reading 90 lbs., while at Oldham the average pressure did not exceed 70 lbs. per square inch. The high pressure in Waverley was a necessity, as the drainage pumps of the mine are operated by compressed air.

The most effective agent in reducing the cost of repairs to drills has been the adoption of the rule of charging all repairs against the contractors or miners operating each drill. At the end of each month the repair bill is scrutinized closely by the management and items unquestionably due to wear and tear are assumed by the company; items due to carelessness or recklessness are charged to the men operating the drill.

In reference to the remarks of several gentlemen regarding the quality of oil to be used, I might say that in gold quartz mining the use of oil has almost to be prohibited, at any rate it has to be minimized, as the oil is most detrimental to subsequent amalgamation in the mills. At the suggestion of Mr Halsey, who was connected in the matter, the experiment was tried of using a compression grease cup on the drill. It was found that although lubrication of the valve was perfect, the grease failed to properly lubricate the cylinder, and after attempts to use glycerine and plumbago had also proved abortive, we were compelled to return to a light machine oil, and to use the greatest care and supervision in its use on the drill. But we have never found the wear on the cylinders to be a principal item, and in this respect cannot consider Mr. Sangster's idea of bushing as of prime importance.

Something over a year ago we substituted a 32 Slugger for one of the No. 3 Little Giant drills, hoping thereby to diminish the number of renewal parts.

Our experience with the Slugger has been most satisfactory, so much so that we have substituted two more Sluggers in place of "Little Giants." We find that the Slugger No. 32 working under our high air pressure is a more economical machine, and one that is fully as effective in hard ground, and we have also had the satisfaction of seeing our bills for new parts materially reduced. In my experience of 17 years I have never worked a more satisfactory air drill than the Rand 32 Slugger.

The Variation of Pressure in Cornish and other Pumps.*

By G. E. J. McMURTRIE, A.M. Inst. C.E.

My attention has lately been drawn to a very interesting subject, viz., the variation of pressure in Cornish and other pumps.

This has led me to make a series of experiments on the Foxes Bridge Colliery pumps.

This engine was fully described in Vol. 18, No. 4, of the Institute Proceedings, and it will be sufficient here to state that it is an ordinary 56-inch Cornish Condensing Engine, with Cataract gearing governing the upstroke of the engine; and with a lower 12 inch plunger forcing 373 ft from bottom, and an upper 15 inch plunger forcing 521 ft. further to surface. The rising main is 13 inches diam. throughout.

Experiments were made just above the delivery and suction clacks of both plungers, so as to compare their action. And to make the experiments as complete as possible, the speed of the engine was in each case regulated as nearly as possible to 1, 2, 3, 4, and 5 strokes per minute, by means of the cataract. In no case was the engine handled by the driver, so that the results obtained are those regularly obtained in its working.

It should be added that each result is the average of some ten experiments.

The guage used was a duplex, with two pointers to check one another, and was kindly lent by Messrs. Harvey, of Hayle, who supplied this new pump work. The pipe connecting it to the pump work was only a few inches in length.

The following are the results (*see* also Plates 4 and 5):

BOTTOM PLUNGER.—GAUGE FIXED JUST ABOVE SUCTION CLACK.

Statical pressure, 144 lbs. per square inch.

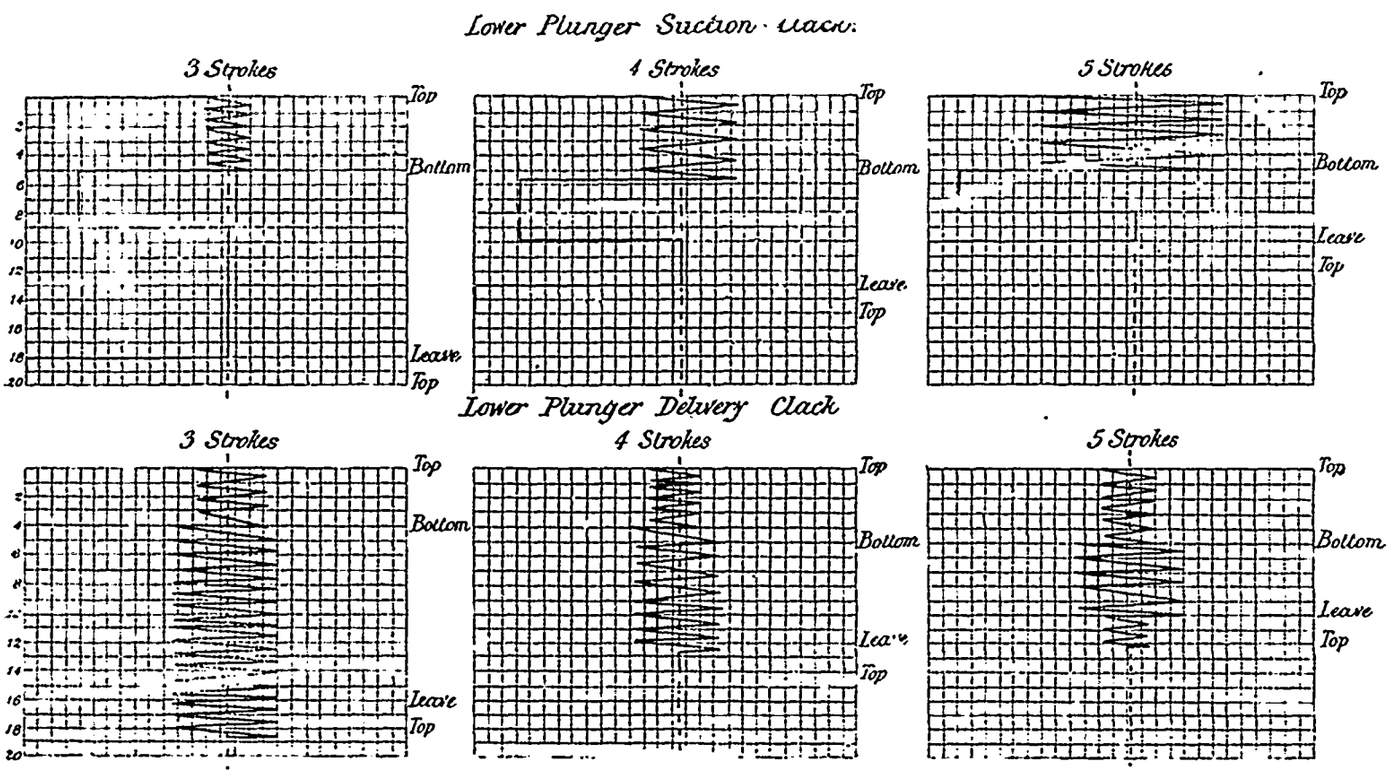
Speed of Engine in strokes p. minute	1	2	3	4	5
Time of up stroke in seconds.	2½	2	2	2	2
" down stroke "	5	6	5	5	5
Resting at bottom	50	20	13	8	5
Pressure during up stroke.....	zero	zero	zero	zero	zero
Duration of same in seconds	2	2	2	2	2
Vibration on Plunger reaching top..	160to130	160to130	160to129	183to116	205 to 79
Duration of same in seconds.....	2 (?)	5	5	5½	5
Pressure on Plunger reaching bottom.	50	43	38	32	22
Duration of same in seconds.	5½(?)	4	4	4	3
Returning to.....	144	144	144	144	144
Duration of same in seconds	48	17	9	3	2

Maximum pressure on Plunger reaching top, 205 lbs., being 61 lbs., or 42·4 per cent. above statical pressure.

Minimum pressure, zero.

Range of variation, 205 lbs.

Experiments made April 26, 1894.



Variation in Pressure in Cornish and other Pumps.

BOTTOM PLUNGER—GAUGE FIXED JUST ABOVE DELIVERY CLACK.

Statical pressure, 143 lbs. per square inch.

Speed of Engine in strokes per minute	1	2	3	4	5
Time of up stroke in seconds..	2	2	2	2	2
Time of down stroke in seconds	5	5	5	5	5
Resting at bottom..... .	54	21	11	7	5
Vibration on Plunger reach'g top	154to133	173to127	172to125	157½to124½	160to122½*
Duration of same in seconds .	5	4	4	4	5
Vibration on Plunger reaching bottom	179to112½	178to110	180to107	175½to113	180 to 105
Duration of same in seconds..	54	23	14½†	8½	5
Gauge returned to.....	143	143	143	143	143
Duration of same in seconds. .	2	2	2	2	—
Vibration on Plunger leaving bottom	—	—	—	—	155 to 125
Duration of same in seconds. .	—	—	—	—	2

*Gauge dropped momentarily to 143 lbs. on Plunger leaving top.
†Stroke, vibration just before Engine reached bottom.

Maximum pressure on Plunger reaching bottom, 180 lbs., being 37 lbs., or 26 per cent. above statical pressure.

Minimum pressure, 105 lbs., being 38 lbs., or 26·6 per cent. below statical pressure.

Range of variation, 75 lbs.

Experiments made April 26, 1894.

UPPER PLUNGER.—GAUGE FIXED JUST ABOVE DELIVERY CLACK.

Statical pressure, 200 lbs. per square inch.

Speed of Engine in strokes per minute.....	1	2	3	4	5
Time of up stroke in seconds. .	2	2	2	2	2
" down stroke " ...	6	5	5	5	5
Resting at bottom	56	21	11·5	8	5
Vibration on Plunger reaching top....	214to191	200to187½	210to188	217½to191	232½ to 180
Duration of same in seconds...	4	4	4	4·5	4
Vibration of Plunger on reaching bottom	260to140	260to 140	260to137	259 to 135	272½to122½
Duration of same in seconds ...	27	21·5	14	2	2¾
Gauge returned to.	200	200	200	200	200

Maximum pressure on Plunger reaching bottom, 272 lbs., being 72 lbs., or 36 per cent. above statical pressure.

Minimum pressure, 122 lbs., being 78 lbs., or 39 per cent., below statical pressure.

Range of variation, 123 lbs.

Experiments made April 23, 1894.

*South Wales Institute of Engineers.

UPPER PLUNGER—GAUGE FIXED JUST ABOVE SUCTION CLACK.

Statical pressure, Zero.

Speed of Engine in strokes per minute	1	3	4	5
Time of up stroke in seconds	2	2	2	2
Time of down stroke in seconds	4	5	5	5
Resting at bottom	59	11½	8	5¼
Pressure during up stroke	zero	zero	zero	zero
Duration of same in seconds	2⅔	2	2	2
Vibration on Plunger reaching top	220	240	240	240*
Duration of same in seconds	3¼	3	2½	2⅓
Pressure on Plunger reaching bottom	150	140	135†	130 } in 5 sec.
Duration of same in seconds	3	4⅔	5¼	.. }
Which gradually rose to	180	170	155	150 }
In	8¼	8	4¼	..
Returning to	zero	zero	zero	zero
In	39	1½	1	1⅓

*On Plunger descending the gauge dropped to 200 lbs. in 1⅓ seconds.
†With a considerable vibration.

Maximum pressure on Plunger reaching top, 240 lbs.
Minimum pressure, zero.
Range of variation, 240 lbs.
Experiments made April 23, 1894.

It is by no means an easy matter to take these indications, but the results agree well, and great care was taken in making them.

The *modus operandi* was first to regulate the strokes of the engine by means of the cataract. Next, to time the upstroke, downstroke, and time the engine rested at bottom; there being no appreciable stop at top.

Finally the pressures were taken in the shaft by myself and two men; one calling out the position of the plunger, the second reading the gauge, and the third timing the period of the vibrations.

At the higher strokes two men were required to read the gauge, and the times were noted after. As the engine was going at a regular speed this would not however matter.

Messrs. Harvey, to whom a copy of these experiments was forwarded, have raised an interesting point. They argue "that the variations in pressure shown by the gauge at the higher speeds is greater than that due to the actual pressure. The increase on the pole reaching the bottom being 30 to 40 per cent. above that due to the head of water, the weight of the rods, etc., would not be able to force the pole down against the pressure, and the addition owing to friction of rods, packing, etc." They have "noticed in practice, that if pressure is brought suddenly on to a gauge, the index vibrates beyond the pressure actually applied, this being due to the elasticity of the spring." And this, they urge, "has happened in these experiments, especially as the mean of the vibrations gives about the pressure to be expected from the head of water."

Their impression is "that the friction of the water, etc., would increase the pressure by from 5 to 7 per cent. above that due to head, when the pole is working at 5 to 6 strokes per minute."

They "instance a case of a 90-inch engine, the load on the piston of which was 12 per cent. more than the area of the poles multiplied by the pressure due to head of water, this 12 per cent. being accounted for by friction of piston rods, pole packing, friction of water in rising main, &c."

In regard to Messrs. Harvey's contention, that with such an increase in pressure the engine would not be powerful enough to do the work, it must be remembered that these great increases both at top and bottom occur just when the rods come to rest, and consequently do not increase the work to be done by the engine, and the consequent consumption of fuel.

To reduce the vibration of the spring they also suggested taking these experiments with the gauge partly closed, and stated that they found if the cock leading to the gauge be nearly closed the gauge moved much more steadily.

No doubt if the cock leading to the gauge be partly or nearly closed, the vibrations will be less, but if water be driven through such a small opening, will not this greatly increase the friction, will the vibrations be equally quickly conveyed, and will the results obtained be accurate?

In order to test this, the following additional experiments were made with the gauge approximately half open, above the suction and delivery clacks of the bottom plunger, the engine in each case being driven at 4 and 5 strokes per minute.

BOTTOM PLUNGER.—GAUGE FIXED JUST ABOVE DELIVERY CLACK.

Statical pressure, 142 lbs. per square inch.

Speed of Engine in strokes per minute	4	5
Time of up stroke in seconds	2	2
" down stroke "	5	5
Resting at bottom	8	4
Vibration on Plunger reaching top	151 to 129	166 to 121
Duration of same in seconds	5	5
Vibration on Plunger reaching bottom	174 to 110	174 to 109
Duration of same in seconds	4	3½
Gauge returned to	142	142
Duration of same in seconds	4	1
Vibration on Plunger leaving bottom	—	150 to 130
Duration of same in seconds	—	2

Experiments made May 8, 1894.

Maximum pressure on Plunger leaving bottom, 174 lbs., being 32 lbs., or 22·5 per cent., above the statical pressure.

Minimum pressure, 109 lbs., being 33 lbs., or 23·2 per cent., below the statical pressure.

Range of variation, 65 lbs.

BOTTOM PLUNGER—GAUGE FIXED JUST ABOVE SUCTION CLACK.

Statical pressure, 144 lbs. per Square Inch.

Speed of Engine in strokes per minute	4	5
Time of up stroke in seconds	2	2
Time of down stroke in seconds	5	5
Resting at bottom	7·5	4·5
Pressure during up stroke	zero	zero
Duration of same in seconds	2	2
Vibration of Plunger reaching top	160 to 127	172 to 112
Duration of same in seconds	5	5
Pressure on Plunger reaching bottom	48	26
Duration of same in seconds	4	3
Returning to	144	144
Duration of same in seconds	5	2

Maximum pressure on Plunger reaching top, 172 lbs., being 28 lbs., or 19·4 per cent., above the statical pressure.

Minimum pressure recorded, zero.

Range of variation, 172 lbs.

Experiments made May 8, 1894.

These experiments agree with those previously taken with the cock fully open, except that the vibrations are not quite so great.

Next, the gauge was fixed above the delivery clack of the lower plunger, and with the engine worked at 5 strokes the following was found:—

With the cock slightly open the gauge stood at zero.

With the cock one-quarter open the gauge stood at 70 lbs.

With the cock one-third open the gauge showed slight vibrations.

With the cock half open the gauge showed considerable vibrations.

The statical pressures were next tested above the delivery clack.

When the gauge was wide open as before it registered 142 lbs.

When the gauge was half open it registered 65 lbs., and this pressure decreased as the cock was closed.

These last experiments, on the dynamical and statical pressures, appear to me to prove conclusively that such experiments, to be accurate, must be made with the gauge cock fully open.

The following are the probable reasons for the great variations of pressure on the pump work:—

Taking first the action of the gauge, when placed above the delivery valves of both plungers, we find on the plunger reaching the top, there is a great vibration, due doubtless to the plunger travelling faster than the water on leaving the bottom; on the plunger stopping at top the water reaches it, and at the same time the plunger drops 1½ inch or so, opening the delivery clack, and throwing the full weight of water suddenly on the plunger. On the plunger reaching the bottom the vibration is considerably greater, possibly owing to the water not escaping as quickly as it might, and consequently there is additional pressure put on it. This is in part borne out by the fact that the vibration with the bottom plunger, which is a 12-inch pumping into a 13-inch rising main, is less than with the top plunger, which is a 15-inch pumping into a 13-inch rising main, even allowing for the difference in height of the respective rising mains. Or else on the plunger coming to rest the rising water is checked, and then falls back on the delivery clack, closing it. Possibly it may be a combination of the two.

At a speed of five strokes a considerable vibration is also shown by the gauge, on the lower plunger leaving the bottom, and on checking the experiment this was found to be correct. Probably this was due to this delivery clack being not tight at the time, but it is difficult to see why this occurs only at this speed.

When the gauge is placed between the clacks, the results obtained from both plungers are very similar, except that the gauge returns to zero when the top plunger rests at the bottom, showing that the delivery clack is tight; while the gauge attached above the bottom plunger suction clack registers the statical pressure when the plunger rests at bottom, showing that there is leakage here. During the up stroke the gauge registers zero, as the plunger outstrips the water. On reaching the top there is a considerable vibration, owing to the rising water reaching it, and the plunger dropping back and thus opening the delivery clack, which suddenly throws the weight of water in the rising main on the gauge.

The drop in pressure on the plunger reaching the bottom, is probably in part, if not wholly, due to the rushing water leaving the now standing plunger, causing a reduced pressure.

In the case of the upper plunger there is a slight increase in pressure before the gauge rests at zero. This may be due to the clack, which is an ordinary one with a relief clack on top. The first pressure is shown on the plunger coming to rest, and the water leaving it, so to speak, the main clack then closes, and the pressure rises as the velocity of the water drops. Next the relief clack closes, and the pressure drops to zero. The absence of this slight rise in connection with the bottom plunger is probably due to the gradual rise to the statical pressure hiding it; this rise being due to leakage of the delivery clack.

The drop in pressure shown by the bottom plunger is much greater than that shown by the upper plunger, and is possibly due to a 15-inch plunger pumping into a 13-inch main in the latter case, and in the former case a 12-inch plunger pumping into a 13-inch main, the freer vent thus given the water producing the lower pressure.

It will be well here to say, that Messrs. Harvey state the increase in pressure caused by a large plunger pumping into a small rising main is very small, except in very extreme cases. They instance the case of an 18-inch pole with 8-foot stroke, making 14 strokes per minute, pumping into a 12-inch main, the increase in pressure due to the small area of the delivery being but 3 per cent. beyond that due to the head.

Experiments similar to these described have been made by several. It may be of interest to refer to some.

Mr. Emerson Bainbridge experimented on an 84-inch beam engine, with two 26-inch lifting sets at one end of the beam, and an 18-inch and 16-inch lifting set at the other end.

Mr. F. N. Hall, on a Cornish engine erected at the Settlingstones Lead Mine in 1868. The engine had a 60-inch cylinder, and attached to the outer end of the beam were a 7-inch set lifting to 12 fathoms, two 13⅜-inch sets lifting a further 17 fathoms, and finally an 18-inch plunger set forcing a further 37 fathoms.

Both of these papers are in Vol. 21 of the North of England Engineers' Proceedings.

The Foxes Bridge experiments can be compared only with those on the Settling-

stones forcing set. With these they agree well, except that the vibration at the bottom of the stroke is greater than that at the top of the stroke, whereas the Settlingstones pumps showed the reverse.

The Settlingstones experiments also showed the dynamic pressure on the bucket to exceed the dynamic pressure on the plunger in the proportion of 1·7 to 1·3 times the statical pressure of the column, which gives forcing sets a decided advantage over lifting sets if this be reliable.

The remedy suggested by Mr. Hall for these excessive pressures is the admission of a small quantity of air at each stroke, pumps connected with fast-working engines on board ship being said to do this. This was further emphasized by other speakers.

Is this ever done in connection with Cornish engines? A compound rotary engine, erected by Messrs. Simpson at Throckley Colliery a few years ago, an air vessel was placed at the pit bottom. In connection with large horizontal pumps placed underground, forcing from the bottom to the top of the pit, this is also generally done. If it is found useful in these cases, it seems reasonable to expect that it would be useful to the Cornish engine.

In the course of the discussion on Mr. Hall's paper, Mr. J. B. Simpson said he had obtained an increase of pressure of 50 per cent. in plunger pumps over that due to the column.

The fact that a pump delivers water long after the stroke is completed was referred to. In our case this continues till the commencement of the next stroke, though it is a decreasing quantity. This *vis viva* may explain the length of vibration of the spring.

Mr. Bulman, in Vol. 3, page 107, of the British Mining Students' Proceedings, describes some similar eaperiments made by Mr. Wight, the engineer, on the Dinnington Colliery pumps. The engine was a 66-inch condensing beam engine, with 10-foot stroke in pit, and steam on the piston on both up and down strokes. It has an 18-inch set lifting the bottom 72 yards, and an 18-inch set forcing 56 yards further attached to the one end of the beam; and a 20-inch set lifting a further 72 yards at the other end.

These experiments agree with the Foxes Bridge ones, in showing a greater vibration at the bottom of the stroke than the top, above the delivery clack, and thus differ from those made at Settlingstones. Above the suction clack, however, at the bottom of the stroke, the pressure appears to rise largely before the fall in pressure comes.

Mr. Wight suggested that the area of the pumps above the working barrels be increased, so as to check the velocity of the rising water above the clacks, and thus the fall of water with its consequent shock would be reduced.

Mr. Bulman also gives the following (Vol. 16, page 88):—

At Gosforth Colliery there is a pair of Tangye's special double-acting pumps, with 7-inch rams, 32-inch steam cylinders, and 6-foot stroke, forcing 1,080 feet. At 10 strokes per minute the gauge showed a vibration of 450 to 550 lbs., while the statical pressure is 468 lbs. A clack was fixed between the gauge and the rising main, and the low pressure was got on this closing, and the high when the head of water was encountered.

At Springwell Colliery there is a pair of Evans' Cornish duplex engines, with 24-inch cylinders, 3-foot stroke, and 8½ double-acting rams, forcing water 780 feet. The statical pressure of this head is 338 lbs. With the two pumps working the pressure varies from 300 to 370 lbs., with one pump only from 250 to 450. At Byer Moor Colliery there is a pair of 6-inch double-acting pumps, with 4-foot stroke and 20-inch cylinders. The statical pressure is 220 lbs.

Until an air vessel was added, with an arrangement for charging the air vessel at the pressure due to the head of water, the pressure varied from 180 to 270 lbs. With the air vessel, there is little or no vibration. Mr. Bulman advocates the addition of air vessels to direct-acting engines, to reduce the strains on the pump work, and considers that the variation of pressure depends largely on the efficiency of the valves.

Other experiments by Mr. Melly (Vol. 8, page 40, of the British Students), on a Cornish engine with 17-inch ram forcing 144 yards, show similar results above the delivery clack to those obtained by myself.

Diagrams of the Foxes Bridge experiments are shown on Plates 4 and 5 with the engine going 3, 4, and 5 strokes.

The vertical divisions represent pressures of 10 lbs., the horizontal division intervals of 1 second.

The times when the plunger reached the top and bottom, and when it left the bottom, are also given.

There was no rest at the top of the stroke.

The zigzag line represents the pressures registered by the gauge, the dotted line the statical pressure.

GENERAL MINING ASSOCIATION OF QUEBEC.

Proceedings of Fifth Annual Meeting—*Continued.*

The concluding session of the Association was held in the New Club Room, Windsor Hotel, Montreal, on Friday afternoon at two o'clock, Mr. John Blue, C. and M.E., President, in the chair.

THE IMPORTATION OF MINING MACHINERY.

THE SECRETARY again called attention to differences of interpretation by collectors of the law respecting the free admission of mining machinery. In the Province of Quebec, for instance, he was informed by one of their members that silvered copper plates for a gold mill had been held for duty, notwithstanding that for a number of years these plates bad been admitted free in the Province of Nova Scotia. The Ontario Government imported recently two Sullivan prospecting drills from Chicago and the duty had been charged, notwithstanding a provision of the law which specially provided that diamond drills be admitted free. The Cumberland Railway and Coal Co. had brought in, for use at their Springhill collieries, a very heavy and specially designed colliery pump, from Jeansville, Pa., of a class or kind not manufactured in Canada, but the duty was collected under protest. The New Glasgow Iron, Coal and Railway Co. had also been compelled to pay under protest duty on their coal washing plant, machinery not manufactured in the country. Some difference of opinion existed in the Department of Customs respecting the meaning of the Act, it being claimed that in this instance a coal washing plant was not, in the strict sense of the word, mining machinery, but he understood that a ruling had been given by the Department of Justice which admitted all machinery and appliances for mining and treating ores and minerals to be within the jurisdiction of the Act. Some action should be taken to bring the matter again to the attention of the Department, and he would move that the President and Secretary, with Messrs. H. A. Budden, H. Drummond, J. Burley Smith, S. L. Spafford, R. T. Hopper, J. J. Penhale, Capt. Adams and S. P. Franchot be a deputation to interview the Minister of Trade and Commerce and the Controller of Customs.

MR. R. T. HOPPER said his company had brought in a crushing plant not manufactured in the country; they had to pay duty, and it had never been refunded. He seconded Mr. Bell's resolution.

MR. PENHALE—The only list in the hands of the collectors was one furnished by the Jenckes' Machine Co. of Sherbrooke, which embraced everything under the sun.

CAPT. ADAMS moved that the Committee appointed by the last motion be requested to bring before the Government the question of admitting all mining machinery free into the Province of British Columbia for a limited period. In making the motion he pointed out that the present law had been framed before mining in British Columbia had assumed its present importance, and consequently so far as that province was concerned the law was practically a dead letter. Mine owners could not imprort their machinery from the Province of Quebec, and they had to import it from the United States. Mining was largely conducted by American capital and American machinery, and if it were not for the present law more capital would be forthcoming from Americans for mining purposes. Capt. Adams' motion was seconded and agreed to.

THE QUEBEC MEETING.

THE SECRETARY moved that the next meeting of the Association be held in the City of Quebec and that the following be a Committee of Arrangements:— Hon. George Irvine, Q.C., Mr. James King, M.P.P., Mr. C. H. Carriere, and Mr. J. T. Dyer.

The motion was agreed to.

A vote of thanks to the contributors of papers and to the chairman terminated the proceedings.

The Geological Survey and its Operations.

BY DR. R. W ELLS, OTTAWA.

(Continued from January Issue.)

In British Columbia the work of the last twenty years has made us very familiar with the immense value of the coal fields of Vancouver, and with the inexhaustible forests which are found, not only on that island, but at many points on the mainland. The mapping of many of the gold fields of the interior has also been done, and the structure of the rock formations in the Rocky Mountain chain has been carefully worked out. The great mineral deposits of the Kootenay district have been thoroughly examined and much valuable information bearing upon their distribution and origin has been obtained. Further to the north the country traversed by the branches of the Peace River has been examined and the probabilities for successful mining investigated, while we have now ascertained very carefully the value of the coal area in Queen Charlotte Islands, and the distribution of the gold-bearing rocks and other formations in the great mountain area, lying to the east of the Alaskan boundary.

But the study of the rock formations and their associated mineral wealth does not by any means limit the work of the Geological Survey of Canada. In its operations are included the study of its forma and flora. In the museum at Ottawa, stored away in cases and high presses can be found one of the largest and most complete collections of plants illustrative of the history of all parts of our Dominion possible to be obtained. Much of the work of this branch of the department is not seen by the ordinary visitor, since, unlike rocks, or masses of ore, dried plants are perishable things, and must not be exposed to light and open air. They must be carefully laid away and precautions taken to guard against the ravages of insects and other enemies of the botanist's handiwork. In these cases more than 100,000 specimens are stored, illustrating the distribution of the flora of the Dominion from the shores of Anticosti to the green valleys of Vancouver. The flora of the Peace River district, of the Mackenzie River, and the famous barren grounds of the great plains and of the Rocky Mountain slopes, in the west; of the shores and islands of the Atlantic coast in the east, as well as of the country about the great inland lakes, and the interior of distant Labrador, is thus rendered available for study to anyone interested in the botany of our country; and to the botanists and collectors of the Survey great credit and praise are due for the careful way in which this branch of the Survey's work has been carried on. Equally inconspicuous also with the botanical specimens are the magnificent collections illustrative of the insect life of the country, and probably most of those who wander through the corridors of the museum are unaware that such beautiful illustrations of this branch of scientific work are there stored. The ornithology, and to a certain extent also, the zoology of the Dominion are well shown by means of a good collection of the principal birds and mammals, while the various species of land and marine shells are also exhibited. Though in but few of these are the collections by any means exhaustive, sufficient has been done to shew that the comparatively newer branches of natural history have not only not been exhausted, but that the results already obtained are of very considerable importance.

The division of ethnology has also received considerable attention. Extensive collections illustrating the manners, customs and institutions of the various Indian tribes which now inhabit our country have been made, as well as large quantities of the remains and relics of former races. The branches of paleontology, mineralogy and lithology, so intimately connected with the geological work, have been maintained at their usual high grade of efficiency, though the opening of the north-west territories has introduced a new feature into the study of Canadian paleontology by the accession of great collections of fossils from the cretaceous and other closely associated formations found in that area, as well as from the older formations of the Rocky Mountain complex. The result of the fifty years collecting in this branch of the Survey's work has been to gather together one of the finest and most comprehensive collections illustrative of the life of past ages in the earth's history that can anywhere be found, a collection of such value to the scientific world, that if by chance it should be destroyed, its loss would be regarded as a great calamity by everyone interested in science the world over.

Of the internal economy of the Survey we have as yet spoken in but general terms. The collecting of facts relative to the structure and the making of sur

veys in the field would not possess one-tenth of their real value were no provision made by which these surveys and facts could be presented in compact and visible shape to the general as well as the scientific public. Hence the necessity for a topographical corps, whereby not only the work of the field staff can be arranged in map form for publication, but connecting surveys can be made to render these more intelligible. Then there is the careful arrangement of the museum, by which means everything deemed worthy of exhibit can be so displayed as to shew to the best possible advantage the relations between the rock structure and the contained fossils where such exist, or the minerals or ores which may be therein contained; so that anyone in quest of information can most readily obtain such to the fullest possible extent and with the least possible delay. The library division also is one of importance, in which the working scientist can find the most recent helps to enable him the better to profit by the researches of his brethren in other but similar fields, and so become the better fitted to work out the problems he may himself encounter; and here it may be said that the library of the Geological Survey is probably the most complete in scientific literature of any of the libraries in the Dominion, and in as far as practicable is kept well abreast of the time as regards the current literature of the subjects concerned.

The financial management of such an institution is also a most important item in its general scheme of successful work, and the proper disposition of the funds, by which the necessities of the several widely scattered parties can be best met, calls for a wise discrimination of the needs of each and the expense peculiar to each locality to be explored; the prime object being the most judicious expenditure of the money at the disposal of the department, consistent with the highest and most satisfactory results obtainable.

I trust in the very imperfect description of the work done by the Geological Survey department, I have shewn you that in the old building on Sussex street, many kinds of work, of great importance to the nation, are being carried on. The structure and contained wealth of the rock masses from the Laurentian or fundamental crust of the earth to the most recent formation of drift sand, gravel and peat, are being systematically studied and their actual value, in so far as this is possible, is ascertained. The importance of each system, as a source of mineral supply, is carefully weighed, and the mode of occurrence and probable extent and value of each element of economic importance, sought out when practicable, to some extent in the field, and in more detail in the labratory. Not only are the analyses of the rocks and of the contained ores there conducted, and their probable value from many localities carefully proved, but the chemical composition of the mineral waters from the various provinces of the Dominion is carefully ascertained, and their probable beneficial effects noted. Many of these have already proved to be large and important sources of revenue to the localities in which they occur, as at St. Leon, Caledonia, St. Catherines and other points. Much of this work, though presented annually in published volumes, fails to reach the general public, being by some curious process of reasoning apparently regarded as of more importance to scientific bodies and institutions of learning abroad than to those who are most directly interested in the development of the country's mineral wealth, a condition of things which doubtless to a large extent accounts for the oft repeated question "What is the work of the Geological Survey?" In the present arrangement of publication, however, much greater facilities now exist for obtaining desired information in any particular area.

It may, perhaps, be allowable for the sake of illustrating some of the points just presented to compare the personnel and the financial outlay of the Canadian Survey with those of our great neighbor to the south, where the area of surface to be covered by its operations is not very different from our own. In the United States, however, owing to certain conditions of climate and other causes, field parties are enabled to spend a very much longer period in exploration than is possible in this country. Thus we find by comparison of the figures of the two surveys for the year 1887-88, that the expenditure of the American Survey for that year, exclusive of publication, was about half a million dollars; that of the Canadian Survey for the same date, including publication and all expenses of management, was about a fifth of that amount. A portion of this sum amounting to about $20,000 only was divided among sixteen parties whose operations extended from Eastern Nova Scotia to Alaska, and included surveys in all the provinces, with special examinations of the country east of Alaska and the MacKenzie River Basin, Hudson and James' Bays and Lake Winnipeg and vicinity. In numbers the staff of exploration comprised in all, including assistants, thirty-five persons. In addition work was carried on in the branches of paleontology, botany, chemistry, etc., the results of that year being comprised in twelve scientific reports, besides that of the Director, which were published in two volumes of 1,364 pages, in addition to the bulletins on paleontology and botany. The American Survey during the same year employed in the geographical branch alone, eighty-five assistants, in addition to the chiefs of divisions, of whom there were fifteen in connection with the outside or geological work proper, and twelve for the associated branches, among whom were many of the leading professors in the different Universities, men most distinguished in their special lines of work. With such a command of men and money, magnificent results may be confidently looked for, yet in the published volume for the year mentioned there are only four scientific reports besides that of the Director, with twenty-four administrative reports, which correspond with the summary reports of the Canadian Survey, and describe the season's operations only as carried on by the different parties, the whole being contained in a magnificently illustrated and printed volume of 710 pages. In addition, as in the Canadian Survey, bulletins containing special reports on the work done in the various associated subjects were also published. Comparing results then, in so far as these can be ascertained, it is evident that the Canadian Survey has continued to maintain the high standard of efficiency which it has enjoyed from its very commencement and is giving full value for the amount of money expended thereon. The excellent reputation which it has borne, both at home and abroad, is due probably, first of all, to the reputation of its founder, the late Sir Wm. Logan, and secondly to the fact that the great majority of its staff have labored to the utmost with hearts filled with a love for the subject and with a desire to achieve great and lasting results; and while it would be folly to assert that the work of the Canadian Survey, or of any similar institution has always been free from mistakes, since that would imply a degree of infallibility and accurate scientific knowledge, not yet enjoyed by mortals, it will, I think, be admitted by anyone conversant with its methods of operations that the attainment of truth in regard to the geological questions presented has ever been the chief aim of those associated in the work.

MR. B. T. A. BELL—I see from this evening's papers the announcement of Dr. Selwyn's superannuation and the appointment of Dr. George Dawson as his successor to the Directorship of the Survey. It would be fitting in the presence of so many who are interested in the development of the resources of the country were we to express our appreciation of the labors of Dr. Selwyn in connection with this important department of the public service. (Hear, hear.) Dr. Selwyn's worth is widely known and honoured in the scientific world and while he may not have realized in the operations of the Survey, the ideals which mining men had formed, it was unquestionable that his labors had been beneficial in greatly extending the knowledge of the resources of the Dominion. It was hoped that the new Director, Dr. Dawson, who was not only the son of an eminent Canadian, but was himself an eminent Canadian, would give particular attention to the equipment of the Mining Bureau, and that more attention would be paid to the commercial features of our mining industries than had been the case in the past. In the present youthful condition of the country we could not afford expensive explorations of the "Barren Lands" and other sections too remote to be economically available for many years to come, when there was urgent need of information that would be economically available respecting mineral discoveries and mining industries nearer at home. It was the duty of the Bureau when new discoveries were made, such as the chromic iron deposits of the Eastern Townships or the gold fields of Rainy River or Lake of the Woods, to immediately investigate and report the fullest possible information to the public. There was also reasonable ground for objection to the great delay that ensued between the preparation of the reports of the officers of the Survey and their publication.

MR. E. D. INGALL agreed with Mr. Bell that where any new discovery of importance was made or reported, the Bureau should send an officer at once, no matter at what time of the year, so as to get reliable and carefully collected information at the very start of the movement. Last year he had asked for an appropriation for obtaining information respecting the gold deposits of the Rainy Lake, Madoc, Chaudiere and other districts, but for reasons which he need not mention, no money was available.

MR. B. T. A. BELL—There was money enough to send Mr. Tyrell into the Barren Lands.

MR. INGALL said he felt strongly that if they could have a definite sum per year for the work, and be expected to keep within it, and be allowed to manage the the thing as he had indicated, they could do just what was required in that way. The future, perhaps, would see that. In conclusion he referred to the remarks which had been made on the previous day during his absence about the unreliability of some of the statistics sent out by the Mining Bureau, and he showed that it was almost impossible to obtain correct figures in regard to the outputs from many of the mines.

ONTARIO MINING INSTITUTE.

The Papers Contributed at January Meeting—Formal Opening of the Mining Laboratory—Members Dined by the Governors of Queens.

The Institute adjourned on Friday morning, 4th January, having held four successive sessions. In the afternoon the members were present at the formal opening of the Mining Laboratory, the first of its kind in Canada, and witnessed the operations of the plant which includes a small steam stamp mill, Frue vanners and other appliances for the reduction of ores and minerals. In the evening they were entertained to dinner in the Frontenac Hotel by the Governors of Queens, the Mayor of Kingston presiding. There was a large company present, including a number of members of the Ontario Legislature and House of Commons. A number of toasts were given and the proceedings were thoroughly enjoyable.

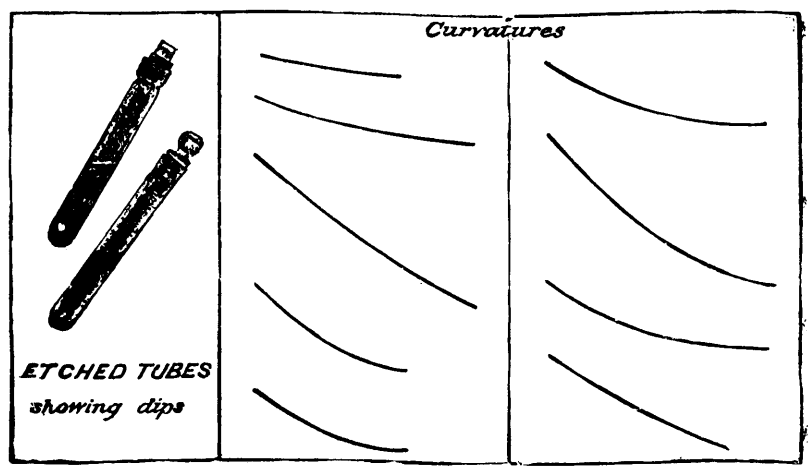
The Glendower Iron Deposit.

By W. G. MILLER. M.A., Kingston.

It was thought that a few notes on the Glendower iron deposit might be of interest to the members of the Institute, as it is the first property on which the new Government diamond drill has been put to work; and moreover, the deposit, in itself, has some features which are worthy of study.

The Glendower mine is situated in the township of Bedford, in the county of Frontenac. four miles east of Bedford station on the Kingston and Pembroke Railway, with which it is connected by a switch.

Much has been written on Ontario iron deposits by Logan, Hunt, Harrington and others. Our iron deposits have probably been studied in as great detail as have any of our economic deposits. Since, however, so few of them have been worked out or, in other words, have had their ore exhausted, most of the theories concerning their



Curvature of Diamond Drill Holes.

nature and origin have been formed, we might say, *above ground*. So that we may hope to understand them better after more underground work has been done.

Many theories have been proposed to account for the origin of these deposits, and as the deposit with which we have to deal consists of magnetic iron ore, I shall, with your permission, give a short review of the chief theories which have been suggested to account for deposits of this nature, although I am aware that most of you are well acquainted with them. Afterwards I shall give a short description of the Glendower deposit, and we will try to determine which of these theories is the most applicable to it.

The chief theories, then, as to the origin of magnetite deposits are:

1st. The theory which received the support of Hutton about one hundred years ago.

Hutton believed that the iron ores which we now find among metamorphic rocks were of igneous origin, *i. e.*, that the ore had been emptied into crevices or fissures in the rocks in the molten state. His theory has now become practically obsolete as regards most iron deposits, and the tendency of opinion, at the present time, is towards the chemico-sedimentary theories. It is, however, believed by some that our titaniferous iron ores have had an igneous origin.

2nd. Another theory closely connected with that of Hutton is that in which it is supposed that iron ores have originated, for the most part, as the excessive basic portions of igneous rocks. There are such occurrences, in Greenland and elsewhere, although seldom, if ever, pure enough or abundant enough to be worked.

3rd. It has been held that many of these deposits have originated as beech sands. This theory was proposed by a Canadian, Dr. Harrington, of Montreal, in 1875, and it has since received the support of many eminent geologists.

4th. In somewhat the same way as under the last example we find magnetic sands concentrated as river bars and collected together in lake expanses or still bodies of water along rivers. Hence it has been held that deposits, which we now find among metamorphic rocks, have originated in this way.

5th. As replaced limestone beds—in which it is supposed that the iron may have replaced calcium carbonate or have existed in the form of siderite, and have been finally metamorphosed into magnetite.

6th. As submarine chemical precipitates, a theory which has been proposed by the Winchells for some of the iron ores—magnetite and hematite—of Minnesota. The igneous rocks associated with these ores lead to the conclusion that the enclosing rocks have been formed by submarine volcanoes. Deposits of iron and silica, which are interbedded, are thought to have originated from the heated, overlying water. During last summer, however, Spurr has shown that these ores originated from the solution or leaching out of the iron in beds of green sand or glauconite.

7th. As metamorphosed limonite beds. This theory has met with quite general acceptance, and it is believed by some observers that many of the iron deposits in this vicinity have originated in this way. The limestone and gneisses or schists which form the country rock are believed to represent sedimentary material which was laid down contemporaneously with the limonite.

8th. There is the method of formation of deposits by segregation or as segregated veins. This theory is viewed with favor by many reliable observers. By this method the iron oxide is conceived to concentrate from a state of dissemination in the walls, by slow secretion in solution, to form the ore bodies along certain favorable beds. "The nature of the action is well illustrated on a small scale by the well known disks of pyrites and calcite that form in clays and shales." This theory cannot of course be applied to magnetite deposits in general, but it is probably true in certain cases. Where it applies we should expect to find hornblende and other ferruginous minerals in association with the ore, since it would be only from the more basic rocks that the iron would be leached out, and it is also likely that the ore would be fairly well crystallized.

Many deposits are, of course, commonly spoken of as veins, although they are quite different in structure.

Besides the theories which I have mentioned, there are some ten or twelve others which have been proposed, some of which seem to be applicable in certain cases, but they are of less general interest.

It is difficult to say which of these theories can be applied to the Glendower ore body. This deposit lies in metamorphic rocks which have a strike about N. E. and S. W. and dip at an angle of over 80°, the rocks on the upper side of the deposit being crystalline limestone, while that on the lower has been described as hornblende schist. The ore itself is a coarse magnetite, and in places is well crystallized and exhibits a well defined parting or cleavage. Mixed with the ore there is considerable hornblende in large pieces. The deposit can be traced for over half a mile and, where the ore was mined, it has a breadth of from twenty to forty feet. It was worked to a depth of about one hundred and eighty feet, and a curious feature of the ore is that down for some distance from the surface of the ground it is quite free from sulphur, but after reaching a certain depth it was found to contain a considerable percentage of this impurity. The object of drilling at the present time was to test the deposit at a greater depth and see if the ore again became free from it. It is said that the shaft was sunk to a depth of one hundred and twenty or one hundred and thirty feet before the sulphuretted ore was met with.

It is claimed that in a former boring, made some years ago, the ore was found to become free from sulphur at a greater depth, and this raises an interesting question as to how the one part of the ore contains sulphur, while the mineral both above and below the sulphuretted band is comparatively free from it.

Having now briefly described the deposit, let us see if any of the theories of origin which I have mentioned will satisfactorily account for the character which it possesses.

Hutton's theory, or that which considers the ore to have been formed as a dyke, certainly cannot be applied to it, as the rocks on the sides of the deposit show no evidence of metamorphic effects, which would have been brought about had the molten mass been protruded between them.

There is no evidence that the ore is the more basic part of an igneous mass of rock.

Certain features of the deposit also preclude the idea that it has originated as beech sands or as river bars.

The deposit shows no characters which would lead us to suppose that it had originated as a submarine deposit.

The magnetite may have been produced through the metamorphism of limonite beds, although the form which the layer of sulphuretted ore takes in the deposit does not seem to point to this mode of origin. The sulphur layer is in a direction transverse to the dip of the deposit, while if the deposit had originated from the alteration of limonite, we would expect this layer to lie in the direction of the dip.

I have not met with any description of bodies of ore of this nature which contain sulphuretted bands in this form. An interesting paper is, however, to be found in the Transactions of the American Institute of Mining Engineers, Vol. XVII., by D. H. Browne, on the "Distribution of Phosphorous at the Luddington Mine." In this paper the author shows that the bands of bessemer and non-bessemer ore alternate and that they lie in the direction of the dip of the rocks.

From some characters of the hornblende rock on the lower side of the Glendower deposit, it seems possible that the ore may have been derived from this rock by a process of leaching or segregation in solution. In grinding down a thin section of the rock for the microscope I found it impossible to get a perfectly smooth and polished surface. The surface was filled with little pits or cavities as if some component of the rock had been dissolved out. Another character which makes it appear as if the iron may have been dissolved out of it is the comparative absence of oxides of this metal scattered through it, although we should expect these to be present, as they are universally found in rocks which are as basic as this one. The components of the rock are essentially hornblende and quartz, with a considerable amount of calcite. Large pieces of hornblende are found scattered through the ore, a fact which seems to point to the presence of hornblende in the source from which the iron was derived. The presence of so much calcite in the section shows that this component has been derived from some source outside of the rock itself and has replaced other constituents.

The ore, if we accept the view that it has been formed by segregation in solution, was formed in a line of weakness between the limestone on one side and the hornblende rock on the other and the iron was dissolved out of the latter by water, more or less heated, percolating through it. Along the line of weakness there would be more chance for the matter carried in solution to become oxidized and the result would be more chance for the matter carried in solution to become oxidized and the result would be that the iron which had been dissolved out and put into solution by carbonic acid or other acids or alkalis, to become oxidized and precipitated in the opening and take the place, to a certain extent, of the calcium carbonate which would be dissolved in its place. This latter material would be carried through by the percolating water and deposited, on the solution becoming concentrated, in the adjoining rocks, where there was little or no oxidation taking place. Thus it is that we find the hornblende rock filled with granules of this secondary calcite.

It seems to me, taking all the character of the ore body into consideration, that the magnetite has originated by this process of segregation from the adjoining rock, although the question needs more careful study than I have been able to give it. This theory will account for the position of the sulphuretted band. A microscopic examination of the rocks on either side of the deposit would, I believe, in connection with the other characters of the deposit, solve the problem effectually.

It has been held by most authorities that the magnetite deposits in our Archæan rocks have had a sedimentary origin and have been formed at the same time as the metamorphic rocks which enclose them. J. D. Dana has summed up the opinion of these authorities in the following words: "Geologists who have studied the widest range of Archæan iron regions—believing that they are alike in mode of origin—have reached the general conclusion that the ore and schists of all are conformable in bedding, and hence they are metamorphic sedimentary deposits."

However, we have a means now, in the petrographical microscope, of examining into these questions more deeply than our predecessors, and it is likely that more light will be thrown on the problem. The Winchells, as late as 1890, claimed, as I mentioned, that some of the iron ores of Minnesota had originated as submarine precipitate, but Spurr, on making a microscopic examination of the ore and their enclosing rocks, during last summer, proved that the ore has been formed by a leaching out of the iron from beds of glauconite.

Since it is likely that many owners of mining locations in Ontario will make use of the diamond drill, which has been so liberally placed at their service by the Government, to test their properties, it may be well to mention an important paper, on diamond drilling, which is published in the Proceedings of the Lake Superior Institute of Mining Engineers, for 1893, by J. Parke Channing. Most people seem to think that diamond drill holes must be straight, but this writer, from careful experiment and observation, has proved that in many cases they have a considerable curvature and that the direction which the drill tends to take is towards the horizontal. Mr. Channing has, as yet, not been able to determine whether there is a side curvature as well as the upward one. His paper is well worthy a careful perusal by anyone interested in drilling, and knowing the results which he has arrived at, much trouble and uncertainty will often be saved. He determined the amount of the curvature by letting down small glass tubes, which were partly filled with hydrofluoric acid, to different depths in the holes. At the end of about two hours the tubes were pulled up and the etching produced on them by the acid showed the direction which the holes took at the points where the tubes had rested.

The Silver Mines of Thunder Bay.

By Mr. Peter McKellar, F. G. S. A., Fort William, Ont.

A few years ago the Silver mines of Thunder Bay were in active operation and much mining development was in progress—now all are closed down. The depression in the value of silver—the advent of the new Mining Law—and about the same time, a number of the prominent mines had penetrated down into the silicious or poor bearing stratum of the Animikie rocks—these causes combined, resulted in the complete closing down of all the mines. Of course, in time, some of them will be reopened, not all, as many mines were started without a showing to justify it, as is generally the case in all mining districts. Other new discoveries will undoubtedly be made here, as there are lots of unexplored areas under cover of drifts and alluvial deposits etc.

It was known to geologists and mining men for many years, that the veins were richer in silver within the argillaceous stratum than within the underlying silicious stratum; but few of the mining men had much knowledge of the thickness of either, and were often disappointed in their mining operations on this account. As this characteristic is becoming better understood, many of the misdirected efforts of the past may in future be avoided. At Thunder Bay the Animikie group of rocks covers an area of more than a thousand square miles. It consists principally of slaty beds, argillaceous and silicious, lying nearly horizontally upon the denuded upturned edges of the highly inclined Archean strata, which in this locality undoubtedly are largely Huronion schists. The thickness of the Animikie formation along the run of the western belt of silver mines, or from Silver Harbor to Gun Flint Lake, 80 to 90 miles, will probably average 600 to 1000 feet; but out towards the coast line it will be much thicker. The silicious or lower stratum, the lower silicious division of Mr. Ingall, is at the base of the Animikie rocks and is about 400 feet thick at the Duncan Mine, and nearly 700 at the Beaver Mine. It is not likely to exceed the latter thickness much anywhere along the northern silver belt. The carbonaceous clay slaty stratum that overlies the silicious stratum, shows a thickness of about 300 feet; but along the northern silver belt, it has been partly or wholly removed by erosion and denudation in places; and in others it is covered with a bed or sheet of trap which, again to the southward, is overlaid with slaty beds higher in the formation. In the mines along this belt, all the rich deposits of silver were found in the veins within this argillaceous stratum, which in the southward direction dips under higher beds of the formation. It remains to be proven whether or not the argillaceous beds of the higher horizons have the same favorable influence on the deposition of the silver within them, as the lower stratum has. From the past showing it would appear not, as in the great central belt, some ten miles or more in width, which lies immediately to the southward of the northern silver belt, no rich silver lodes have yet been found like the mines on the western silver belt. This apparent barreness of the central belt may be accounted for, 1st. That the lower argillaceous stratum is the real silver bearing startum of the formation, in which case the veins here would have to be mined down through the overlying beds to reach the silver bearing stratum; 2nd. The western silver belt seems to lie along a line of weakness, where there are many fissure veins, while along the central belt the veins are comparatively few and may not penetrate down to the metalliferous reservoir to which I will refer further on. I consider the search for the causes that produced these silver bearing veins a matter of much importance, that is, to try and find out if the silver in the veins is due to lateral segregation, or if it ascended in the fissures from a deep source, to be deposited subject to the laws of attraction or to

the influences of the adjacent rocks. If the infilling is by lateral segregation, it seems to me clear, that in the Animikie group the veins need only be worked down to the lower silicious division, for the underlying Archean strata are exposed in extensive areas, here and there, throughout the Algoma district. They show to be auriferous in many places; yet, they do not show to be argentiferous in this respect anywhere, I believe, excepting in the vicinity of the great Lake Superior trough, as at the Gopher and Star mines, Whitefish River, north of Whitefish Lake; the 3 A. mine north of Silver Harbor, Thunder Bay; Syrette location east of Nipigon Bay; the locations at the mouth of the Steel River; and the Little Pic silver mines, west of the Little Pic river. These are all in the Archean strata and carry silver ore similar to that of the Animikie veins, and in the case of the 3 A. and Gopher mines, rich ores. If the infilling is from below, we may look for these veins to prove valuable for mining to great depths, as the 3 A mine, and Gopher etc. prove that some of the Archean strata at least, have the influence to cause the precipitation of silver in fissures within them, when present in solution, as well as the argillaceous slates of the Animikie have. The gaeater showing of silver in the Animikie veins than in the Archean, may be on account of the Animikie area occupying the more favourable position in relation to the metalliferous reservoir below.

There is no doubt, the Thunder Bay silver veins are true fissures, as shown by the faulting of the walls. The Silver Mountain vein shows a fault of 60 to 70 feet; the Beaver vein, 15 feet; the Rabbit Mountain much greater; the Duncan mine vein 120 feet, etc.; so that the fissures must penetrate to a great depth. It seems certain that the copper and silver of the native copper mines of Lake Superior, were ejected from great depths with the fluid rocks of the Keweenawan group, and also that the fissures of the silver veins here, resulted from the subsidence in cooling of these great eruptions, and subsequent to the flow of the fluid rocks. The previous fissures formed were filled with fluid rock and show now as trap dykes in great numbers, especially along and near the coast. It is highly probable that those fissures cut down to the great reservoir from which the eruptive rocks of the Keweenawan were ejected, heated vapours, steam and aqueous solutions would ascend in the fissures, and carry metals and minerals along; and continue the ascension and precipitation of the solution subject to the influences of the adjacent rocks until the fissures were filled as we find them. In the event of the argillaceous beds having a greater influence in depositing the silver, than the interstratified silicious beds that the Animikie have, the veins within the former should show richer in silver than within the latter, as we find them. So also with the underlying Archean strata it is quite probable that the veins will be rich in silver within some of them and poor within others in a similar way.

The middle of the Lake Superior trough, the portion opposite Thunder Bay, appears to have been the most metalliferous part of the great reservoir for all the great copper mines are here on the one side and the silver mines on the other. Although the rock formations continue westward for 200 miles or more, the rich mines do not show excepting around the middle portion of the trough.

There are two series of fissure veins here; those of the one the most numerous vein nearly east and west, about parallel with the great trough; those of the other, cross and are prominently developed along the outer coast line, and rarely penetrate far inland. The position of the latter series near the middle of the trough, might be expected to prove richer than the other series of veins. The Silver Islet vein is one of them, and is certainly the richest one known thus far.

If it can be proven satisfactorily that these veins carry the silver in the underlying Archean strata, this locality is likely to prove a valuable deep mining district. I consider it quite probable that it will do so, in view of the natural conditions that bear on the matter, some of which I have in this paper endeavored to show.

In conclusion I may say in regard to the processes of lateral segregation and infilling of veins from below, that these are well known theories. The statement of minerai veins in the Encyclopedia Britannica remarks, "But that this mineral matter came chiefly from below appears almost certain."

Gold in Ontario and its Associated Rocks and Minerals.

By Dr. A. P. Coleman, Toronto.

Since the discovery of the Richardson mine in the township of Madoc, in 1866, gold has been found at hundreds of points in Ontario, from the Madoc region in the east to the Lake of the Woods in the extreme west. In this distance of 900 miles there is nowhere a gap of more than about 100 miles between known gold deposits, except in the little explored region north east of Lake Superior, where gold has not been discovered for a stretch of 175 miles. It will be convenient to speak of three gold regions in the province, a south-eastern one in Hastings county, a central one reaching from Wahnapitae to the Sault, and a western one extending from Lake Shebandowan to the Lake of the Woods. A few isolated discoveries lie outside these areas, and it may be that future finds will connect the three gold regions into a single one including the whole Archaean portion of Ontario.

Unlike most gold regions, Ontario has no placer deposits, a consequence of intense glacial action which has swept away all gold bearing sands and gravels and so mixed them with barren materials in the immense beds of drift found in the southern portions of the region as to make placer mining hopeless. It is said that colors of gold may be washed from the sands of Toronto Island, and probably traces of placer gold could be obtained at many other points by perseverance in panning, but nowhere in paying quantities. In this respect Ontario resembles Nova Scotia and differs from Quebec with its Chaudiere placers, and still more from British Columbia.

Another important result of ice action has been the more or less complete removal of weathered products from the surface of veins, so that the sulphides which regularly accompany gold bearing quartz in all parts of the world below water level are here found as a rule only a short distance beneath the surface; implying that no large amount of thoroughly free milling oxidized ore can be obtained from our mines, and that the more refractory sulphide ores must be treated from the very first. The points just mentioned account largely for the slow advance of gold mining in the province.

The gold from our mines is unusually pure, resembling in this respect the gold o Nova Scotia rather than that of British Columbia. Assayers notice that Ontario gold ores, when free from galena or copper pyrites, yield buttons with little more silver than is accounted for as coming from the litharge or test lead employed in the assay. Probably the proportion of silver is generally less than five per cent., though exceptions occur to this rule. Dr. Lawson states that in some gold ores from the Lake of the Woods "silver occurs in the auriferous quartz veins, generally as an accessory mineral, in small quantities, but sometimes, as the assays of the Pine Portage mine show, in greater proportion by weight than the gold."*

Our gold appears in the usual forms as nuggets, scales, etc., and never, so far as I have observed, in crystals, though crystals of gold have been reported from the interesting new region of Wahnapitae. Specimens from that lake in the museum of the School of Practical Science, Toronto, show smooth planes, but apparently only an impress from adjoining quartz crystals.

Of the minerals associated with gold quartz is by far the most constant, so that miners and explorers are apt to call every gold ore, no matter what its composition, quartz; if, indeed, they do not refer to it as a "quart," with the idea that a single specimen should be spoken of in the singular, not in the plural. The gangue quartz of Ontario gold ores varies greatly in character. Often as found at the surface it is rusty and porus, "good looking rock," while a short distance below it contains sulphides and is quite different in appearance. The quartz may take on crystal form and be more or less clear and transparent, as in some specimens from Wahnapitae, or it may be massive or bluish-gray, as in the ore from the Ophir mine in Galbraith township, or the Sultana mine near Rat Portage. Some of the latter quartz, which is distinctly schistose and has a crypto-crystalline appearance with thin bands of chlorite or hornblende running through it here and there, might properly be described as quartzite. In other regions the quartz is apt to be fine grained and milky or dull white, as at the Partridge mine near the Atikokan, or the Ledyard mine in Belmont. From the latter locality come some beautiful specimens of white cellular quartz with specks of gold disseminated over the walls of the cells. In the same quartz Mr. McAree has observed small red jaspery concretions.* Sometimes the quartz is stained to a pale red with films of hematite, as at the Ray-Wiegand mine on the Seine river, or green with malachite, as in the McGowan mine near Parry Sound.

In texture, then, the quartz may form crystals or coarse or fine grained crystalline masses, or it may be cryptocrystalline and compact. Its color may vary from pure white to greenish black, or it may be stained red or brown or green with iron or copper compounds. It may be almost transparent, or only translucent or quite opaque. It may be true vein quartz or a schistose quartzite. A few other oxides occur in our gold ores, especially the brown hydrous and the red anhydrous oxides of iron in weathered surface ore. Vennor states that gold has been found embedded in the third oxide of iron, magnetite, in the Madoc and Marmora district, and that Prof. Bell of Albert College, Belleville, found oxide of tin in a specimen of ore from the same district.† A similar association has been observed at the Vermillon mine in the Sudbury region, where small amounts of cassilerite occur.

Sulphides of one kind or another are almost universal accompaniments of ores of gold that have not been subjected to weathering, the most prominent, of course, being iron pyrites, whose brassy gleam may be seen in most of our gold ores. It displays the usual crystal forms, cubes with striated planes or pentagonal dodecahedra. Crystals almost an inch in diameter are sometimes found in the Belmont ores. The common occurrence of pyrite with gold is no doubt accounted for by the mode of transport and deposit of the metal, sulphate of iron having the power to dissolve small quantities of the metal. Any reducing agent, such as organic matter, destroys the solvent by forming sulphide of iron, the gold being deposited at the same time This theory satisfactorily accounts for the particles of gold o ten found embedded in the pyrite. If the particles are above a certain size they are more or less completely liberated by crushing and may be saved by amalgamation. Such sulphide ores are partially or wholly free milling. If the particles are very minute many of them will not be set free by simple crushing, and the ore is refractory. It is worthy of note that some of our ores which have been looked on as highly refractory, so that thousands of dollars have been spent on chlorination or other plants with which to treat them, have turned out to be almost completely free milling. An excellent example of this is to be found in the Sultana mine, from whose sulphide ores 92½ per cent. of the gold is extracted in the stamp mill, and the small quantity of concentrates obtained hardly pays for treatment.

In the Sultana ore one frequently sees specks of gold embedded in the quartz entirely apart from the iron pyrites. It is clear that this gold cannot have been deposited in the way suggested above. Perhaps this and the nuggets sometimes found in pure white quartz at the neighboring Ophir mine have been carried in the form of a gold silicate, as suggested by Bischoff and other writers.

The cellular white quartz from Belmont doubtless once had its cavities filled with pyrite crystals like those now found below the level of weathering. The sulphide has been oxidized into sulphate and leached out, one stage of the process being perhaps the formation of hydrous sesquioxide of iron and of siderite.

I am not aware that the marcesite variety of iron pyrites has been found in our gold ores, but pyrrhotite, the lower sulphite, is not infrequent in the Lake of the Woods region.

Small amounts of copper pyrites are often found accompanying the iron pyrites in our gold quartz, sometimes largely replacing it, as at Oliver Daunais' Wabigoon mine. The other copper sulphides, bornite or peacock ore, and chalcocite or copper glance, are much less common. In one very interesting deposit found last spring near Parry Sound these two minerals occur in large quantities in the quartz, far outweighing all the other sulphides, and small nuggets of gold may be enclosed in them or lie between the copper ore and the quartz. An assay of some of this bornite free from visible gold gave ½ ounce per ton, with a very small per centage of silver.

Mr. Coste in his report on the Lake of the Woods region mentions the somewhat rare sulphide of copper, covellite, as occurring with iron and copper pyrites, bornite and other sulphides in the gold ores from that part of Ontario.‡

The only other sulphides which I have observed or seen mentioned in connection with our gold ores are galena and zincblende. The former is often found at the Lake of the Woods and Rainy Lake and is there considered a favorable sign, since it is generally associated with free gold. The cause of this relationship is not easy to understand, for the galena itself does not usually carry any important amount of gold. Zinc blende is found in small quantities in mines near Port Arthur and Marmora, but seems to have little influence on the gold contents of the ore. The sulphides of iron and copper seem much more efficient as gold bearers than those of the other metals.

The only compounds of arsenic or antimony found in our gold veins are mispickel and tetrahedrite. The latter mineral has been reported from only one locality, so far as I am aware, the Empire mine in Madoc, where Vennor found it forming small gold-bearing veins with calcite, magnesite and quartz in dolomite.§ Mispickel, on the other hand, is rather widely spread in the gold deposits of the Province, being found in small quantities in ores from the Lake of the Woods, and in immense amounts at the Gatling and other mines near Delora in Marmora. The mispickel of Delora occurs sometimes as very pretty roseate-like twinned forms or as crystals of prismatic habit, but more commonly in fine or coarse-grained masses. According to Prof. Chapman, ‖ it averages from one or two to seven or eight ounces per ton of gold, and the value of the ore is considerably increased by the large amount of arsenic it contains; but the ore proved so refractory that the expenditure of hundreds of thousands of dollars in elaborate reduction works resulted only in failure.

A quite similar ore was worked, apparently at a profit, many years ago at Goldberg in Silesia, where the arsenic was made a valuable part of the output. It is prob-

* Geol. Sur. Canada, 1885, p. 142, C. C.

*Papers of Engineering Society, S. P. S., p. 26, etc.
†Geol. Sur., Can, 1871-2, p. 131.
‡Geol. Sur. Can., 1866-69.
§Geol. Sur., Can., 1866-69.
‖Minerals and Geology of Central Canada, p. 307.

able that improvements in method may yet cause these mines to be valuable. In considering the province as a whole one should remember that arsenic in amounts sufficient to make the ore very refractory is confined to this narrow belt of territory. The Belmont mines, a few miles away, show no trace of mispickel.

Tellurium occurs apparently in only one locality in the province, in the sylvanite of the once famous Huronian mine west of Port Arthur.

The other minerals associated with gold in the province are not specially important. Free gold may sometimes be found in the silicates forming the wall of veins. A pretty specimen from Wahnapitae, now in the museum of the School of Practical Science, Toronto, contains several small nuggets completely enclosed in green chlorite. Vennor refers to occurence of gold in dolomite and calc-spar;* and describes the wonderfully rich cavity of the Richard-on mine in Madoc, where the first gold was discovered in Ontario. The gold was here found in a "reddish brown ferruginous earth in which were scattered fragments of a black carbonaceous matter, the latter showing when broken, small flakes and scales of the metal."† Specimens of free gold from Marmora, in the School of Science collection, are associated with a somewhat weathered siderite. Probably some of the rusty quartz with free gold from this and other parts of the province, results from the decay of siderite or other carbonates rich in iron rather than from the weathering of sulphides.

Turning now to the rocks in which the gold deposits of the province occur we find that they are all very ancient, most of them Archaean. The south-eastern region, that of Marmora, Madoc, Belmont and other townships, is probably the most ancient, belonging to what Vennor calls the Hastings series, believed by him to be the equivalent of the lower Grenville series of Logan, *i.e.*, to the lower portion of the upper division of the Laurentian. It is possible, however, that these rocks are really a small area of greatly modified Huronian. The remarkable gold bearing deposit of Parry Sound is probably of the same age. All the other important gold districts are Huronian, if we assume that Lawson's Keewatin is in reality of that age.

Dr Chapman, however, has obtained gold from a vein in Keweenian rocks at the Enterprise mine on Black Bay, Lake Superior; and gold has been found in the Animikie, north and east of Port Arthur,‡ showing that the precious metal does occur in rocks younger than Huronian, probably lower Cambrian.

Lithologically, the rocks in which gold has been found in Ontario, vary greatly. Vennor describes the famous Richardson mine as occurring at the contact of a "chloritic and epidotic gneiss with a silicious ferruginous dolomite." It was in a cavity at this contact that the thousands of dollars worth of rusty earth thickly spangled with flakes of gold were found, which roused a gold fever the like of which has never been experienced since in the staid province of Ontario. In several other parts of the Hastings series Vennor finds gold in veins running through dolomite, in silicious dolomite or at the contact of mica slate and dolomite. With the dolomites are mentioned various schistose rocks, talcose, micaceous, chloritic and hornblendic. So far as mining experience goes in Hastings, the deposits in connection with dolomites are merely pockets, sometimes rich, but quickly exhausted. Vennor believed that the gold of the region is in close association with the summit of an iron bearing band.

The only specimens of country rock from the region which I have examined, are from the Belmont mine. The specimens, which are greatly weathered, consist of diorite, perhaps originally diabase, and chloritic schist. The latter contains a large amount, almost 50 per cent., of a carbonate, calcite or dolomite. Mr. McAree, who examined the country rock of the Crawford mine in the laboratory of the School of Science, found it to be weathered diorite, with chloritic schist in the walls.§

The gold of the McGowan mine, Parry Sound, is found in a bedded vein resting on a dark diorite-schist and covered with a mica-diorite schist. A few feet above this a bed of dark grey rock turns out to be a gabbro. Mingled with the quartz is a rock consisting of quartz, muscovite, garnet and a little augite, a combination hard to name. Not far off one finds dykes of very coarse grained pegmatite and a large extent of gneiss, while a bed of impure crystalline limestone occurs a mile to the west. It is somewhat doubtful if this association of rocks should be placed with Vennor's Hastings series, but it differs decidedly from the typical Huronian and from Lawson's Keewatin. As this is a new locality the rocks have been mentioned in some detail.

Passing to the central gold region, the rocks containing the gold deposits about Lake Wahnapitae have, so far as I am aware, never been carefully examined, though Bell maps them as Huronian with eruptive masses of diabase and diorite, the Huronian being defined as consisting of a variety of crystalline schists and stratified clastics, such as greywacke.

The country rock of the Vermilion mine is Huronian, but of just what character I am not aware.

A specimen of the country rock of the Ophir mine in Galbraith Township, submitted to me by Mr. Blue, Director of the Bureau of Mines, though greatly weathered, is pretty certainly a diorite.

Going still farther west we find some gold-bearing veins in the dark Animikie slates, north and west of Port Arthur. No doubt the eruptions of fine grained diabase which traversed these rocks and covered them with widespread beds of lava have had a great influence on the formation and filling of the gold veins, as well as those of silver, in the region.

The Huronian mine, unique in Ontario as containing the rare mineral sylvanite, doubtless occurs, as its name suggests, in the Huronian, but I have not seen any detailed description of the enclosing rocks.

We now come to one of the most recent gold regions of Ontario, that of the Seine River and Rainy Lake, where fortunately the geology has been, in many parts, quite carefully worked out by Lawson and his assistants and successors. Lawson's excellent map shows rounded areas of Laurentian gneiss, granite or syenite enclosed in wide meshes of Conchiching gneiss or mica schist, underlying the Keewatin schists, probably of Huronian age. Up to the present gold has not been found, so far as I am aware, except in or near the latter group, which consists of a complicated series of schistose, massive and fragmental rocks. The schists are either basic in character and of some green shade of color, or acid and yellowish or brown. The green schists are probably of volcanic origin and are mixed up with massive fine grained diabase, the latter being probably solidified lavas, while the schists represent ash beds. The green schists are sometimes soft and chloritic, at other times hard and hornblendic. The acid series of rocks represents, according to Lawson, a later series of volcanic products resembling quartz, porphyry and related rocks originally, but now turned by metamorphic action into schistose, felsites, etc. Besides the rocks mentioned, distinctly fragmental rocks, such as graywackes and even schist conglomerates occur in large amounts. Of these rocks the softer green schists naturally appear the most promising, and many gold bearing veins have been located in them, almost always of the bedded variety. Examples of this are found in the well known Little American mine, where a series of lens shaped quartz veins dip steeply (82°-85°) to the south, between layers of chloritic and hornblendic schist. Free gold has however been found also in bedded veins in schist apparently of the felsitic or acid type, as in the series of locations north of Wild Potato Lake, an expansion of the River Seine. The most talked of claims of all in this region, the Ray-Wiegand property and adjoining ones, which are now being developed, show free gold at many points and assay well, but are of a totally different character. They are distinctly fissure veins, with sharply defined walls, crossing the general trend of the schists of the region. These veins are not in the schists, but in a peculiar quartzose granite, not very far from the contact with the Keewatin schists. Some other bosses of granite, and also of a very coarse grained gabbro, or perhaps anorthosite, since the white felspar greatly predominates, lie just to the west on Bad Vermillion Lake.

The rocks of the Manitou region to the north are of the same general character, but have not yet been mapped.

On a claim owned by LaCourse, a pockety vein which has provided a great number of handsome specimens, lies in a gneissoid rock that looks very different from the ordinary Keewatin, and may be Conchiching, but I wish to examine thin sections of the specimens taken before speaking positively. Another claim which is now being developed at the north end of the lake, shows bedded veins of quartz with visible gold in Keewatin graywacke.

The massive diabases of the Rainy Lake and Manitou contain few quartz veins, and these are apparently not auriferous.

The most westerly gold field of Ontario, that of the Lake of the Woods, has been before the public for a number of years and is fairly well known as compared with the territory just to the east.

The Sultana mine, which produces its brick of gold with great regularity, works a bedded vein in green and gray chloritic and hornblendic schist. On the same island or point we find a vein striking in a quite different direction and enclosed in a somewhat coarse syenitic gneiss. This is the Ophir mine, which has produced such wonderfully rich specimens of free gold.

The Bad mine, near Rossland, which also provides specimens rich in free gold, is on a quartz vein lying upon gray syenitic gneiss and having a few feet of fine grained flesh-colored gneiss or granite just above, followed by the syenitic gneiss again.

Other mines in the same vicinity have been sunk upon bedded veins in green schists of the usual Keewatin type, but nowhere far away from the syenitic gneiss.

In summing up the results of this very brief survey of a very wide field, one may say that the gold of Ontario is generally alloyed with only a small percentage of silver, and is usually found, as in most other regions, in quartz containing iron pyrites or other sulphides, or the oxides resulting from their decomposition. Much of it is free milling, and very refractory ores, such as tellurides or arsenic compounds, occur in only two localities. In the western part of the province the presence of galena or copper pyrites is believed to indicate rich ore.

In the majority of cases the gold-bearing veins are of a bedded character, especially those in highly schistose rock. In the eastern part of the province the enclosing rocks are rarely more or less pure dolomites, but are often diorites, diabases or gabbros, or schistose modifications of these rocks, and belong probably to the upper Laurentian. In the western region the chief country rock is the green Keewatin schist of the Huronian, rarely the brownish felsitic variety, and in these rocks the veins are bedded. Gold-bearing veins in this region occur chiefly near the contact of the schists with granite or syenitic gneiss. At a few points true fissure veins with much free gold occur in the granite or syenitic gneiss, but, so far as known, close to the contact with the green schists.

*Geol. Sur., Can., 1866-69, p. 167.
†Ibid, p. 165.
‡Min. and Geol. Central Canada, p. 301, etc.
§Papers of Eng. Soc., S.P.S., p. 26, etc.

Diabase Dykes in the Sudbury Mining Region.

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

(Continued from Page 25.)

	I.	II.	III.
	Per Cent.	Per Cent.	Per Cent.
$S_1 O_2$	47·22	49·88	51·22
Al_2O_3	16·52	18·55	14·06
$Fe_2 O_3$	3·32	2·06	4·32
Fe O	12·40	8·37	8·73
Mn O	·04	·09	·16
Ca O	9·61	9·70	8·33
Mg O	3·33	5·77	4·42
$K_2 O$	·67	·68	1·25
$Na_2 O$	3·40	2·59	2·55
$H_2 O$	·30	1·04	1·28
$C O_2$	....	....	·19
$Ti O_2$	3·62	1·19	2·42
$P_2 O_5$	·33	·16	·25
$Fe S_2$	....	....	·49
Ba O	·01	·02	....
$N_2 O$	·0275	....	....
Co O	·0055	....	....
Cu O	Trace	....	....
Total	100·803	100·10	99·67
Spec. Grav.	3·01	2.97	2·98

The proportion of ferrous oxide is much higher than usual, as is also the titanic acid. This latter doubtless occurs partly in the ilmenite and magnetite, and partly in the augite, giving it its characteristic violet color. The small amount of oxide of barium was found by working with a large quantity. Mr. Hildebrande (6) has recently shewn that the occurrence of this element in rocks is much commoner than formerly supposed. About eighty grams of the rock powder was fused with an arsenical flux and the resulting arsenide buttons were treated for copper, nickel, and cobalt. In this way the quantities of cobalt and nickel could be easily separated and weighed. It has long been known that nickel is a frequent constituent of the heavy ferro-magnesian minerals, especially of pyroxene and olivine, and it is quite probable that in this case the nickel, cobalt and copper occur in these minerals. Whether these metals were primary constituents of the magma or not, it would be difficult to say. They may be derived from the nickel-bearing greenstones, as the diabase dykes cut through them and possibly through some of the nickel deposits associated with the greenstones. It is easier to regard the original diabase magma as containing the heavy metals. No nickel deposits have been found associated with the dykes.

The quantity of nickel contained in this rock may seem to be only trifling, but there is more nickel in one of these dykes than in the best nickel mine in the Sudbury region. Take the dyke which crosses the railway between Sudbury and Murray mines. This dyke has been traced for three miles, though it is probably much longer, and is at places 150 feet wide. It contains enough nickel to form a band of 2 per cent. nickel ore over two feet wide and as long as the dyke. If it were all concentrated in one mass, the deposit of 2 per cent. ore would be forty-eight feet wide and one-eighth of a mile long. The deposit would have the same depth as the dyke. This would yield 10,560 tons of 2 per cent. ore for every foot in depth, or 1,056,000 tons for the first hundred feet in depth. This would represent 21,120 tons of metallic nickel, or enough to supply the market for ten years. This is for only one dyke, counting only three miles as its length. But this low percentage of nickel is of no value whatever. Nature has not concentrated the nickel here as she did in the greenstone areas. Had the diabase cooled more slowly and contained a considerable quantity of sulphur, then the nickel contents of this rock would doubtless have concentrated in lenticular masses along the wall, so as to be available for mining purposes. These conditions were present, however, in the case of the nickel-bearing greenstones, and consequently we have large masses of nickel ore.

A Few Notes on Merchantable Mica in the Laurentian.

By Wm. Hamilton Merritt, F. G. S., Assoc. R. S. M. S., &c.

Mica mining may properly be said to be in its infancy, and until quite recently had nowhere arrived at the dignity of mining, the operation consisting for the most part in making irregular surface pits where mica crystals were discovered at the surface.

This condition was chiefly due to the fact that the consumption of the mineral was very small. Electricity has, however, brought about a much larger demand for mica, and it is expected that mica-mining will assume considerable importance in the near future.

Last year, up to Dec. 1st, $26,257 is given by the Customs Department as the value of shipments to the United States and Europe—chiefly the former.

During the past summer I had occasion to visit some of the mica deposits in the Kingston district in Ontario, and near Ottawa and in the Saguenay district in the Province of Quebec.

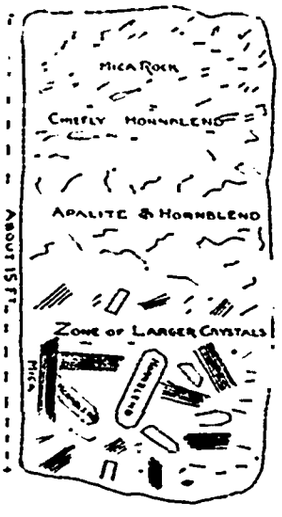


Fig. I.—Section of Smith and Lacey Mine, Sydenham, Ont.

It has occurred to me that it might possibly prove of interest to record a few notes on the occurrence of some of the deposits, for I think it is a subject well worthy of investigation, and all the information relating to it should be collected by our Institute. In fact I do not know of any economic mineral substance in which there is a larger field for investigation than that of mica deposits.

Dr. R. W. Ells has given a very interesting and valuable communication on "Mica Deposits in the Laurentian of the Ottawa District" to the Geological Society of America. He gives six principal modes of occurrence for mica in that district.

It may be open to question whether a specific number of conditions can properly be laid down at present. Without doubt the deposits examined by Dr. Ells occurred as he described, but it may be possible that he would have expanded the number of conditions if more deposits had come under his attention. With reference to my own general observations, I may say that, as you probably all know, and as explained by the title of my paper, the mica bearing formations of eastern Canada occur in the Laurentian.

Nearly all of these old crystalline rocks carry more or less mica, but only in certain belts, and in limited areas in these belts is mica found in large enough crystals to be of commercial value.

The mica occurrs in two classes of rocks:

1. In granite—the mica being associated with quartz and felspar, and generally present as muscovite, or white mica. Other minerals, such as tourmaline, garnet, phosphate and common emerald, are very often found in a crystalline form associated with this class of deposit.

It is evidently where the crystallization of the rocks has been slowest that we find the merchantable mica, for the other components of the rock accompanying it are also more or less equally well developed, and we not only find larger crystals of mica, but the crystals of the other minerals composing the rock are of a correspondingly increased size. It is therefore advisable to note the general crystalline character of the rock masses where mica crystals appear at the surface and mining operations are contemplated.

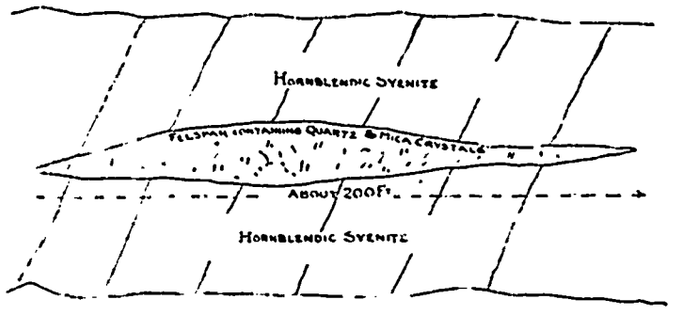


Fig. II.—Lenticular Mass or Vein of Feldspar with Mica Crystals, Murray Bay Mine, Que.

2. Associated with hornblendic or pyroxenic rocks—chiefly hornblendic syenite, often gneissic, but in cases graduating from a pyroxenic syenite to a diorite or gabbro. In this latter class of deposit the mica is either found associated with hornblende or pyroxene and apatite, or in veins or irregular masses of calc-spar or felspar (with more or less quartz) cutting hornblendic or pyroxenic syenite. The mica is chiefly phlogopite or amber mica, and sometimes biolite or black mica is found.

It is remarked that where the hornblende contains a larger quantity of iron (typical black hornlende) the mica is darker, and when the mica is associated with the lighter colored actinolite it is found to be amber colored or almost white.

Working of Mica—Before proceeding to illustrate the above mentioned general classification of deposits by a few examples, I shall give a note or two about the working of mica.

It may correctly be inferred from the above remarks that the occurrence of the larger (or merchantable) crystals, is somewhat irregular and precarious, and such is found to be the case. Indeed, in most formations the crystals are much twisted, broken by joints, with embedded crystals of quartz or calcspar in them, and sometimes spotted with iron or manganese stain, or minute crystals of tourmaline or magnetite.

It is perhaps more difficult to put a price upon the cost of mining mica than upon any other mineral, though it be conceded that all mineral occurrences vary greatly in the cost of their yield.

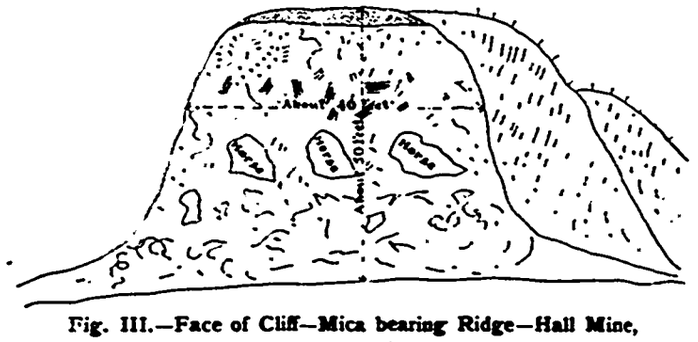


Fig. III.—Face of Cliff—Mica bearing Ridge—Hall Mine, Saguenay District, Que.

Mica mining being quite in its infancy, the most economical manner of attacking and mining the mica remains yet to be determined. It will, however, probably be in the direction of cheapening the excavation of the rock containing it, by operating on a large scale where the formation warrants it. Most of the mining has been done up to the present in Canada by merely making pits where crystals were formed of any size.

When the mica is associated with apatite, as is very often the case, that mineral yields a good price, and the felspar, which is in other cases largely developed in association with the mica, has been exported, but the extensive use of this mineral at remunerative prices to the producer, remains for further developments.

From instances observed, it may be said that in exceptionally favourable cases 20 tons of rock may yield a ton of merchantable uncut mica, and it in turn gives a very good result if from 4 to 10 tons yield one ton of cut mica. In one case in a yield of 23 per cent. of cut mica, 7 per cent. was No. 1, and 16 per cent. was No. 2. Sizes running from 6in. x 7in. down to 1½in. x 2½in., the smaller sizes being much the most numerous.

It is a somewhat strange coincidence that 23 per cent. is the exact yield of a well known Indian mine, as given in a very interesting article on Indian mica in The Canadian Mining Review.

(6) Journal Am. Chem. Soc., Feb. 1894.

One deposit yielded from 1½ to 7 tons a week of uncut mica, for six men employed.

The cost of getting the rock carrying the mica may vary from 50 cents to $2 per ton, and almost any shot in most mica deposits may bring an altered condition for the time being.

The cutting of the mica may be said to cost from $50 to $100 per ton of cut mica produced, depending upon the size and quality of the mica crystals.

The resulting cut mica furnishing a varying quantity of first or second class mica, and the price obtained for the product increases immensely in proportion to the sizes of the sheets, and whether the mica is pure white or dark amber color.

There are a variety of uses for the waste mica produced in the cutting, and the demand for this is constantly increasing, but the enormous quantity of defective crystals produced in mining may be said to be of no value.

The following are examples of the occurrence of mica:—

1. In Bedford Tp. Frontenac Co., Ontario—Mica crystals are associated with apatite in a hornblendic belt, occurring in a syenitic gneiss. Mica dark amber-colored phlogopite.

2. In same locality as No. 1—(*a*) Mica is largely developed in a light colored gneissic syenite band, varying from compact to highly crystalline, and where the large crystals are developed it has been mined in connection with phosphate, which occurs with it.

(*b*) At one place the formation is cut with a distinct calc-spar vein, 5 to 8 ft. wide, and large mica crystals occur in this with light colored hornblend masses. The mica is light amber-colored phlogopite.

3. In Loughborough Tp. Frontenac County, Ont.—A strong belt of a quartz syenite carries mica crystals. Largely crystalline quartz and felspar, with patches of light colored hornblend, contains mica crystals chiefly associated with the latter mineral. The mica is light amber-colored phlogopite.

4. In same Tp. and County as last—A belt of quartz syenite in large crystals carries mica. The quartz, felspar and light actinolite crystals are largely developed. The mica is light amber-colored phlogopite.

5. In Portland Tp., Frontenac Co., Ont. — Crystalline syenite, with light colored, almost white, amber mica.

6. Hichinbrooke Tp., Frontenac Co., Ont.—A diorite (spotted), quartzose in places, and varying in colour from grey to blackish colored with dark hornblend, contains mica with phosphate and magnetic iron. Mica is black biotite.

7. Loughborough Tp., Frontenac Co. Ont.—A belt of hornblendic rock contains a zone of large hornblend and mica crystals occurring with apatite. Mica is dark amber colored and has been found in crystals seven feet square.

8. North Burgess Township, Ont.—A hornblendic rock which has decomposed to a green steatitic rock, about 50 yards wide, occurs between a quartzose gneiss and a felsitic gneiss and is mica bearing. The mica is light coloured amber phlogopite.

9. Hungerford Township, Hastings County, Ont.—A granitic gneiss contains mica and tourmaline crystals. Mica is white muscovite but at times spotted with minute tourmaline crystals.

QUEBEC.

10. Hull Township, Ottawa County, P.Q.—A dark coloured augite (diallage) syenite is cut with strong veins of calc-spar up to 15 feet wide. The veins carry mica crystals. Mica is dark amber coloured and somewhat spotted.

11. Murray Bay District, North Shore River St. Lawrence, P.Q.—A lenticular mass, or possibly a vein, of felspar with quartz horizontally cuts a dark hornblendic gneissic syenite which dips almost vertically.

The felspar mass has been opened for nearly 200 feet and shows a thickness of from 15 to 20 feet at the widest place running down to a few feet. The mica is scattered in bunches of crystals. The felspar and quartz assume the character of graphite granite occasionally and more commonly that of pegmatite. Large quantities of pure felspar are obtained. The mica is found both as white muscovite of excellent quality and also as phlogopite of an amber shade, a peculiar transition occuring very abruptly.

12. Saguenay County, Que.—A granite ridge has the quartz, felspar and mica largely developed in crystalline form. The general character of the ridge is in the main quartzose with development of felspar and mica crystals, and more rarely crystals of tourmaline, garnet and phosphate. The ridge appears to have a stratification which is nearly vertical. On the flanks of the ridge a gneissic form appears with hornblend and some calc-spar, but the main body of the ridge consists of quartz, felspar and mica, the former largely predominating, some in the form of "rose-quartz." The crystallization is large in certain irregular zones where mica is mined. Large-horse like masses of greyish fine grained rock come in here and there, with the larger crystallized rock occuring between them. The whole body of the ridge carries small mica crystals. The mica is muscovite, white and strong. The mica crystals are often impaired with quartz crystals lying embedded in them, sometimes partly cutting through the mica crystal or entirely piercing it.

Description of Webber's New Miner's Dial.

By Mr. Hort. Huxham, M. Inst. C. E.

(South Wales Institute of Engineers.)

The chief objects aimed at in the construction of this improved dial, or circumferentor, are greater facility for reading, increased accuracy of work, portability and reduced cost.

The instrument (see plate) consists of an ordinary tripod stand, of any convenient height according to the nature of the work, and provided with parallel plates for adjustment of level. In lieu of the parallel plates, however, may be substituted either an improved Hoffman's or Pastorelli's ball and socket joint if thought preferable for some class of work

The upper parallel plate is provided with a male axis, which fits into the socket forming the bottom of the body piece of the instrument. This axis is grooved in the usual way to receive the end of a milled-headed clamping screw passing through the socket, so that the head of the instrument may be set horizontally in any direction on loosening the clamping screw.

The hook for attaching the plummet to is carried through a central opening left in the tripod head, and is attached to the ball pin of the parallel plates, so that whatever may be the amount of displacement of the parallel plates in levelling up, the hook will always be in the vertical axis of the instrument.

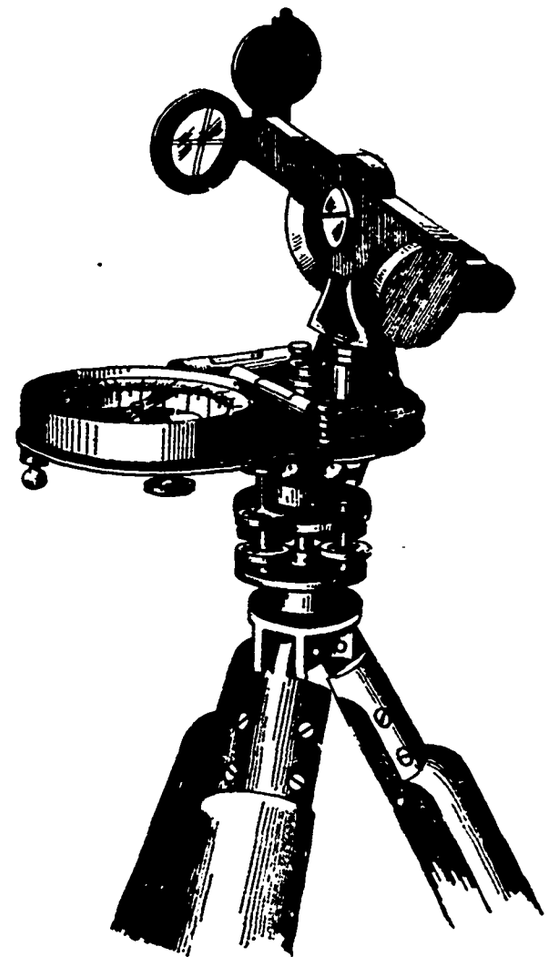
The lower plate, or limb, attached to the body piece is 3¾ inches in diameter, and is fitted on its outer circumference with a rack, and on its upper surface with a horizontal circle divided from zero to 360 degrees.

The central vertical axis of the body piece is slightly prolonged above the lower horizontal plate to carry the upper horizontal or Vernier plate, which is of an oblong form, 7 inches by 4⅜ inches, the centres of each end of which are 3 inches apart. One end of the upper plate is centered on the vertical axis of the instrument, and has a flange cast on its under side, which completely encircles and protects the lower plate; to the under side of this flange is attached an annular shield plate, thus completely boxing in the lower plate.

The other end of the upper plate projects 3¼ inches over the lower plate and forms the base of the compass box, which is 3¾ inches in diameter, and is thus placed three inches out of centre, or eccentric to the central axis of the instrument. This affords a clear and unobstructed view of the compass, and gives greater facility for accurate reading.

The bottom plate of the compass is divided from zero to 90 degrees from north and south towards east and west, whilst the step is divided from zero to 360 degrees.

The compass is fitted with a pair of edge bar needles with sliding riders, and reading points placed between the needles. It is also furnished with the usual lift to raise the needles off the central pivot. The compass box has a plate glass cover, and also the usual metal lid.



The Vernier is placed in an aperture in the bottom of the compass box, through which the readings of the lower limb are taken. This arrangement admits of the Vernier and the limb being placed on the same horizontal plane, and thus tends to greater facility and accuracy of reading. The Vernier and limb are entirely enclosed and protected from dust or injury, the only portions visible being those seen through the reading aperture in the compass box.

The Vernier plate and compass box is furnished with a rack and pinion motion, and provided with a clamp and tangent screw. On the upper side of the plate are affixed two cross levels for levelling the instrument.

The sights and vertical arc are carried by a swivelling axis mounted on a pillar, securely attached to the upper or Vernier plate by a strong milled-headed screw and set studs. This makes the arrangement very portable, as the pillar is readily detached for packing in the case.

The rocking motion of the sight-piece allows of angles up to 45 degrees being read on the vertical arc.

The sights are formed of two windows, or circles of metal, placed opposite each other at a distance of 7 inches apart. Each window has two pairs of parallel hairs stretched across it at right angles to each other, thus forming a small square in the centre. In lieu of the hairs, the windows may be filled in with parallel glasses having the sight-lines etched on them.

The windows at either end are covered by revolving metal shutters, each having a small eye-hole in the centre corresponding with the central axis of the windows; each shutter or eye-piece can be brought down to cover the window or turned away from it, according to whether a forward or a back sight is being taken, without in any way altering the set of the instrument.

This arrangement enables the instrument to be clamped at one station and carried forward to the next, and sighted back to the station just left without any reversal of the sights.

The line of sight cuts both the vertical and horizontal axis of the instrument, so that there is no correction needed for parallax, and the readings can be plotted as taken.

The vertical arc, fixed to the sight-piece, is read by a Vernier, and is fitted with a rack and pinion motion and clamp and zero stop; it is also provided with a scale of differences of hypothenuse and base.

The instrument is 7½ inches in height above the tripod head, and packs away in a case 8¼ inches by 5½ inches by 5½ inches, outside measurement.

CORRESPONDENCE.

Minerals in the Parry Sound District.

To the Editor:—

Some time ago when looking for land I came across some promising outcrops of minerals, notably copper and I believe gold, but having no means either to prospect myself or take up the land, perhaps you might find space for this in the hope that some mining man or company might acquire or work the lots. I can give the numbers of the lots, concession line and township; but in the event of any mineral deposit being opened would like to get a fair share of the value.

THOMAS NIXON.

92 Clinton St., Toronto,
11th Feb., 1895.

Mica in British Columbia.

To the Editor:—

Through the kindness of the editor of the *Inland Sentinel*, Kamloops, B.C., I have been favored with your issue of December, 1894, in which, among other very valuable information regarding mining data throughout the Dominion, considerable space was given to the product and use of mica in the commerce of the world. Having, for some time past, devoted my attention to the determining of the mineral resources of a certain section known as the North Thompson in this province, induced me recently to interest myself in and determine the extent of the mica deposit in the Tete Juan Cache section, which has its natural outlet through the North Thompson Valley. Being thus interested, I found your descriptive article on the product and use of mica very interesting. This must be my apology for intruding on your valuable space, to make known to your readers the fact, that, in British Columbia there is a wonderful deposit of mica. These deposits are tremendous when considered alongside of those described in your December number, both in respect to the extent of the area, size of clear sheets, transparency, texture, flexibility, etc., etc., having, as far as investigation has gone, all the requisite elements required in the use and manufacture of all the innumerable articles for which the mineral is now being utilized, at the same time devoid of a great deal of the disabilities to which this particular mineral is subjected in other parts. The existence of mica in the Canoe River and the Tete Juan Cache region, was known to the Indian trappers of the upper reserve of the North Thompson for a good many years before they imparted their knowledge to anyone outside of the tribe. About five years ago a couple of them brought out a few samples and showed them to the Indian Agent at Kamloops. He informed them that that quality of mica was valuable. This information roused their cupidity, and a high figure was set in case any speculator should turn up with a desire to secure the mineral. Through one means and another, L. V. Bennett got on to the find and made a bid, which was even larger than the Indians had any hope of getting. He was consequently taken up. An expensive expedition was fitted out, the mines were visited and several locations secured. Not being a practical man, considerable money and time have been expended to no great purpose. I took over the management of the property in December, 1893, and visited the localities during the past summer in company with two experienced miners. I was surprised to find such an extensive mica bearing area, in fact, instead of finding deposits of mica, I found veins of well defined leads of spar quartz, perfectly impregnated with Mica. At Canoe river I found what I have been pleased to term a doubtful ledge, in which fair sized sheets could be had, at least five miles from where the mammoth veins are exposed, in an embraced area of from two and a half to three miles square. The veins run south-east and north-west in well defined ledges, of which there are no less than twenty, varying in size from five to twenty feet across the face on the surface; from the one tested a superior quality of mica was produced, but our operation was not sufficient to determine what size blocks can be obtained, what I got was in small sheets four feet below the surface. The mineral was found to be firm, clear in transparency when stripped, tough and flexible in nature, although from the surface the elements seemed to have had no deteriorating effect, being totally void of foreign elements. On examination I found that numbers of the veins were capped to the depth of from three to four inches with smoky mica, connecting in some instances with the white mica below with no bad result.

I next visited the mine at Tete Juan Cache which is twenty miles distant, north of Canoe river, here I found even a more extensive area in which mica was imbedded. I operated on one of the veins and satisfied myself that blocks can be had from which perfect clear sheets, from two to four inches thick, that would square from 2 x 4 to 24 x 36 inches. As yet no depth has been gained on any of these veins; here we drove in under a bluff to make a face, and found the blocks had suffered more or less from slight movements of the mountains, the slight interruption produced a waste of about 30 per cent. The waste is, nevertheless, strictly confined to the blocks horizontally and those lying in any way sideling in the vein; those lying perpendicularly did not suffer in any way. I noticed also that the transparency of the mica was not in any way affected by percolation or intrusion of any foreign matter. The mica throughout is formed in felspar. Fluor spar and beryl are also found among the quartz, traces of iron is also visible. The blocks I put out were from 4 to 10 inches thick at one end, they being wedge shaped; the average weight was from 20 to 70 lbs. I brought out eight blocks, the largest 10 inches thick at one end and weighed 64 lbs. The samples brought out from the latter mine are of a perfect clear white, somewhat brittle, yet retain a flexibility that gives it toughness nearly equal to that of Canoe river. With this vast field at our door, I can see no reason why Canada through British Columbia, should not furnish the world of commerce with all the mica that will be used for an unlimited number of years. I will be much pleased to give any further information in connection with this mineral at any time should any of your readers so desire; as an important source of wealth to the Dominion it should be widely known to the commercial world.

JOHN F. SMITH.

LOUIS CREEK P. O., B. C., 8th Feb., 1895.

LEGAL.

An Unrivalled Boomer.—S. J. Ritchie's Ambition to make Millions.—A fat Claim for Compensation.

Since our report of the celebrated action, McMullan vs. Ritchie, in the United States Circuit Court for the Northern District of Ohio, we have been favored with a copy of the decision as rendered by the Circuit Judge, the Hon. Horace H. Lurton, which gives much interesting information respecting S. J. Ritchie's *modus operandi*. The following excerpt will, we are certain, be of interest to many of our readers:—"The aggregate amount of compensation claimed by Mr. Ritchie for services of one kind or another, to one or other, or both the mining companies exceeds $1,000,000. These services may be enumerated under the following heads:— First, for buying mineral lands now owned by the Copper Company; second, for buying lands now owned by the Iron Company; third, for services rendered in getting nickel ore placed on the free list of the McKinley bill; fourth, services in the matter of extending the uses of nickel as an alloy in armor steel; fifth, services in Europe, Canada and America in advertisement of the value of the copper and nickel mines owned by the copper company, and endeavoring to bring about a sale of the product and of the property, or a consolidation with other nickel-producing mines; sixth, services in experiments tending to add to the value of the iron mines owned by the iron company; seventh, services in getting certain valuable contracts for the sale of nickel matte to the Unites States goverament and to Carnegie, Phipps & Co.; eighth, services in obtaining a proposition from Edison for the erection of a plant for the concentration and desulphurization of the iron ores of the iron company; ninth, services in getting certain propositions for subsidies from Canadian towns in aid of the erection of plants intended to work the ores of the iron mines; tenth, for services in getting switches put down to connect the copper mines with the Canadian Pacific Railway.

With regard to each and all of these claims, it may be said that, when Mr. Ritchie was engaged in the matters for which he now claims compensation, he was officially connected with the companies, either as an officer or director; and neither company had by any resolution or by-law provided for any salary or compensation to any president or director, and that the only salary paid for services rendered by any president or director, was a small salary paid the secretary and treasurer, Mr. McIntosh, and that the services rendered by Mr. Ritchie were voluntarily rendered, and without expectation on his part that he would be paid for them, or on the part of either company that he expected payment. There was neither an express nor implied contract upon which he can now predicate a claim for services rendered. That he expected no salary or other compensation is overwhelmingly shown by circumstances, as well as by his direct declarations, established by several witnesses. Most of his claims for services have no equitable basis whatever. For the purchase of the original tract of land containing copper ore he claims $50,000. That tract was bought by him for $14,000. It was bought for himself and Senator Payne. Ritchie took a three-fourths interest, and Payne one-fourth, each paying the purchase money in that proportion. Subsequently it was conveyed to the copper company, for the consideration of $1,000,000 in the stock of that company. This stock Ritchie thinks was then and is now worth par. This stock was issued to Ritchie and Payne, and to such other persons as they directed. Just why the copper company should now pay him $50,000 for selling to it at $1,000,000 property which cost him $14,000 does not appear. The great bulk of the mineral lands now owned by the iron company consist in a tract of 15,000 acres, in which the company owns an undivided three-fourths interest, the other one-fourth interest being owned by one Coe, who has persistently refused to sell his interest to the company. The interest the iron company owns was conveyed to it by Ritchie, Payne, and one McLaren, each of whom owned an undivided one-fourth interest; Coe, as before stated, owning the other one-fourth. For their interests, Ritchie and his co-vendors had paid some $14,000. They conveyed their undivided interests to the iron company, in consideration of $1,500,000 paid up stock of the company; $500,000 being issued to each of them. Subsequently, other lands were bought by Ritchie; sometimes in his own name, and sometimes in association with one or the other of his codefendants. Such lands were subsequently conveyed to one or other of the companies, at large valuations, for stock of the company. The terms on which these conveyances were made were always satisfactory to Ritchie as a vendor, and equally satisfactory to the corporation vendee, it being practically represented and controlled by the vendors. Just why either of the companies should now pay for such services is past finding out on this record. The demand for payment of $100,000, as the value of certain switches put in by the Canadian Pacific Railroad Company to connect the copper company's lands with their line of railway, is equally groundless. The grading seems to have been done by the copper company, the rail and ties being furnished and put down by the railroad company. His claim is that he should be paid for what the railroad company furnished and did. This he puts upon the ground that he had some special influence with the Canadian Pacific Railroad Company, and that what they did was in discharge of obligations to him. What the railroad company did was done for the copper company, and in the interest of the railway company, and for the purpose of developing business for itself. The transaction is one well known to be quite common, and the claim for the value of the track thus put down has no merit in it.

That Mr. Ritchie was extremely active and zealous in endeavoring to make a market for the nickel ores produced by the copper company, and in securing the admission of such ores into this country free of duty, and in efforts to give some value to the iron ores of the iron company by the discovery of some cheap process by which lean ores might be concentrated and deprived of the excess of sulphur which rendered them useless, is most clearly shown. That he spent his time, influence, and money under any employment by either company is not shown. On the contrary it is shown that he gave his services with no expectation of compensation, other than as the stocks owned by him in the mining companies would be enhanced in value or made saleable as a result of his efforts. Another motive moving him to do all in his power to bring about a large operation of these mining properties is found in the fact that he was the president of the railroad company extending from Lake Ontario to the iron company's lands, in the interior. That road was valueless unless it could get freight, and its chief expectation of freight was in the large operation of this iron property. Ritchie was also the owner of a majority of the bonds issued by the railroad company, and of a majority of its shares of stock. It was unable to pay interest upon its bonds. The operation of these iron mines on a large scale would, it was believed, enable it to pay interest on its bonds, and give value to its stocks. Still a stronger explanation of his willingness to aid in every way the development of both the mining companies is found in the character of Ritchie. As this record shows him, he was a man of great ability, enormous energy, and a towering ambition for great enterprises. As a promoter or "boomer" he seems to be unrivaled; a man of large general information and robust constitution, extraordinarily sanguine, desperately pugnacious, generous as a prince, and possessing no degree of caution whatever. His ambition was to make

millions. He believed with all his soul that these mines were of fabulous wealth. On their development he had staked all he had and all he could borrow. Difficulties did not deter him, nor danger affright him. In his mad pursuit of what he believed could be made out of these properties, he could not be restrained by his associates. His determination to dominate led him to give an amount of time to the affairs of these companies largely in excess of any duty by reason of official position. Their caution was, in his judgment, timidity and cowardice. He acted as if he owned the whole property, and, when his advice was rejected or his unauthorized contracts repudiated, he pronounced the conduct of his associates as treasonable, malicious. The court is not particularly impressed with the scrupulousness of his methods, or his reliability as to details of fact. He appears to have been an overbearing, imperious man. That such a man, owning a majority of the shares in each of these companies, should assume to represent them upon all matters of moment, and should endeavor to promote their interests in a thousand ways, is just what might be expected. That he should do so in his own interest, and by reason of his invincible desire for leadership, is precisely what we might look for. That he should wait for employment, or look for compensation when the stake was millions, we should not expect. That he should now turn round and demand pay for all this expenditure of energy, time, and influence is only explainable by the unfortunate result of all his grand schemes and heroic efforts. The conservatism of Payne, Cornell and Burke was never a barrier to his exertions, or an obstacle to his plans. He never saw difficulties in the way of the development of these properties, and their consolidation with the other great nickel mining companies of the world. To these ends he devoted himself with the zeal of a crusader. That such an unrestrainable man, of cyclonic energy, zeal, and ability, should now ask pay for each speech he made in favor of free nickel, or day spent in the laboratory of Edison, endeavoring to solve the problem of desulphurization, is wholly due to his final disappointment at results. I am quite clear that, on the whole evidence, there is no evidence which would justify a court in saying that there was an implied agreement for compensation.

What has been said as to compensation for services applies equally to his claim for $50,000, spent in the services of these companies. He admits that he kept no account of such expenses. He cannot apportion them between the several corporations, or say in what service he spent any particular sum. He had no purpose to make a charge for his personal expenses when engaged in the matter for which he now asks compensation. Some of his expenses seem to have been paid. During 1890 he was paid $1,600 on this account. His present demand is purely an afterthought, and has no just basis."

McKinnon vs. Snowden.—This appeal was heard before Justices Crease and Drake in the Division Court, Victoria, B.C., last month. The plaintiff, Alexander F. McKinnon, claims that the defendant, N. P. Snowden, has trespassed on his claim, known as the Maple Leaf mineral claim, situate in the district of Kootnay on the left side of the C.P.R. going east, about a mile and a half up the mountain from Muir tunnel. He alleges that the claim was first recorded by him in May, 1886, and he claims possession of this claim, the ejectment of the defendant, and the sum of $1,000 damages. The defendant, Snowden, denies all this, and alleges in contradiction that the plaintiff is within the railway belt, and, moreover, that the plaintiff has lost any rights he might otherwise have had owing to his non-compliance with the provisions of the Mineral Acts. In the alternative, the defendant further pleads that if the plaintiff had any claim to the mine, it was an adverse claim, and that even that had been waived by him through his not having prosecuted such claim with due diligence in accordance with the provision of the statute, and he is, therefore, barred now from any right of action. The case came up for trial before Mr. Justice Walkem at Kamloops, who made an order making the Lanark Mining Company party defendants to the action. From this order the present appeal was brought by plaintiff. Judgment was reserved. Mr. W. J. Taylor for appellant (plaintiff); Mr. E. V. Bodwell for respondents.

Disputed Mica Title.

Supreme Court of Canada—Appeal—Dame Altha Ann Baker (Plaintiff in the Court Below) and Alexander McLelland, (Defendant and Respondent) and F. W. Webster & Co., (Mis en cause and Respondent in the Courts below).

On first November, 1877, the respondent, Alexander McLelland, by deed sold to one Stephen Wilkins, of Ottawa, all the mining rights of phosphate on the south half of lot 10 in the 14th Range of Hull, County of Ottawa, The sale was made for $25.00 in cash and upon condition that the vendor should receive a royalty of $3.00 per ton of phosphate. The deed of sale contained the following clause: "In case said purchaser in working the said mines should find some other mineral of any kind whatever, he shall have the privlege of buying the same from the said vendor, by paying the price set upon the same by two arbitrators appointed by the parties." On 16th April, 1884, Wilkins assumed to sell to Thos. Birkett the mines and mineral rights upon the lot. On 31st January, 1888, Birkett assumed to sell to W. E. Brown of Ottawa, the same property. On 19th July, 1890, Brown in turn sold to S. J. Edmonson, who again on 21st July, 1890, assumed to sell to Dame Baker, the wife of the said W. E. Brown. On 9th November, 1891, McLelland for good and valid consideration disposed to Webster the exclusive rights to mine and work all the mines or veins of mica for a term of ten years. The appellants brought their action alleging a claim of title from McLelland through Wilkins setting up the pretension that the clause referring to the right to purchase on a price to be fixed by arbitrators, covered all minerals upon the lots which were not included in the original grant to Wilkins and further alleging that mica had been discovered upon the property of great value and that the final appellant deserved to acquire the same at a price to be fixed by arbitrators, that McLelland had refused to agree upon an arbitration although duly required to do so, but had on this sold the mica rights to Webster who was then working the same, and by so doing he greatly impaired and caused damage to to the appellant.

The appellants (plaintiffs in the Court below) pray that McLelland and Webster should join with them in this arbitration to fix the price of the mica and other minerals not covered by the original grant to Wilkins and that McLelland should be compelled to pay the appellants $20,000 damage with interest.

The respondent Webster filed:— (1) A general denial. (2) That the clause cited was null and void and inoperative as regards him inasmuch as the same was inserted in the deed to Wilkins without any consideration. (3) That the stipulation did not convey to Wilkins any real rights in any minerals then existing or which might thereafter be discovered upon the lot, and that neither Wilkins nor any of the parties holding from him, ever had possession of the mica rights. That if any benefits were conveyed to Wilkins by said stipulation, which was not admitted but denied, the benefit was a personal right and privilege of Wilkins to become purchaser of the said minerals and the rights did not pass to Birkett and the others, and that no assignment as may have existed in favor of Wilkins was ever served upon or notified to the respondent McLelland or the present respondent, Webster. Also among others that the right had been extinguished by lapse of time. The judgment of the Superior Court for the District of Ottawa dismissed the action of appellant with costs, on the ground that the stipulation in question did not convey any such real right to Wilkins as the appellants were seeking to exercise and enforce in their action in the Court below, and that consequently no such pretented rights as the said appellants were so trying to exercise could be conveyed by Wilkins to Birkett and through Birkett to others. The judgment appealed from confirmed the said judgment, hence the present appeal to the Supreme Court.

MINING LEGISLATION.

NOVA SCOTIA—The Mining Society of Nova Scotia having appointed a committee for the purpose of securing, if possible, further legislation, which may be in harmony with good mining practice and the best interest of their province have issued a circular letter to members asking for their views and suggestions on the following points:—

1. Amendment to the present Mining Act. (a.) Of title and tenure; (b.) of mining regulations; (c.) of special rules; (d.) of royalty and rentals; (e.) of applications for and locations of areas; (f.) of forfeitures, etc., etc.

2. As to the general policy of the Government towards the mining industry generally as a whole. (a.) Looking to improved facilities; (b.) looking to general topographical and geological surveys of the province, and extended information of our mineral resources; (c.) looking to extension of markets for the raw products of our mines; (d.) looking to the investment of foreign capital in this industry; (e.) looking to technical mining education.

3. Generally of a policy which will look to the prosperity of the mining industry, either particularly, or as in whole.

This Society has already proved a valuable auxiliary to the Provincial Government in amendments to mining legislation, and this effort to secure the views of the representatives of the various industries is a practical measure which should secure a full and hearty co-operation of all the members.

BRITISH COLUMBIA—Several bills amending the mining laws of this province have been introduced during the present session of the local legislature, notably one respecting coal mines regulation, which seems to have provoked a good deal of discussion, both in the House and in the press. Not having seen the bill itself the REVIEW can make no comment upon it.

GOLD MINING IN NOVA SCOTIA.

From our own Correspondent.

CARIBOU DISTRICT.—The developments made on the Jack and Bell property by Capt. Mackintosh show a strong lode, well mineralized and running high in gold. A stamp mill and the necessary mining plant is being placed on the mine this winter and will be in running order by the advent of spring.

The consolidated property of the Caribou Co. is being worked chiefly in the "Dixon" mine. Some work has been done on the "Truro" mine and at other places, but without published results to date.

FIFTEEN MILE STREAM—This property has had a most favorable and wonderful report made upon it by Mr. Hermann Hampt, of Chicago, who puts a valuation of $150,000.00 upon the property. The average value of the ore milled is shown to be about $10.00 per ton.

KILLAG—Nothing is doing in this district, nor in the adjoining one of Beaver Dam.

STORMONT—Guysboro County bids fair to hold the palm for 1895 as it did for 1894. The "Richardson" leads the van in production and is running full time, with the new machinery giving great satisfaction. The vein at the eastern end of the mine has reached a width of 22 feet; at the western end it is from 7 feet upwards. This is one of the largest and most remarkable veins ever opened in the Province.

The "St. John" and "Antigonish" companies are working steadily at Johnson's Brook, Country Harbor, and are preparing to increase their outputs in the early spring.

The "North Star" mine at Isaac's Harbor remains closed down, as are also the "Palgrave" and the "Gallihar" mines.

SHERBROOKE—Returns from the Wentworth block (Stellarton Gold Mining Co.) are 279 ozs. gold from 298 tons in January.

Mr. Jas. A. Fraser has returned to Goldenville from Fifteen Mile Stream and is busy opening up and equipping the "Chicago" mine. There is much idle property in this district that would be bought and developed were it not for the inflated value set upon isolated areas and blocks by both resident and non-resident owners.

WINE HARBOR—Trustworthy information has been received that the Wine Harbor Co., (Harding *et al)* have cut the "Plough Lead" belt east of the large fault. It is reported that sinking will be commenced as soon as snow is off the ground.

COCHRANE HILL—The mine and mill at this place remain closed and idle. There is good authority for the statement that wages for some months are due and that the mill has never been taken off the contractor's hands.

OLDHAM DISTRICT.—The "Hay" lode, famous in the sixties for the large nugget it produced, has been cut about one-fourth of a mile north-west from the old workings, and yields about two feet of $6 rock.

MOOSE RIVER.—Mr. Damas Tuquoy is working here a seven ft. belt of slate which mills from $1.50 to $2.50 per ton. He is also working a small vein called the "Copper Lode," which is of higher grade.

The Moose River Gold Mining Co. of Montreal have recently had their property examined by Mr. J. E. Hardman, of Halifax, who has reported to the company upon the large body of low grade ore believed to pass through its mining areas.

WAVERLEY.—There is nothing new to report from this district. The East Waverley Tunnel and the Tudor Mining Co. are the only operators running. Work has begun in the Dartmouth branch railway here and soon there will be one gold district in Nova Scotia having direct rail communication.

CENTRAL RAWDON.—It is reported that the Central Rawdon Co. will reopen their mine the coming season.

COMPANIES.

Kootenay and Columbia Prospecting and Mining Co., Ltd.—During last year 40 tons of ore averaging 135 ounces of silver and 39% lead, were shipped from the Company's "Stanley" mine; 55 tons running 165 ounces in silver and 60% lead, together with 40 tons concentrating ore were shipped from the Wellington mine. Two Worthington pumps, two Kelly's sectional boilers and an Ingersoll drill were added to the plant at the Wellington. A contract was made last month to drive a 675 ft. tunnel to tap the vein at a depth of 250 feet from surface. The engineers estimate 1,000 tons of ore in sight.

The Colonial Iron and Coal Company, Ltd. will apply for an Act of Incorporation at the next session of the New Brunswick Legislature. Authorized capital, $1,000,000. The objects of the company are to acquire and work coal, mineral and other lands in any of the counties of the Province of New Brunswick. Mr. R. G. Leckie, M.E., of Londonderry, N.S., is the proprietor.

The Dunsinane Mining Company is applying for Letters Patent under New Brunswick statutes for the purpose of acquiring and working coal and other mines in the Province of New Brunswick. The authorized capital is $50,000 in shares of $5.00. The directors are: John Whyte, manufacturer; Robert Jardine, manufacturer; and Sherwood Skinner, barrister, all of St. John, N.B. The office of the Company is to be at Dunsinane, King's Co., N.B.

Kootenay Hydraulic Mining Company.—Work is to be commenced at once on the foundation of a large pump to draw water from the Pend d'Orielle river for washing gravel.

The Victoria Consolidated Hydraulic Mining Co., Ltd.—An Act incorporating this Company passed its third reading of the Legislature of B.C., on 1st inst. The new Company comprises Wm. McKenzie, President of the Toronto Street Railway, Toronto; George A. Cox, banker, Toronto; Donald D. Mann and Thos. G. Holt, contractors, Montreal; Wm Wilson and F. S. Barnard, M.P., of Victoria, B.C. The authorized capital is $300,000 in shares of one dollar. Head office, Victoria, B.C. The property comprises hydraulic ground on the south side of the South Fork of the Quesnelle river and adjoining the Hop E. Tong Company on Dancing Bill Gulch, commencing at a stake placed about 20 feet north-westerly from the Hop E. Tong Company's tank, where they take water into their hydraulic pipe, thence extending in a westerly direction one mile, thence northerly one-fourth of a mile, thence easterly one mile, thence southerly one-fourth of a mile to the point of commencement, as indicated by stakes at the four corners, and which is held under a lease from the Crown, dated 6th November, 1890, for a term of twenty years at the yearly rental of fifty dollars, save and except thereout that mining ground known as the "Loo Quong Ching Tong" line claims, containing twelve acres, more or less, on Dancing Bill Gulch and which said ground was demised by the Lieut. Gov. in Council to the Cariboo Hydraulic Mining Co., Ltd.

The Vavasour Mining Association.—This corporation, of which Mr. T. F. Nellis, Ottawa, is President, is mining mica with considerable success on lot 10 in the 12th Range of Hull, Ottawa County, Que. The property has been in operation since May, 1891, more or less actively, and has produced over 300 tons of merchantable mica. The property contains four main veins of calcite, pyroxene and phosphate running in a north north easterly direction with a dip of 45 east. One of these veins has been followed for a distance of 1,646 ft. and averages from 3 to 4 feet. Considerable work has been done, consisting chiefly of an excavation of 200 ft. and shafts of 90 and 70 ft. with a gallery of 80 ft. The principal vein was opened for a length of over 400 ft. and several other veins in various parts of the property. At present the main vein is being worked in two places, one of which is 12 ft. wide and 70 ft. deep; the other 10 ft. wide and 30 ft. deep, fine crystals of mica being exposed. A cutting shop has been in operation since September last year.

Similkameen Gold Gravels Exploration Co., Ltd.—The new directors of this company are:—H. Hoy, J. M. Murray, A. H. Chaldecott, H. Rhodes, T. R. Morrow, W. E. Patterson, and C. E. Hope. The property contains 667 acres on the Similkameen river and is opened by three shafts of an average depth of 30 feet, and an adit 60 feet. The average value of the gravel is from 15 to 35 cents per yard, but a portion gives as high as $1.20 per yard and even higher. Water-rights cover 5,000 inches. Operations on an extensive scale will be begun in the spring.

Le Roi Mining and Smelting Co.—The mines of this company at Trail Creek, B.C., are producing and shipping to United Smelting and Refining Co. at Helena, Montana, an average of 30 tons of ore per day. The main shaft is down 355 feet and work is being pushed on the 300 and 350 ft levels, a force of 50 men being employed. A 10 drill compressor and two large boilers have been added to the plant.

Slocan Surprise Mining Co., Ltd.—Two hundred tons of silver ore have been shipped from this company's mine in the Slocan, B.C., and 100 tons more will go forward to smelters before the spring.

War Eagle Mining Co.—Machine drills are being put into this company's gold mine at Trail Creek, B.C. A tunnel is being driven to prove the property to a depth of 300 feet.

Cariboo Gold Fields, Ltd.—This is the name of a company now being promoted in London with a capital of $100,000 to work the alluvial properties of A. D. Whittier, at Barkerville, B.C.

Ophir Mining Co. of Chicago.—Rumours of differences among the owners are rife and it is not unlikely that litigation will ensue. In his report recently issued Mr. A. Blue, Director of Mines, makes the following pertinent remarks respecting the operations of this company:—"The stock was eagerly sought after at first, and large blocks were subscribed for by Americans who visited the mine and carried away samples of the ore. Numerous assays of these samples showed it to be very rich; but having been selected for their richness, no prudent dealer in mining stocks would consider that they represented the average ore of the vein. A mill test made at the Houghton School of Mines however, was regarded as much more reliable. Three lots treated there, aggregating 5,170 lbs. were reported to yield 9·7 ozs. of gold and 6·15 ozs. of silver. On the strength of this report sales of stock were readily made in the spring of 1893, but the financial panic which swept the United States soon afterwards caused many of the purchases to be cancelled. For this and other reasons of an administrative nature, the company has been working along under difficulties. The mine was absurdly overstocked, and this is a too common fault in Ontario as well as elsewhere; yet there does not appear to be any sufficient reason for doubting that it is a good gold property."

Cumberland Railway and Coal Co Ltd.—At the annual general meeting of shareholders held in Montreal this month the old board of directors was re-elected. Sales of coal in 1894 were within 6,000 tons of previous year.

Sunshine Mining Co. of Duluth—This company is making arrangements to start work on its silver claims near Ainsworth B. C. Mr. W. W. Warner, superintendent is now at the mine.

H. H. Vivian & Co. Ltd.—The following is the twelfth report of the directors:—At the commencement of the twelve months the selling-price of nickel was about 1s. 9d. per lb. net, and of cobalt about 6s. 1d. per lb., while at the end nickel had been sold as low as 1s. 3½d. per lb., and cobalt 5s. 3d. per lb., and it was necessary to reduce the value of stocks in accordance with the prices ruling at the time of taking stock. The loss on the nickel and cobalt trade of Hafod Isha Works was £15,502 10s. 7½d., of which £13,340 15s. 11d. is entirely attributable to the reduction in the value of stocks. Over such a loss no control is possible. The difference between the two sums is due to the constant fall in prices of current sales during the year. A loss of £1,299 15s. on the Murray Mine, Canada, arises from the value of the nickel product being credited at less than cost, although this mine has produced, and is producing, at a low rate. A loss of £3,764 12s. 1d. on the Evje Mine is very vexatious. When the directors took a lease of this mine the value of nickel was about 2s. 9d. per lb., at which it was capable of working profitably. The fall of nickel to prices previously mentioned upset all calculation, and converted the anticipated profit into a loss. The lease of this property has now been terminated. On the company's works at Birmingham there was a small net profit of £1,095 6s. 2d.

Bell's Asbestos Eastern Agency, Ltd., has been registered in London with a capital of £10,000 in £1 shares to enter into an agreement with the B 's Asbestos Co. Ltd. and to carry on in China, Japan, the Straits Settlements or elsewhere, the business of purchasing, selling, and dealing in as agents or otherwise, asbestos goods and articles connected with the utilization of asbestos.

Slough Creek Mining Co. Ltd.—Messrs. Moran Bros. of Seattle, Wash., have a cotract to supply a number of pumps of special design for this company's gold property in the Cariboo district, B.C. They are so made that they can be raised and lowered in the shaft, or attached to the sides as required. Two pumps are joined together, with an eight inch suction and six inch discharge, placed between the two; but they can be worked indipendently. The machine is held in suspension by steel cables attached to hooks on the top, but it can be made stationary to the side of the shaft with steel clamps attached to the side. These two twin pumps have a combined capacity of one thousand gallons per minute, and with the pump now in place the mine will possess a pumping plant of 1,250 gallons per minute. This is more than sufficient to take care of any water that may be met with. The contractors were determined, however, to place themselves in a position to meet any emergency, so that any further delay in driving towards bed rock would not occur. Arrangements have been made with the founders so that duplicates of any parts which might become broken can be ordered by wire.

Dominion Coal Co., Ltd. By courtesy of the management we are able to give below the returns of the various collieries operated by this company during the twelve months ended 31st December:—

	Coal raised.	Coal shipped.
Gowrie	138,286 tons.	127,018 tons.
Reserve	223,079 "	209,343 "
Old Bridgeport	54,842 "	54,656 "
Glace Bay	144,341 "	137,567 "
Victoria	130,962 "	120,647 "
Caledonia	125,124 "	118,872 "
International	138,190 "	127,205 "
Dominion No. 1	33,346 "	33,776 "
	988,170	929,084

Recapitulation.

Shipped	929,084 tons.
Land sales	2,644 "
Collieries	43,849 "
Employees	14,490 "
	990,067

The intention of the contractors is to at once put on two ten-hour shifts, so that the work of sinking and running a tunnel will proceed night and day. For the past couple of months a number of men have been engaged in cutting fuel and sawing lagging for timbering the shaft and tunnels, the company having their own sawmill for this purpose, so that in reality work has not been stopped at the mine at any time during the past year. The present drain tunnel is to be extended from a point three hundred

feet below the shaft for a distance of four hundred feet across Slough creek to the rim rock at the mouth of Nelson creek. The boring machine proved that this bench of shallow bed-rock extended over four hundred feet from the mouth of Nelson creek to where the channel of Slough creek suddenly dips to the 245-feet depth. The gravel between the surface and the shallow bed-rock has been proved by prospecting to contain a large amount of gold. A shaft will be sunk from the surface at a point where the drain extension strikes the rim-rock, and be continued to the old channel if necessary.

Creighton Gold Mining Co., Ltd.—A meeting of the shareholders of this Company was held at the offices of the Company, Ottawa, on 18th inst., when Mr. J. Burley Smith, M.E., presented his report of recent boring with diamond drill on the Company's property at Sudbury. The following officers were elected for the ensuing year:—E. Seybold, *President;* F. P. Bronson, *Vice-President;* Hon. E. H. Bronson, G. B. Pattee, J. R. Gordon, W. D. McPherson, W. A. Clark, Wm. McGillivray, *Directors;* A. W. Fraser, *Secretary-Treasurer.*

Fraser River Mining and Dredging Co., Ltd.—A sale of stock, by auction, was held at Vancouver on 11th instant. There was a large attendance and keen competition, the entire block, consisting of 300 shares, being knocked down to Alderman Coupland, at $2.10 per share, the highest figure yet realized for this Company's stock.

The Lillooet, Fraser River, and Cariboo Gold Fields, Ltd.—The prospectus of this concern has been issued on the London market. The authorised capital is £50,000 in shares of £1, of which £32,500 was offered for subscription, the remaining £17,500 being paid for the properties. The directors are:— Mr. F. S. Barnard, M.P., (Member of Dominion Parliament for Cariboo District), Victoria, British Columbia; Mr. A. E. McPhillips, Q.C., Victoria, British Columbia; Mr. Charles T. Dunbar, Lillooet and Vancouver, British Columbia (mine-owner); Mr. Reginald Northall-Laurie, 57, Sloane Gardens, London, S.W.; and Mr. E. C. Robson, 8, Austinfriars, London, E.C. The directors will hold a qualification of £1,000 or 1,000 shares each, and will give their services to the company, without remuneration, until the shares are receiving a dividend of 20 per cent. per annum, when they will divide 5 per cent. on dividends paid in excess of that amount. The following are the descriptive paragraphs of the prospectus:

This company has been formed to acquire and develop gold claims in British Columbia, and, in particular, to acquire and work the gold deposits in five claims at and about the village of Lillooet, Fraser River, known as the Irving, Jensen, Macdonald and Hurley, Robson, and Welton claims.

The Canadian Pacific Railway is now at its station at Lytton, within 42 miles of the properties, and from its station at Ashcroft there is a capital government stage road to Lillooet, 65 miles. This removes the principal difficulty which has hitherto retarded the development of the celebrated Fraser River Goldfield, where since 1858 thousands of hand-washers have been at work, although the difficulties of transportation were such that for years the original cost of commodities was scarcely considered, and flour, tobacco and nails were worth the same price per pound. The lands are held under perpetual leases direct from the Crown, and comprise altogether about 480 acres. The attention of the directors was drawn to these properties some two years ago by the good results obtained in these alluvial gold fields by the most primitive methods of working. The Macdonald and Hurley claim was shown by official certificates to have yielded a good return to these primitive methods. This is supported by the certificates of the following gentlemen:

Mr. A. W. Smith, Member Provincial Parliament, obtained from 1890 to 1893 £1,135.

Mr C. A. Phair, Government Mining Recorder, obtained from 1890 to 1893 £145.

Mr. Angus Beaton certifies that in six months work, and with only 200 inches of water, he obtained in 1893 £1,340 from this claim.

With these facts before them the directors despatched Mr. R. C. Campbell-Johnston, a gold mining engineer of long and varied experience, to the place, to make a report upon these properties. His report is inclosed with the prospectus. It will be observed that he has driven the ground in the Macdonald and Hurley claim for 40 ft., and has found that it averages 25 cents per cubic yard, and that this rich gravel measures on the Macdonald and Hurley Claim alone 10,000,000 cubic yards.

It will be observed from Mr. Campbell-Johnston's report, that his estimate of 25 cents per cubic yard is confirmed by actual results obtained on the Macdonald and Hurley Claim, which has yielded 7,000 dollars worth of gold from 30,000 cubic yards of gravel—that is, 23 cents per cubic yard. For effective working a full supply of water is necessary, and the directors, under the advise of Campbell-Johnston, intend to bring water from Cayoose Creek, as shown in the map which accompanies the prospectus, at a cost of about £23,000. This would deliver 2,000 miners inches of water on the claims, and would allow 1,250,000 cubic yards of gravel to be moved annually. The estimated cost of treating such a large amount is 3 cents per cubic yard. This would allow a profit of 20 cents per cubic yard of gravel, and this on 1,250,000 yards of gravel would give a profit of £50,000 per annum. The directors have decided to make a public company of this in order to obtain the necessary funds to lay down a pipe-line to deliver 2,000 miner's inches of water, to enable them to obtain these profits; and 5,000 miner's inches of water have been secured and recorded with the Government so that at any time the pipe-line may be duplicated, and the profits more than doubled. The whole of the capital subscribed by the public will be applied to this purpose, or to the purchase of further claims.

The directors have secured the services, as manager, of a gentleman of undoubted responsibility and position, and long and eminently successful experience of mining business, at a salary of £200 per annum, and £100 for every 1 per cent. of dividend paid in excess of 10 per cent.

The price at which the Company acquires these properties is £17,500, the vendors taking the whole amount in shares.

The directors are personally interested in the sale of the property—that is to say, they receive £17,500 in fully paid shares, and they pay to the original owners of the claims £9,750, namely, £2,000 in cash and £7,750 in shares. The directors have also expended, in having the mine examined and reported upon, some £1,750; so that, in consideration of their time, trouble and risks in consolidating and thoroughly testing the claims, their joint profit is £6,000 in shares.

The only contracts entered into are between John Irving and Archibald Macdonald and Daniel Hurley as and for the vendors, and Robert Horne-Payne for and on behalf of the Company, dated Victoria, British Columbia, September 15th, 1894, whereby the vendors severally agree to sell the above mentioned mining claims and water privileges for the consideration of £17,500 in fully paid shares.

These agreements, and full reports, certificates, maps, etc., and all other particulars may be inspected on application at the office of the Company.

Mente et Malleo.

DEDICATED TO THE LOGAN CLUB.

By thought and dint of hammering
Is the good work done whereof I sing,
And a jollier lot you'll rarely find,
Than the men who chip at earth's old rind,
And often wear a patched behind,
By thought and dint of hammering.

All summer through we're on the wing,
Kept moving by the skeeter's sting;
From Alaska unto Halifax,
With our compass and our little axe,
We make our way and pay our tax,
By thought and dint of hammering.

We crack the rocks and make them ring,
And many a heavy pack we sling;
We run our lines and tie them in,
We measure strata thick and thin,
And Sunday work is never sin,
By thought and dint of hammering.

Across the waters our paddles swing,
O'er wind and rapids triumphing;
Thro' mountain passes our slow mules trudge
As if they owed us a heavy grudge
And often can't be got to budge,
By thought and dint of hammering.

To the stars at night our thoughts we bring
But no maiden fair to our arm doth cling;
She, at Ottawa, with smiling lips,
The other fellow's ice cream sips;
You can't prevent these feminine slips
By thought and dint of hammering.

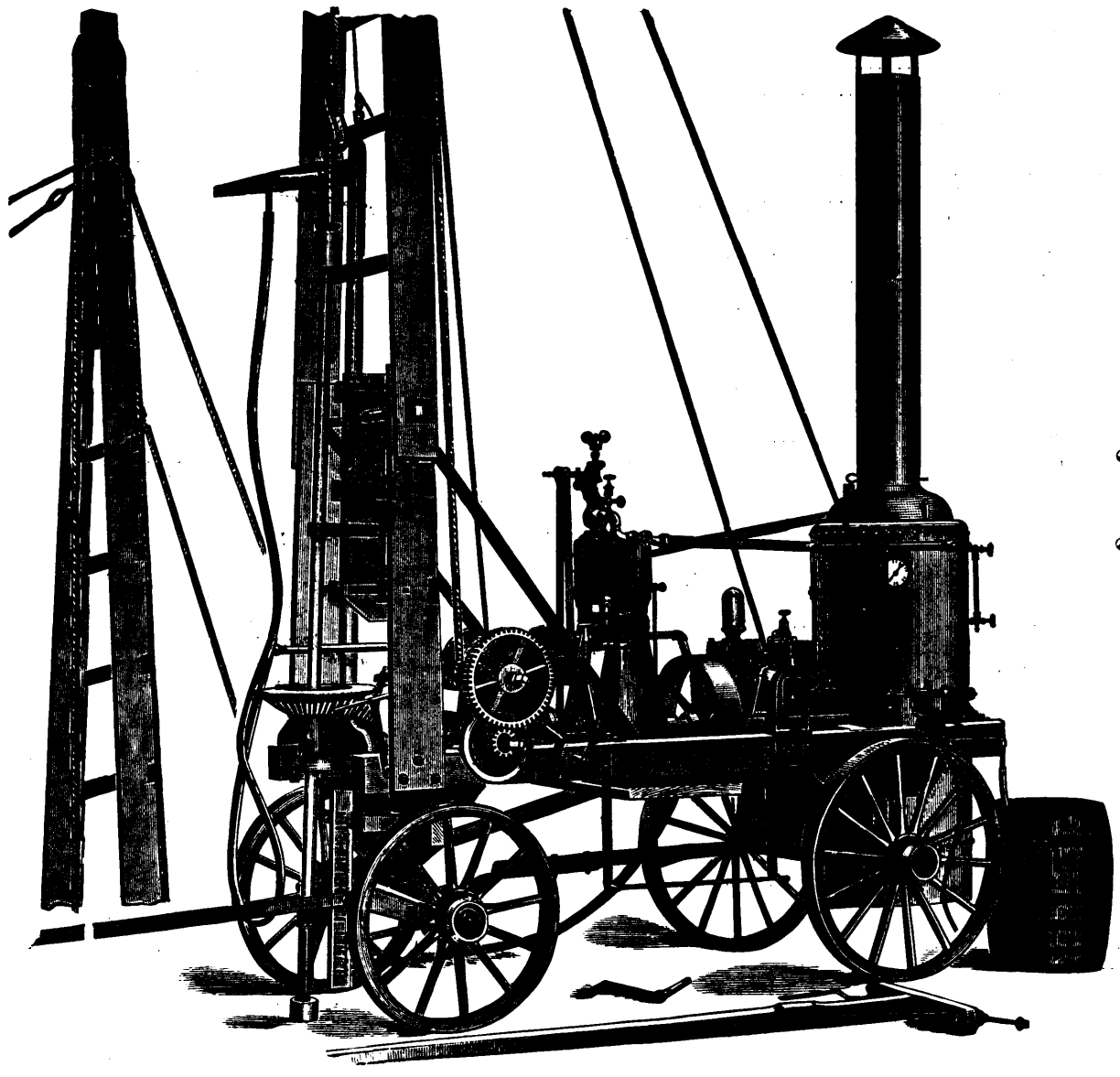
To array the "chiels that waunna ding"
Is our winter's work far into spring;
Some people think us wondrous wise;
Some maintain we're otherwise;
We're simply piercing Nature's guise
By thought and dint of hammering.

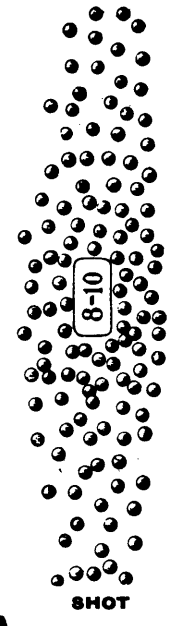
—A. C. L.

Peat Bogs as Electric Stations.—The peat bogs of the United Kingdom are roughly estimated by Mr. P. F Nursey at 6,000 acres, having an average depth of 12 ft., and being capable of yielding 3,500 tons of dried peat per acre. In Ireland there are 2,830,000 acres, or nearly one-seventh of the entire area of the island. More than half of the Irish peat is of the best quality, and, reckoned at one-sixth the value of coal, the total supply in Ireland is thought to be equivalent to 470,000,000 tons of coal. Here is a vast store of energy, points out Mr. J. Munro, which, like the power of Niagara, may be converted into electricity and applied to many industries—especially those of manufacturing various possible products from the peat itself—in factories established near the bogs. Neighbouring towns, moreover, could be lighted from the dismal moors, and railways worked.

Beal's Patent Core Drill

DOES THE WORK WITHOUT THE USE OF DIAMONDS.





THIS DRILL does the work without the use of Diamonds, using as a substitute Chilled Steel Globules, or as they are commonly called, shot. These are inexpensive, costing in actual work about ten cents per day; whereas, diamonds are very expensive, a single one often costing from $80 to $100, thus showing the difference in cost in case of loss of tools. It is THE BEST, CHEAPEST, and MOST EFFECTIVE CORE DRILL made for Prospecting Quarries, Coal Lands, Sinking Wells and the like.

Owners of undeveloped Mineral and Quarry Lands can, with one of these machines, at a small outlay, bring them into a marketable condition. This Drill has been thoroughly tested in California Quartz Rock, Granite, Marble, Lime, Flint, Iron Ore, Sand Rock and everything in that formation, cutting the hardest as well as the softest material with great rapidity. It has also been very successfully used in Hard and Soft Coal, Shales, Slate, Clay, etc., taking out a core from 2in. to 6in. in diameter. It is an excellent machine for sinking air holes for Mines, Sounding Foundations for large Buildings, Bridges, etc.

This Machine has been in practical use in the United States for several years, and was awarded the gold medal at the World's Columbian Exposition at Chicago, in 1893, in preference to all other core drills.

Length of machine, eleven feet; weight, mounted on truck as shown in cut, 5,000lbs. It can be easily loaded in a box car.

The Patentee, MOSES BEAL, ELYRIA, OHIO, U.S.A., would like to correspond with responsible parties with reference to the formation of a stock company for its manufacture in Canada, or would prefer to sell entire Canadian Patent.

The Patentee gives for reference any bank or business house in Elyria. Address him for full particulars. All letters will receive prompt attention.

For Full Information Apply to the
PATENTEE and SOLE MANUFACTURER,

MOSES BEAL, Elyria, Ohio, U.S.A.

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.