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Geological and Natural History Survey of Canada.

ANNUAL REPORT, 1887-88.

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Our Gold Fields In Quebec.

In view of the increased interest which has of late been manifested in the mineral resources of the Province of Quebec, not only as regards the comparatively new mineral asbestos, in the production of which Canada may now be said to lead the world, but also in the development of large and new bodies of copper ore, the great value of which as a source of supply for acid is is just beginning to be fully realized, it is a matter for enquiry why the gold fields of the Province, concerning which so much has in former years been recorded, should have failed to attract the attention which they so evidently deserve. For that in the Province of Quebec there exists a very large extent of territory containing rich deposits of gold, not only in the alluvions of its ancient river channels, but in many of the quartz veins which traverse the slates and sandstones of the Chaudiere and Ditton Districts, and of the whole belt of similar rocks which extend along the eastern portion of the Province contiguous to the boundary of New Hampshire and a portion of Maine, has been very conclusively established. One has but to take up the papers written on this subject by the late Mr. James Douglas of Quebec, or to glance over the earlier reports of the Geological Survey, more especially those from 1847 to 1866, to see that, in this area, the chances for profitable gold mining, under suitable Government regulations and proper management, are unsurpassed by any other portion of the Dominion, and possibly even by the adjoining States.

The evidence also presented before the Select Committee appointed by the Quebec Government in 1865 to consider the question of the Chaudiere gold field, while containing doubtless some statements bordering on the sensational, and therefore requiring to be cautiously accepted, present such a mass of cumulative evidence, both on the part of skilled workmen in this field, as well as from ordinary explorers, that we can but come to the conclusion that had such stories of the presence of gold in large quantity proceeded from any other section of the country than the Province of Quebec, the influx of gold miners and of capital would have almost equalled that of the palmy days of the Californian discovery.

The evidence presented in the different reports of the Geological Survey is also largely confirmatory of that stated by other writers on the subject; and yet, in the face of all evidence tending to prove the existence of a gold field equally adapted for quartz mining, as shown by repeated assays from a number of leads, with that of Nova Scotia, and far surpassing that country in the value of its alluvial workings, a feature in gold mining which has in Nova Scotia apparently never awakened any interest, we find not more than three or four companies, almost without capital, trying in a very small way and with the worst appliances and the almost entire lack of proper mining skill, to extract the gold from the ancient river channels, whose presence and great richness have been known for twenty years, but which, except in two or three widely separated cases, have never been explored to any extent.

The history of gold mining in the Province of Quebec has apparently from the very start been a huge system of blunders, and possibly the greatest, as it was the first, consisted in giving the entire control of all the gold found in the seigniory of Rigaud, Vaudreuil, on the Chaudiere River, and in which the richest developments yet found are located, into the hands of one person or family *forever*, and without any provision being made for the payment of royalty to the Government, since the clause inserted in the letters patent, and intended to cover this point, was so worded that it practically became inoperative; the royalty only being payable on such gold as was obtained by smelting the ore—a mode of working gold which has never prevailed in this country in gold mining, and which most surely never will. By the *forever* clause in the lease the outside public are entirely debarred by the Government from taking any part in mining or exploration in this section of the province, except by permission of the owners of the seigniory. But this is in turn prohibited, since in 1864 the De Lery Company, who derived their patent direct from Government, sub-let their entire mining right to the DeLery Gold Mining Company for a term of thirty years, so that until the second ownership expires no work can be done in the seigniory by outside parties without direct permit from the second company. The effect of all this is very evident. While the company is apparently quite willing to grant mining leases to any person desirous of working gold mining claims in any part of their territory, there is a very well founded objection on the part of those contemplating investment in this direction to advance the capital necessary for the erection of permanent works on the large scale by which the extraction of the gold can be most profitably carried on, owing to the insecurity of tenure existing under the present regulations. Works adapted to the requirements of the case mean the construction of reservoirs for permanent storage of water to meet the possible requirements of a dry season, extensive flumes or ditches for the conveying of such water when required, properly prepared grounds and appliances for washing the gravel and collecting the gold when separated; in fact a somewhat extensive plant. This, with a prospect that in a very few years their lease must of necessity expire, and if good results are obtained, an almost absolute certainty of non-renewal from the original company on any terms which would permit of profitable mining, has effectually placed a bar to all possible chances of development in this direction. Here, then, is one of the principal causes why capital does not at present flow into the Chaudiere district, rich as it is in gold.

As regards the second gold mining area, which, according to the most reliable reports, is in many respects equally as valuable as the Chaudiere, though not nearly so extensive, we find that, in a lucky moment for the proprietor. but an unlucky one for the Government of Quebec, the whole right and title to some 6,000 acres of the country, including mineral rights as well, has also passed *forever* into the hands of a private individual, and is, if anything, even more securely locked up in so far as the investmeut of capital is concerned, than the other.

The history of gold mining in Quebec, from the first discovery, sixty years ago, furnishes reading, not only of great interest, but of a kind from which good sound practical lessons may be derived. The first vein of gold found in 1836 was valued at from $50 to $60; a very fair sized nugget for any country, and sufficiently large, one would suppose, to warrant anyone interested in gold mining to make further and vigorous search; yet for nearly fifteen years but little attention seems to have been paid to it, further than in the securing in 1846, by the DeLery family, of the mining rights already referred to. From 1850 to 1860 desultory mining operations were carried on at a number of points by various parties. Some exceedingly rich pockets were found on the Des Plantes and the Gilbert, as well as on the main Chaudiere River, while a series of trials at the forks of the DuLoup in 1851-52, extending over one acre of gravel from the bank of the stream with ordinary appliances only, showed a margin of profit sufficient to warrant anyone in investing the capital necessary to make a speedy and abundant fortune should the proper appliances be used. The amount of the gold obtained from this acre of gravel was considerably over $4,000 — the profit considerably over $1,000. The results of these trials are given in the report of the Geological Survey for those years, and being official may be taken as reliable. Yet, owing to some dispute with the proprietor of a neighbouring lot, the work which promised so well had to be abandoned, and nothing further was done in this quarter for nearly thirty years. It is unfortunate that the next attempt to extract the gold from the gravels of the DuLoup in 1879-80 should not have been undertaken by some one with even a slight pretence to mining knowledge so that the most fitting plan for successfully carrying on the washing of the gravels, and what is equally important the collecting of the gold afterward might have been adopted, but instead we find a very large amount of money, aggregating many

thousands of dollars, placed in the hands of a person who certainly, from his previous occupation, could not be supposed to have acquired much practical or scientific knowledge of the best means to be employed in the extracting of the gold. A trench eleven miles in length was dug along the banks of the river DuLoup for conveying water for the hydraulic process, and a magnificent head of about 150 feet was obtained, sufficient to tear down the gravel banks at any desired rate, but very slight provision appears to have been made for collecting the gold, either coarse or fine, after the bank was torn down; though from the trials made in 1852 it is known that there was sufficient in every cubic yard to have paid most handsome dividends, even by the old rocker method of washing. Under such management it can scarcely be a matter of wonder that the costly experiment was a failure of the worst kind.

A second attempt to work an old channel near the village of St. George was equally disastrous to those engaged, though the outlay was on a greatly reduced scale, the management being the same. Four shafts were here attempted before bed rock could be reached, the operations extending over a period of several years, the last and final attempt requiring nearly twelve months to sink 165 feet. This surely implies engineering skill of a wonderful kind.

In the work on the Gilbert, where exceedingly rich ground was found in 1863-64, the mining also was of the crudest kind. The claims allotted were very small, water could not be obtained for washing the gravel properly, and there appear to have been no proper appliances for saving the fine gold. A sluice 1,800 feet long, built at a cost of about twelve thousand dollars, to bring water from the upper part of the stream, which had been dammed for that purpose, was destroyed before it could be utilized, simply through lack of proper precautions in its construction; yet here, in the face of all these adverse circumstances, gold was obtained in large quantities, so that four men, working under the greatest disadvantages, are said to have taken out nearly $80,000 in less than four years. Anyone visiting the workings as conducted at the present day must wonder how any gold except the coarsest can be saved at all. Sluices of very slight pitch and of insufficient length, are unfitted with any proper means for saving the fine gold, the greater part of which must of necessity be carried away down the stream with tailings. The only mining skill observed is on the part of those who have used the pick and shovel in some former enterprise in the vicinity, and yet, gold in good paying quantities continues to be obtained, simply because much of the gold in the district is coarse, and nuggets of ten to one hundred dollars are not uncommon, while others having a weight of nearly sixty ounces have been obtained.

Such coarse gold does not travel far, yet no practical attempt to test the quartz leads by milling has ever been made, except by one ill-starred crusher so faulty in construction that when free gold was put in none ever could be extracted. Yet, in spite of all these well known facts, when the value and importance of the gold fields of Eastern Quebec are mentioned most people calmly shrug their shoulders and smile incredulously. Why? Because most people are content to take the results, or rather the lack of results due to stupid blundering and ignorance of the first principles of mining, properly so called, as a satisfactory and conclusive test of the true value of the entire district.

There is no doubt, as can be proved by the evidence furnished both from official reports and from other sources, that in nearly, if not in every stream, tributary to the Chaudiere above St. Joseph, gold can be obtained in paying quantities with material of the right sort and knowledge of the conditions involved.

The gold mining of to-day should be understood far better than that of twenty years ago. In the Nova Scotia gold fields the mistake of sinking shafts in unprofitable lodes is not now made so frequently as in the first days of the industry in that Province, simply because certain laws apparently exist which govern the distribution of the metal. Scientific skill is now producing profitable returns where twenty years ago bad management and utter ignorance on the part of those in charge of valuable mines squandered capital by the hundreds of thousands of dollars. The crude style of gold mining has also surely lasted a sufficiently long time in Quebec. But until some provision is made on the part of the local government by which the titles so long ago obtained can be extinguished and these areas thrown open to the advent of outside capital, there does not appear to be much chance of permanent improvement in this direction. Should the government of Quebec acquire once more the titles to the mining rights of the province in gold, and proclaim the districts of the Chaudiere and the Ditton mining districts, with proper regulations as to title, size of claim, royalty, etc., there is not the slightest doubt that capital, to almost any desired amount, would pour in for the development of this great industry. In the present condition of mining in Quebec, with its great deposits of apatite, copper, asbestos, iron, gold and silver, one would suppose the establishment of a well organized mining bureau would be a prime necessity, not only conferring great benefit upon the province at large but bringing in also a very considerable direct revenue to the government. The little Province of Nova Scotia has long felt the benefit arising from such a bureau, and certainly, with proper management, Quebec, with her far greater variety and abundance of mineral wealth and her immensely greater area, would derive not only equal but far greater results from the establishment of such a department. The mining industries of Quebec are but in their infancy. No one can say to what enormous proportions they may in the next twenty years extend. Foreign capital is awaiting investment to day in many lines, but is restrained from entering, in some cases by the unfavourable conditions which are known to prevail. Surely the time is not far distant when these conditions will be changed, and when the gold mines of Ditton and the Chaudiere, freed from the incubus that has so long stifled their development, will be teeming with a mining population whose labours will be properly directed and whose rewards will be sure. May the happy time come right speedily.

A New Superphosphate Company.

From an interview with Mr. R. N. Hall, M.P., we learn that his recent trip to London was successful in securing the organization of a company with a substantial financial support for the manufacture, on a large scale, of artifica fertilizers for the Canadian and American markets. The scheme involves the purchase of the property of one of the most prominent phosphate companies in the Buckingham District, and a long term contract for the supply of sulphuric acid from the Capelton Works, near Sherbrooke. It is intended to erect large superphosphate factories both at Buckingham and at Capelton.

Mr. Hall reports an increased interest in the London market for developed phosphate properties, and much enquiry about asbestos. The great obstacle in securing capital for the development of both these industries is the enormous speculative prices place by proprietors and agents upon properties controlled by them.

When it is considered what an extensive area is represented by phosphate indications, and the thousands of such properties which are offered and *pressed* upon the London market, the folly of such a course must be apparent.

When prices have come down to a basis which leaves some chance for the employment of capital in *bona fide* working we shall see prosperous activity in our phosphate districts. The present speculative mania does no good to those who are responsible for it, and only hinders the development of a legitimate industry. The keen competition for the English and Continental markets between the phosphate supplies of Norway, South Carolina and Canada, with certain recognized disadvantages pertaining to the latter in the way of transportation and difficulty of treating the rock, should convince speculators that it is only upon the basis of moderate prices that the working of our phosphate areas stands any reasonable chance of success.

A new company, styled the Nova Scotia Syndicate, limited, was registered in London on the 25th ult., with a capital of £12,000, in £5 shares, to acquire and work mineral properties, and particularly the Waverley Mine, upon terms of an agreement with C. G. Palgrave.

Our Portrait Gallery.

[A series of portraits and biographical sketches of Canadian mining engineers, mine managers. inspectors, geologists, explorers, etc.]

No. 1.

Mr. E. Gilpin, Jr., Deputy Commissioner and Inspector of the Nova Scotia Mines.

In commencing a series of sketches of representative mining men, difficulties necessarily present themselves in making a selection of a subject for the first; but Nova Scotia has been, and is so pre-eminently to the forefront in mineral development that we have no diffidence in giving as our initial portrait the "counterfeit presentment" of one of her sons, whose name and personality are alike familiar and prominently associated with the industry, and who has, in a very conspicuous manner, contributed much to the material welfare of her various mining interests.

Mr. E. Gilpin, jr., Deputy Commissioner of Public Works and Mines, and Chief Inspector of the Mines of Nova Scotia, was born in the city of Halifax, N.S., in the year 1850. His father was the Very Reverend Dean Gilpin; his mother Amelia McKay, daughter of the late Mr. Justice Haliburton ("Sam Slick"). Mr. Gilpin was educated at the Halifax Grammar School, and thereafter at King's College, Windsor, where he graduated in 1871 as B.A. with "optime" in chemistry, and honours in geology and mineralogy; also Welsford, General Williams and Alumni prizeman. At Windsor he had the advantage of pursuing his chemical and mineralogical studies under the late Dr. How, well known as one of the best analysts of the day. These studies were continued afterwards under Professor Lawson, at Dalhousie College, whenever the pursuit of his profession gave opportunity. After leaving college he began the practical study of Mining Engineering, especially at the Albion collieries of the General Mining Association in Pictou county, and the knowledge and experience gained in this way was materially extended and improved by a visit to the principal mining localities in England.

In 1873, he was elected a member of the Nova Scotia Institute of Science, and in 1874, a member of the Geological Society of London. After visiting professionally all the mining points in the Lower Provinces and Newfoundland, he was for two years engaged in the exploration of the iron ore deposits of Pictou County, succeeding Sir William Dawson, who had devoted much time to the problems presented by the unequalled grouping of many iron ores of various geological ages in a comparatively small district.

During the existence of the Halifax Technological Institute he was appointed Lecturer on Mining, but did not lecture, as the Institute was not able to secure sufficient support to guarantee complete courses. The success attending the drawing and mechanical engineering classes, however, laid the foundation of the present Art School of Halifax.

In 1879 Mr. Gilpin was appointed by the Government of Nova Scotia its Inspector of Mines. In September, 1881, he was appointed a member of the Board of Examiners of Colliery Officials, to which Board he has continued to act as Secretary up to the present time. The visit of a portion of the British Association to Nova Scotia, was under his charge, in so far as related to the mineral sections of the Province. He also read two papers on Nova Scotia Gold and Coal before that Association. Mr. Gilpin also acted as local secretary during the memorable visit of the American Institute of Mining Engineers to Nova Scotia, and was entrusted with the carrying out of the various excursions, etc., which resulted in one of the most successful and enjoyable meetings held by that body. At this meeting he was elected a member, and contributed an excellent paper descriptive of the Nova Scotia gold fields.

In October, 1886, upon the decease of the then Deputy, Mr. Gilpin was appointed to the position of Deputy Commissioner of Public Works and Mines conjointly with his position as Inspector, and these positions he still holds in conjunction with an appointment made some years previous as Provincial Analyst.

Upon the formation of the Royal Society of Canada he was appointed one of the original fellows.

Following the formation of a Board of Examiners for granting certificates to Underground Managers and Overseers of Coal Mines, the Government has established schools of instruction for candidates desirous of undergoing examination, at various points in the coal districts. In these schools, ten in number, are taught mine surveying, mining practice, etc., to an extent corresponding to the positions to be filled by those passing the examinations.

These schools are under the supervision of the Inspector of Mines, who, it must be confessed, is not allowed by the Government to rust for want of work. Amid the various details of inspection, of the instructors' schools, and the various calls of the Public Works Department of even a small province like Nova Scotia, Mr. Gilpin has still found time to write many papers on Nova Scotia mines and minerals for home and foreign societies. In 1883 a large edition of his report on the Nova Scotia minerals was circulated by the Government, a new edition of which is much needed. His annual report on the mining industries of the province gives full details of the progress of the development of this resource, whose importance may be seen when it is stated that the revenue from Mines Royalties is now $165,000 a year, nearly double what it was a few years ago.

The Transactions of the North of England Institute of Mining Engineers, the Geological Society of London, the Nova Scotia Institute of Science, the Royal Society of Canada, and the American Institute of Mining Engineers contain numerous papers by him, among which may be mentioned: "The Carboniferous of Western Newfoundland," "The Coal Measures of Newfoundland," "Limonite Ores of Pictou Co.," "Nova Scotia Copper Ores," "Pictou Coal Field" (several papers), "Submarine Coal of Cape Breton," "Iron Ores of Nova Scotia," "Pit Waters," "Gypsum of Nova Scotia," "Canadian Coals," "Trap Minerals," "Geology of Cape Breton "(several papers), "Gold Fields of Nova Scotia," "Folding of the Carboniferous in the Maritime Provinces," "Manganese Ores of Nova Scotia," "Limestones of Pictou Co.," "Notes on Nova Scotia Gold Bearing Veins," with other papers of more technical and local character, principally contributed to the transactions of the Nova Scotia Institute of Science, etc. Many of these papers contain analyses by the writer, notably those on the iron ores and pit waters. The paper on Canadian coals gives the fullest set of analyses of Nova Scotian ores ever made, being the result of a special investigation into their qualities made by him for a foreign syndicate. This paper was read before the North of England Mining Institute, and awarded by them with a special present of mining books.

The paper on the Limestones of Pictou County, read before the Royal Society, gave his analyses of numerous beds of this mineral, and while showing the suitableness of certain beds for iron making, incidentally touched upon their freedom from magnesia, a point of interest from their connection with marls and gypsums.

The Canadian Institute of Civil Engineers embraces most of the mining engineers of the Dominion, and Mr Gilpin has assisted to further their aims in the Lower Provinces. Has served as a member of Council; and its Transactions contain an elaborate paper by him on coal mining in Nova Scotia, giving in detail the systems ot working, hoisting, pumping, etc.

Mr. Gilpin was married in 1875 to Florence Ellen, daughter of Lewis Johnstone, Surgeon, Albion Mines, and has three children.

Of untiring industry and unequalled integrity and honor, an ardent lover of geologic science, a trained and competent engineer, Mr. Gilpin combines in ample measure those sterling qualities which contribute so largely to the material well-being and prosperity of the mining community in which he takes so conspicuous a place.

The subject of our next sketch will be Mr. H. S. Poole, General Manager of the Acadia Coal Company at Stellarton, Nova Scotia.

Au Revoir.

During the last few days the Geological Survey has suffered a severe loss in the resignation of Dr. A. C. Lawson, one of its most efficient officers, who has gone to Vancouver to begin independent work as consulting geologist and mining engineer.

Dr. Lawson is a gold medalist in Natural Sciences of Toronto University, and a Doctor of Philosophy of John Hopkins University in Baltimore, and in 1882 accompanied Dr. Bell across the plains of the North West in his expedition to the Athabasca river.

Since that time he has been engaged in unravelling the geology of the Archæan plexus on Rainy river and the Lake of the Woods, and the results of his labours are published in the Annual Reports of the Geological Survey for 1885 and 1887-8, while another report on an adjoining area is shortly to appear.

In the summer of 1888 he attended the meeting of the Universal Geological Congress held in London, England, at which the origin of the Archæan gneisses and schists was one of the principal objects discussed, and his able paper there, read before the geologists collected together from all quarters of the globe, proving the intrusive character of many of the basal Archæan gneisses, placed him at once in the first rank among the scientific men of the day. He is also the author of many other papers and memoirs, all giving evidence of close observation, extensive research and deep thought.

Being an expert mineralogist, and an easy and accurate writer, he is eminently fitted to assist in developing the great natural mineral resources with which British Columbia is so richly endowed, and his sterling integrity and independence will soon recommend him to all with whom he may be brought in contact.

Dr. Lawson carries west with him the best wishes of a large circle of friends and admirers, not only in Ottawa, but throughout America and Europe.

The Mineral Production of Nova Sotia in 1889.

The Annual Report of the Commissioner of Public Works and Mines is to hand, and. as usual, contains a mass of information respecting the provincial mines of great interest and value to the general public. From the returns furnished to the Department, we find that there is an increase in the yield of eight, and a decrease in the production of nine of the minerals recorded in the report for 1889. Of gold there has been a yield of 26,155 ounces as against 22,407 in 1888, or an increase of 3,748 ounces; iron ore, 45,907 tons compared with 41,611 tons in 1888, an increase of 4,296 tons; manganese 67 tons as against 88 tons in 1888, decrease 21 tons; coal raised, 1,756,279 tons against 1,776,128 tons, decrease 19,849 tons; coke made 35,565 tons, as against 29,808 tons, increase 5,757 tons; gypsum exported 147,344 tons, against 125,800 tons, an increase of 21,544 tons; grindstones 18,000 tons, against 17,225 tons in 1888, increase 775 tons; antimony 55 tons, as against 308 tons, decrease 253 tons; limestone 19,000 tons, against 15,448 tons, increase 3,552 tons; and an increase in the production of copper ore to the extent of 500 tons.

Wire Ropes.

In concluding an excellent paper read before the South Wales Institute of Engineers, Mr. T. H. Deakin said:—It would appear that the wire required to make a good rope must combine strength and toughness; but no hard-and-fast rule can be laid down as to the make of ropes for indiscriminate use, and I find the better plan in asking quotations for ropes is to give the makers the exact conditions under which the ropes will have to work—whether in a downcast or furnace-shaft; whether the pit is a wet one; size and form of drum, and the pit-head pulley, the load, and the speed at which it is lifted. A respectable firm will then, for its own reputation's sake, give the benefit of its experience, and suggest a make likely to yield the best results under the special circumstances of working. Some years ago I took charge of a colliery where it had been customary to use 4 in. circular iron wire ropes working off an 8 ft. diameter drum. The average life of the three last ropes used was, in the upcast shaft, six months eighteen days, and in the downcast eight months sixteen days respectively. We adopted two three fourths in. circular improved plough steel wire ropes in lieu of the larger iron ones, and the average life of the three succeeding ropes has been for the upcast fourteen months six days, and for the downcast twenty-five months fourteen days; the cost at to-day's prices of the iron ropes being 3s. 5·60d. per fathom, and of the plough steel ropes 4s. 11·75d. But tho steel ropes lasting more than two and a half times the life of the iron ropes, made the comparison in cost in favour of the plough steel ropes, as say 5s. is to 9s. 1d. There were also other advantages in using the plough steel ropes: (1) They gave one-eleventh greater breaking strain; (2) the engines had less than half the weight of rope at the "lift;" (3) when taken off the shaft they could be used for haulage purposes, whereas the large iron ropes were done with. It was therefore clear that the wrong make of rope had been used on so small a drum. Speaking generally, it may be taken that after providing ample strength, then the lighter the rope the better. This is sometimes objected to because small wires are ordinarily used in the smaller ropes, and there is therefore less wear in them; but this need not be. I remember a case of a long underground incline where the gradient was so little that the empty tubs would scarcely take down the rope, and where, on this account, it was necessary to have as light a rope as possible. It was also necessary to have a medium-sized wire, for the road was a wet and dirty one, causing a good deal of rubbing. For this work a rope was made of four strands, thus allowing of a fairly large wire to be used in a small rope. I would not, however, recommend using ropes of this make, except under some such circumstances as the above, for with four strands the rope is not as uniform in shape, nor can it be as easily or firmly spliced, as when made in the ordinary way. Ropes are made either flat or round, and these are again divided into "ordinary make," such as those first in use, or "compound" ropes. An "ordinary" made rope is understood to be a six-strand rope with six wires in each strand. A "compound" is made with wire cores in the strands, such as a six-strand rope, with eight or more wires outside and a wire strand for core. For winding purposes, if the ropes are made of the old construction, a rope six strands of nineteen wires will be found to give good results. If the rope is made "Lang's lay," fewer and larger wires may be used, and ropes six strands of seven, eight or nine wires with wire cores do excellent work. When wire cores are used they should be made of annealed wire, so as to allow for the stretching of the strands when under load.

LETTERS TO THE EDITOR.

Phosphate Analysis.

TORONTO, April 17th, 1890.

The Editor:

SIR,—With reference to the vexed question of phosphate analysis, and different results obtained by buyers' and sellers' chemists respectively, the solution of the trouble is not a difficult one. I would suggest the appointment of a Government Inspector and Analyst, say at Montreal, whose duty it would be to grade all phosphate that is offered in the market; and all contracts to be made on the basis of his report and certificate. This would be the most satisfactory way of selling for the Canadian miner and equally fair to the broker.

There is a Government Inspector at the port of Montreal to grade wood ashes, and why a similar officer has never been appointed to guard the interests of the phosphate trade—of vastly greater importance than that of wood ash—is a mystery. United action on the part of mine owners would rectify this neglect in a very short time.

A. S. THOMPSON, M.D.

MONTREAL, April 18th, 1890.

The Editor:

SIR,—I have read Dr. Francis Wyatt's "intemperate and illconsidered denunciation" in the March REVIEW with considerable amusement. Dr. Wyatt is evidently very angry because Capt. Adams and I have dared to speak disparagingly of Maret's method for the estimation of phosphoric acid; and because I explained that it had been almost universally superseded by the Molybdate method. Dr. Wyatt presents a *selection* of figures from his laboratory note book, remarking "the figures speak for themselves." What do they say? What bearing has this selection on the question whether the Maret or Molybdate method is the one generally used by chemists in estimating phosphoric acid? One is forcibly reminded of the three tailors of Tooley Street, who began their petition, "We, the people of England"—

If Dr. Wyatt objects to what I have written concerning the widely extended use ot the Molybdate method let him lay aside rhodomontade, let him ascertain what method is adopted by leading English, German and American chemists; let him disprove my statements if he can.

J. T. DONALD.

Mr. J. Lainson Wills, who left for London in the beginning of the year, is now *en route* to report on certain petroleum sources in Trinidad, Venezuela, and Ecuador, (S.A.), where he will in all probability be located for the next three months. Mr. Wills writes that when he left London the Phosphate Trust was fairly in the way of becoming serious and practicable, "but when it *would* be in activity and life was uncertain."

PHOSPHATE.

In General.

Mr. E. D. Ingall, with Mr. James White and party, will shortly resume their work on behalf of the Geological Survey in the phosphate region of Ottawa County. Last season, the geological work was found to concentrate itself chiefly on the broad and extended belt upon which are the considerable excavations of the Crown Hill, High Rock and Star Hill mines, time being also found to similarly investigate for some distance the belt on which are the openings of the North Star mine and adjacent properties, at which latter point, the belt being narrow and the bush and surface cover having been more thoroughly removed by clearance and bush fires, better facilities were afforded than elsewhere for acquiring the necessary data. "In this way," writes Mr. Ingall, "it is hoped to obtain a few thoroughly worked-out examples, which may serve as illustrations of the numerous similar belts in the surrounding country, and of their nature, associations and habits, thus possibly adding something to our stock of knowledge of the pyroxene belts and the associated apatite deposits. Such systematized knowledge, systematically applied, must necessarily be the basis of all intelligent mining ventures."

Freights.

Every preparation is being made for the resumption of ocean shipments, the port of Montreal at date of writing being entirely clear of ice, and the river, further down, fairly open. Our quotations for ocean freights are: Liverpool and Glasgow—Regular liners, 6/3; outside steamers, 5/-. Business is being done at these figures, although several outside steamers have been booked at 7/-. London—By regular liners, 10/-; no outside tonnage has yet been offered. Hamburg—Business is being done at 15/- over the season.

Markets.

Business has been done for German account at 1/4½ on 80% with rise. English manufacturers have not as yet paid this price. The lower grades are keenly feeling the competition of the Osso phosphates. English prices for phosphate may be quoted at 1/- for 70% and 1/3 and 1/4 for 80%, with 1/5 per unit rise. The market is a little less firm owing to the expectation of a supply of Florida phosphates from the newly discovered beds, but much uncertainty exists as to the early availability of these deposits, and as to their average quality.

Templeton District.

At the McLaurin, work has begun on three different shanties; about 75 men will be employed here from this out.

The Blackburn mines, operated by the East Templeton District Mining Syndicate (Limited), are turning out a large quantity of ore.

Lievres District.

Mr. Walter Pickford, who has returned from his visit across the water looking hale and hearty, reports that mining operations at High Rock will be pushed with the utmost vigor. A new Ingersoll 5-drill compressor, additional boilers, and other plant is being added, and we may look for a substantial increase in the production from the pits of this company. A little over 3,000 tons will be ready for shipment by opening of navigation.

The pits of the Canadian Phosphate Co., although still troubled with water, are yielding excellent outputs.

Mr. S. P. Franchot, of the Emerald, arrived home from the other side on the 17th inst.

There will be sold at the office of Registrar for the County of Ottawa at Hull, on 27th May next, by order of the Sheriff, the phosphate lands owned by "La Société Française de Phosphate du Canada." The properties comprise:—In the township of Portland East: Lot thirteen (13) in the first range; west half of lot two (2) and north half of lot three in the second range; west half of lot two (2) and north half of lot three (3) in fourth range; lots eight, nine, twenty-two and twenty-four (8, 9, 22, 24) in the sixth range; lots seven, eight, nine, ten and twenty-one (7, 8, 9, 10, 21) in the seventh range; lots six, nine, ten, eleven sixteen, seventeen and thirty (6, 9, 10, 11, 16, 17, 30) in the eighth range; lots four, five, nine, eighteen, nineteen, twenty, thirty, thirty-one (4, 5, 18, 19, 20, 30, 31) in the ninth range; and the mining rights existing on lots one and two (1, 2) in the third range, the south half of lot one (1) in the fourth range; on lots three, seven and ten (3, 7, 10) and north part (39 acres) of lot one (1) in the sixth range; on lots twenty-seven and twenty-eight (27, 28) in the seventh range; on lot twelve (12) in the eighth range; on lot seventeen (17) and the south part (75 acres) of lot sixteen (16) in the ninth range. In the township of Portland West: Lot twenty (20) in the fourth range, and the mining rights on lot three (3) in the tenth range.

It is reported on very good authority that Mr. George Stewart, now in London, has been successful in placing the Brazeau property, in conjunction with his lots at the High Falls, at a good figure, and that arrangements are being made on this side for an early commencement of work.

Kingston District.

Mr. Adolph Lomer, of Montreal, has acquired from the Anglo-Canadian Phosphate Co. the Bob's Lake mines in Bedford, Ont. A steam tug has already been transported to Bob's Lake: and a barge is in process of construction. This fine property will thus be made readily accessible in summer as well as in winter, and it is intended to put a strong force immediately at work to produce phosphate.

Mr. Lomer has also arranged with the Anglo-Canadian Phosphate Co. to work their Battle Lake mines in Templeton, P.Q., upon royalty.

The Anglo-Canadian Phosphate Co. has discontinued contract mining at the Otty Lake mines in North Burgess, Ont., and has resumed the system of days' work under the charge of Mr. Robert Cordick. They have been so fortunate as to strike several new veins at the outset of the renewed efforts, one of which shows a width of over ten feet of solid phosphate and others have a continuous breadth of three or four feet. Over three hundred pits have already been opened on this property, and it seems that the surface workings are still in good supply.

The Foxton mine is turning out phosphate in large quantities, and will employ about 50 men during the season. The shafts are being worked with steam drills day and night and a third shaft is being sunk.

MINING NOTES.

Nova Scotia.

Miscellaneous.

The next regular meeting of the Gold Miners' Association of Nova Scotia will be held at the Halifax Hotel on Tuesday, 6th of May, at three o'clock in the afternoon. At this meeting will be presented the report of a special committee appointed at the April meeting to devise ways and means for utilizing the Association, and the recommendation of this committee will be brought before the meeting for immediate action. It is understood that the report will deal with the re-organization of the Association in a radical and very important manner.

The output of Limonite ore from the mines of the New Glasgow Coal Iron and Rail Co. at Springville is estimated to have been about 3,000 tons.

From Londonderry, the returns show 40,823 tons extracted.

At Brookfield, Colchester, about 1,700 tons were mined for use at Londonderry. The vein was found too narrow going east, but going west it was proved to have a thickness of at least 30 feet.

The Eastern Development Co. at Colchester are building a railway and smelters. The county of Cape Breton has released the company from taxation on all real and personal property for 25 years. Below ground the shaft has been deepened about 50 feet, and more cross-cuts driven, which have proved the continuation in depth and quality of valuable veins. The ore extracted in the underground levels has been dressed, and the quantity now in stock is about 2,000 tons.

Durlng the past summer two companies began to work the iron ores ot the East River of Pictou. One of these, under the management of Mr. H. V. Leslie, of New York, has begun the construction of a railway from Sunnybrae to New Glasgow, which is projected to extend to the harbour of Liscomb, on the Atlantic coast. The second company, under the management of Mr. Graham Fraser, of New Glasgow, has also surveyed a line of railway from the iron mines of the I. C. R., near the fork of the East River, and vigorously pushed the development of the mining areas. The mining has been done on a large vein of excellent limonite, which follows the contact of Silurian and Cambro-silurian rocks with carboniferous limestone in the valley of East River.

Fifteen Mile Stream.

The Egerton Co. under the new management is pushing work. The new compound condensing engine, tandem type, built by I. Matheson & Co., of New Glasgow, is on the ground ready for erection, and extensive alterations in the surface are under weigh. Mr. Jas. A. Fraser, M.P.P., is the managing director of the new company.

Killag District.

Mr. Geo. Stuart has gotten out his supply of cordwood for the ensuing year and this month commenced active operations. The new lode discovered late last fall will be developed this summer. The paragraph on this district in the Mines Office report for 1889 (just issued) would lead to the supposition that a mill had been built last year; such is not the case, as the property has had a very good mill, equipped with the Nissen batteries, for several years.

Lochaber District.

Reports from this district are most discouraging, it being evident that the ores, whether assaying well or not, are free from milling. The management of the property is in good hands, but is handicapped by the character of the deposit.

Beaver Dam District.

Mr. Turnbull and associates have gotten out the timber for a new mill of the Homestake type, to replace the old Yeadon mill. It is understood that the order for the machinery has been placed, and that the work of erection will begin this month.

Salmon River District.

The lode in this famous mine has pinched somewhat, but has been enriched in consequence, the returns for March showing 173½ ounces from a little over 400 tons, or an average yield of about 8½ dwts. per ton. The Mines Office report for 1889 is also in error as regards this district when it states that the plant is giving satisfaction; on the coutrary, the mill is to be remodelled, as are also some parts of the mining plant. It is understood that the services of Mr. Wm. MacPherson, the veteran millwright, have been secured.

Whiteburn District.

So far this year this district has produced only 93 ounces, coming from the Graves mine. The new management here is busy in getting the property into working shape, and is changing over from underhand to overhand stoping as fast as possible.

Goldenville.

Mr. Robt. McNaughton has discontinued work in this district, and at present has a small force working on the middle lode at Wine Harbour.

Stormont.

On Thursday, the 31st of March, work upon the Palgrave Co.'s property on Hurricane Island, was closed down indefinitely. On Friday morning at 9.30, under the personal direction of Mr. H. K. Fisher, the president of the company. the work of removing the entire surface plant was commenced, and by 7 p.m. that day the entire pumping and hoisting plant, with all the buildings, had been removed. On Saturday, the old mining leases were surrendered and new ones obtained, and before midnight that day Mr. Fisher had effected services of arbitration notices on a majority of the parties claiming surface rights on the island

This action was the result of a prolonged litigation as to the ownership of the surface rights, etc., and is, we

believe, the quickest piece of dismantling work on record in Nova Scotia.

The company have a fine property here, and will rebuild a very superior plant just as soon as the question of damages can be settled.

Pictou County.

At No. 1 and 2 Slopes of the Intercolonial Coal Co., work has been for some time attended with some degree of danger, owing to a "creep" which seemed to imperil the safety of some portions of the mine. "I am of opinion that the danger of that is past, as no indication of any serious nature has been seen for the past few months in the year, and a large percentage of coal is now being successfully won. The air is kept well up to the workmen, of which a very large volume circulates in this mine."

Work has not been carried on to any large extent at the Scott pit. During the latter portion of the year twelve men were started to work with a view to pierce through a fault in the east side, and there test the quality of the coal. This was done, and the coal proved satisfactory, the fault being an upthrow of some 16 or 18 feet. Since that time no work has been done.

The Acadia Slope (Acadia Coal Co., limited) is now down a distance of 3,560 feet, a new lift having been sunk this summer of 440 feet. A considerable quantity of gas is met with in this lift, but every precaution, as hitherto, is taken to guard against every possible accident. No powder is used in the new lift or in any portion of the mine. A new overcast airway, as well as air returns, are completed, and a steady flow of air circulates freely round the different portions of the mine. The air and regulations were all that could be desired.

The McGregor pit has been kept steadily to work all the year, and the workings extended to the deep. The North Slant, which is down now a distance of 2,760 feet at the top dip at an angle of 16°, and at the bottom 25°. Pillar working, which in all mines is attended with danger to the immediate workmen, has been prosecuted successfully, and a very satisfactory percentage of coal is being had.

The English Slope (Cape Pit Seam, Stellarton) is down about 1,700 feet. During the latter part of the year some gas has been met, and, in consequence, safety lamps are used. In the distance gone down two-fourths have been encountered in the coal measures.

At the Foord Pit, after much perseverance and difficulties, they have succeeded in clearing the bottom of the Square Pit, and their large pump is now in effective condition. Very serious obstacles have been met and overcome in doing this much, and we trust that ere long this fine mine will again be in working order.

At the Vale colliery, Thorburn, improvements have been made during the year in the air passages by making connections between 1,600 feet level and 1,800 feet level, thus decreasing the distance air has to travel, and consequently increasing the air current around working faces.

Mr. Madden describes the operations at the Black Diamond as follows:—"In January they began drawing the pillars to the rise, and extending the bords westerly to the dip, and subsequently began drawing the pillars in the lower lift. At present it is all pillar work, which is being done very well. The tunnel mentioned in last report driven to test uuderlying seam was driven about 120 feet, when they struck some heavy feeders of water, they then stopped driving and put up a wooden dam three feet thick to prevent the water escaping into the workings, as they connect with the Acadia mine and were causing them trouble and expense to keep the water out. The wooden dam proved too weak to sustain the pressure, which is calculated to be about 300 lbs. to the square inch. A brick dam 2 ft. thick with 16 inch of a curve was subsequently built and likewise proved too weak. A third dam is now under course of construction; it is built in two sections. The inside section is 16 inches thick from pavement to 3 feet high, thence 12 inches thick to roof 5 feet; a space of three feet is left when the outside section is built three feet thick. Clay is rammed in the space between the sections."

Cumberland County.

We are indebted to the Annual Report of the Commissioner of Mines for the following extracts referring to the operations of the various collieries during last year:

The production of the Springhill Mines was 425,149 tons. The fire in the Syndicate Slope was successfully extinguished by damming water up against it. It is proposed to utilise it for the presen as an up-cast and travelling road. The New or No. 5 Slope shows the turn of the measures toward Amherst. It is now down about 1,200 feet, and the levels going north show coal of good quality. It is reported that not far from the north-west corner of the old General Mining Association's area, a coal outcrop has been found. If it dips toward Springhill it will complete the structure of a basin. If the dip should be northward, the Springhill Basin is either complete or the northwardly dip of the crop would show that there is in Springhill a basin subsidiary to the great basin of the coal-field. As these mines give off more gas than in former years, the management are introducing safety-lamps at several points.

The sales to the Province of Quebec from this county were 177,461 tons, compared with 182,927 tons during the year 1888.

In April, at the Joggins, they began sinking a new lift in the slope, and also drove a place to surface from the top-lift for an airway. They are now down a distance of 600 feet, and have levels driven in some distance, and a back balance completed. In extending levels on 1,500 feet lift they crossed three dikes or troubles in the coal measures, two down—throws and one up—throw. The coal is now pretty well extracted from the old lift, and owing to so many faults on the 1,500 feet lift, the output of coal has been retarded. The work is now in fair order, and we may reasonably anticipate the output to be materially increased next season.

The management of the Chignecto Colliery have driven a plane from the present lower lift out to the surface on the east side of the mine, inside the old original fire, and are using it as a return airway and travelling slope, and during the latter portion of the year have begun operating on the east side of the mine. Some small fires during the year have originated from spontaneous combustion, but have been all built off and appear to have died out. They have been extracting pillars, but the angle or dip of the coal being so steep makes it a rather difficult job in this mine. Ventilation has been always satisfactory.

Mr. Hall, who for 16 years has successfully managed the Springhlil collieries, Nova Scotia, has resigned. Under his careful management these collieries have been well developed. It is understood that he will still reside in Springhill.

Cape Breton.

The total sales in 1889, as per Mr. Neville's official report, were 751,997 tons, against 738,250 tons in 1888, and 715,442 tons in 1887.

The home sales were 700,182 tons, compared with 190,508 tons in 1888.

The sales to Quebec were 381,074 tons, against 381,012 in the year previous.

At the Sydney mines the management are fitting up a new underground forcing pump of 36in. cylinder and 5ft. stroke to force the water from pit bottom in one lift of 700 feet to the surface, and thus take the place of the large Cornish set of pumps. A stone engine house with arched brick roof is being built at the pit bottom for this pump. On surface, tressel work is built to the outer side of the coal yard, and an apparatus put up by which the tubs of coal for banking are drawn out to the bank by an engine. A screen is erected for screening the coal on the outer side of the heap, and a branch railroad to this screen from the main line.

At Victoria mines work was brisk during the whole of the season. West levels were extended 550 yards, and the east levels, 450 yards. East slope has been straightened and graded. The length of the slopes at present from the surface to the low levels is about 1200 feet. A new Blake pump has been placed at the bottom of the lower lift, which discharges to the upper pump and lodgment. Its dimensions are as follows: cylinder 15 inch, 12 inch stroke, 6 inch plunger, calculated to throw 130 gallons per minute. A new trolly has been made and placed on the slopes for the men to ride on, ten at a time. The management say they intend to put another on, so there will be one for each slope. The screens and bank have been roofed and covered in.

At the Reserve mines the east slope has been driven three hundred and ninety-six feet down, and levels turned off. North level driven six hundreed feet, south level driven five hundred feet. In the main or west slope fifteen rooms were worked, some of them driven to the barrier. Six pairs of men to the rise of this were kept splitting and drawing pillars. The old furnace has been pulled down and a new one built in place of it, which is about six inches wider and higher than the old one. The management say that it is their intention this winter to drive the east slope down six hundred feet further in order to gain another lift.

The coal at the Intercolonial seems much improved, being more free from impurities and the seam thicker. In order to test the Ross seam under this area, a slope has been driven into the crop of it about one hundred feet. The coal is five feet seven inches thick, and appears to be a good quality.

There has not been much change in the workings at Little Glace Bay, except that the levels on the north side have been driven about five hundred feet into the Campbell area, which they now control. Also, the level on the south side of the pit has been driven five hundred feet. On surface, a new locomotive shed has been built, and the railroad wide-guaged from pit to wharf. New four and a half ton cars built and put on the track instead of the pit tubs. The bank and screens have been roofed and covered in. A new shed for a saw-mill has been built, and a steam saw-mill placed therein.

At the Caledonia, work has gone on as usual both at the dip and rise; dip levels have been extended on the east and south side, and rooms worked off; a few pillars have been split and drawn from the south side of the rise workings. On surface, a new No. 3 Manville windmill and Starr pump has been placed over a well twenty chains north from pit, which supplies the reservoir with water and gives good satisfaction.

The main dips of the Gowrie mines have been driven down 750 feet, which now makes them, 1,800 from shaft level; from that point levels are turned off east and driven 900 feet. Also the west levels from the upper dip have been driven 300 feet, which makes it about 1,800 from the landing. A pair of slants is being driven from the level to come out on the west level near the pit bottom. The coal from the west side is to be drawn up this slant this season; a new pump has been placed at the bottom of the low lift, which delivers water from there to the lodgement and pumps of No. 1 deep.

New Brunswick.

"Peat bogs are numerous and well developed near the bay of Fundy coast and in many places inland. Those near Musquash, Popelogan and Digdeguash Rivers are quite extensive. Lying just east of Musquash Harbor is a bog covering an area of 450 acres and 20 feet in depth, which is now about to be utilized in the preparation of "moss litter." This in an article used in stables as bedding for horses. Owners of studs in the United States have for some time been looking for a material for this purpose sufficiently light and porous to be an absorbant of the liquids, moisture and ammonia which collect in stables, and which could afterwards be used as a fertilizer in gardens, &c. A few capitalists from St. John, St. Stephen and other places have formed what is known as the Musquash Moss Litter Company, and having purchased this bog, are now erecting buildings and machinery there for the preparation of this article, which, it is claimed, is well adapted for the object intended, and as good as the imported European moss litter. The kind of peat used is not the upper or living peat, nor the deep-lying, decayed material, but that between the two, in which the mosses and rootlets are only partially decomposed, and which has the fibres nearly whole. The chief process in its preparation is depriving it of the water, of which it contains 90 to 95 per cent. This is done by a plunger, by pressing it between rollers and by evaporation. When thoroughly dried it is packed in bales for shipment, and is worth $15 to $17 per ton in the principal United States cities. This new enterprise promises to be successful. This paragraph has been gleaned from Mr. Chalmers Report to the Department of Interior."

The same gentleman writes as follows regarding the Brine Springs and Salt deposits found at Sussex: "Brine springs are found at Sussex, at Salina, on Salt Springs Creek, and at Bennett's Brook, near Peticodiac. Five or six hundred bushels of salt per annum are manufactured at Sussex. This is all consumed locally, and used chiefly for table and dairy purposes. Several springs occur near the site of these salt works. A boring 125 feet deep was recently sunk at one of these springs—13 feet of it through surface deposites and 112 feet in rock. The object was to find the salt rock, but nothing of the kind was met with. The strength of the brine, I was informed, increased slightly till the solid rock was reached; beyond that it did not perceptibly change. At Salina an attempt was made some years ago to manufacture salt from the brine of the surface springs there, but was discontinued. Possibly a series of borings might result in improving the quality of the brine, but none have yet been made. At Bennett's Brook nothing has been done to utilize the springs there, to my knowledge. In all these places the

brine contains a considerable percentage of sulphate of lime or gypsum. There appears to be less, however, in that of the Sussex springs than at Salina or Bennett's Brook. The salt manufactured at the Sussex works is said to be of a superior quality."

Quebec.

Our latest advices from the asbestos districts show that unusual activity is prevalent at all the mines of Thetford and Black Lake. The raw material continues in strong demand, and supplies are insufficient to meet the wants and uses of consumers. Consequently a considerable advance on our last quotations has to be reported, one large producer having predicted that the prices for crude No. 1 will go as high as $250 per ton before the season closes. It would appear by this that the foreign trade is prepared to absorb the whole of our asbestos production at profitable rates. Additional and improved machinery, and largely increased working forces are notable at most of the mines, and with favourable weather there should be a large advance in the year's production.

There are four copper pyrites mines in this district actually in working operation now, viz., the mine of G. H. Nichols & Co., of New York, the Eustis mine at Capelton, and the Moulton Hill and Howard mines.

The Nichols and Eustis mines have been producing for a term of years; they produce a grade of pyrites which burns freely, and is well adapted for the manufacture of sulphuric acid.

The Moulton Hill and Howard mines have been opened up within the last year, and the work has been mainly development.

At the Howard mine, shafts have been sunk, and drifts and cross-cuts made to a depth of some two hundred feet, and a large amount of ore opened out, which will be broken when the developments are sufficiently advanced.

At the Moulton Hill mine about the same amount of work has been done, and in addition a plant has been erected, calculated for raising, dressing and shipping from 100 to 200 tons of ore daily. The ore-ground is as yet broken except incidentally in the shafts and drifts. The shipments of the company to date from ore incidentally met with amount to some 2,000 tons.

Ontario.

The Bill respecting mining regulations and also that amending the General Mining Act have both passed their third reading. A third Bill respecting mining claims, (having relation to staking off mining claims,) was withdrawn after its second reading, as it is desired to make it more extensive, and to embrace matters not now included in its present shape. It is desired, also, to have the benefit of the report of the Mining Commission before dealing with that subject.

We learn from Dr. Bell, one of the Commissioners, that the Report of the Royal Mining Commission will not be issued for at least two weeks yet. Surely, after so much tinkering, we may expect something good and to the point. Let us hope so.

Mr. H. P. Brumell, of the Geological Survey spent a portion of last season in a visit to the counties of Welland, Lambton and Essex, in all of which drilling is being actively carried on. In his preliminary report he describes these workings as follows:—

In Welland county a company has been in operation since the month of June last, and had, at the time of my visit, completed one well, which attained a depth of 846 feet, and had begun a second. From the first well a flow of gas of $1,000,000 cubic feet had been obtained, though subsequent to my visit this well was shot, and the flow increased to about 1,750,000 cubic feet. An accurate log and specimens were obtained of this well, and also of others in the Niagara Peninsula. In August last eight wells had been completed in the Peninsula. Of these, three are at Port Colborne, two at Niagara Falls South, and one each at Thorold, and at St. Catharines and in the township of Bertie. A very small flow of gas was obtained in the well at St. Catharines and at Thorold, while from the wells of Port Colborne there is a total production of about 50,000 cubic feet per diem. It is understood that the burning spring at Niagara Falls is being supplied with gas from one of the wells recently sunk at that place.

At Bertie and Port Colborne the gas was obtained from the upper beds of the Medina formation, which is reached at these places at a depth of 735 feet respectively. At Niagara Falls the gas comes from a depth of 201 feet, at which depth the bore is in the lower beds of the Niagara shales, while at Thorold and St. Catharines the flow is obtained from the lower part of the Trenton series, in the former place at a depth of 2,394, feet or 489 feet in the Trenton limestone, and at the latter in a sandstone at a depth of 2,185 feet, or 13 feet below the limestones of the Trenton series.

Two more wells have been drilled in the townships of Birtie and Humberstone, to a depth of 851 and 836 feet respectively, having a flow of gas of about 500,000 cubic feet per idem each, the flow in both cases being from the Medina sandstone,

In Lambton county the oil fields of Enniskillen township are still being extensively drilled upon. A number of drillers living in Petrolia and Oil Springs were interviewed, and logs and information regarding wells throughout the province were obtained from them.

In Essex county exploration for gas is being continued, It has, however, been obtained in quantity but in one well, namely, "Coste No. 1," which has a daily flow of 10,000,000 cubic feet. This well, drilled to a depth of 1,031 feet, is situated in the township of Gosfield, lot 1, concession 3, eastern division. Wells had recently been completed at and near Kingsville and at Comber, and drilling was, in September, being carried on at Amherstburg, Essex Centre, Marshfield, Kingsville, Leamington and Blytheswood. The well at Marshfield, being sunk for Messrs. Walker & Sons, of Walkerville, will be watched with considerable interest, as it is the intention of the firm to carry this drilling down as far as the Trenton limestone.

Sudbury District.

By recent changes in the United States Tariff Bill, nickel ore is admitted free into that country. This will please Mr. C. J. Ritchie and his Ohio stockholders in the Canadian Copper Co. as well as the other concerns now operating the copper and nickel mines in this promising district.

Messrs. H. H. Vivian & Co., Swansea and Birmingham, England, who are operating here, are seeking Incorporation.

On the 4th inst., while a car load of rock was being hauled to the surface in one of the pits of the Canadian Copper Company, the cable snapped, precipitating the car with great violence to the bottom of the shaft and instantly killing three miners at work there. Accidents due to carelessness and negligence are far too frequent in some of our mines, and call urgently for an efficient service of Government mine inspection.

The Ontario Government has granted $1,000 to build a road to the north of Sudbury six miles, to reach the Dominion and Stobie mines, $1,500 to extend the road west to a French settlement at Chelmsford, and $1,000 to open a road from Whitefish Station seven miles to the timber limits on Lake Penago.

At the mines of the Canadian Copper Company mining development continues brisk. The Stobie track is now clear, and operations at this mine will be resumed at once on a large scale. The ore from this place is largely used as a flux for smelting.

At the Evans mine this company is putting in a new 10 drill Rand air compressor to replace the 6-drill Ingersoll. The new boarding houses at this mine are now fully occupied; they are well laid out, commodious and comfortable. The rock-house—one of the best in Canada—was brought from the Calumet and Hecla mines. The output runs from 90 to 100 tons per day, and average from 8 to 10% copper and from 3 to 4% nickle. It is first brought to rock-house, where it is crushed and sorted, then dumped into bins and taken to the roast-yard at smelter and roasted.

At Copper Cliff the ore in 5th level west continues rich and in large quantities, it being estimated that quite 3,000 tons of 12% Cu. and Ni. ore are in sight in this new level. A new compressor will shortly be added to the plant at this well equipped mine.

At the suggestion of Capt. Jones the diamond drill was set to work at a point about half a mile from this mine, and the results of the operations have been extremely favourable, proving beyond doubt that the virgin ground contains even richer deposits of nickel than that now operated. The new find has been named the "Great Jones Mine," after Captain Jones. The drill is still boring.

Both smelters have been shut down for a week in order to admit connections of blast pipes to one engine, thereby saving fuel and use of extra engine. At date of writing the company has just shipped 6 cars of matte in bulk to Joseph Wharton, of Philadelphia, the large nickel refiner.

Mr. Duncan McIntyre and a number of gentlemen connected with the Dominion Company visited their mines and works during the month, and expressed their approbation of the progress of operations there. The management are carrying in their coke by rail, and will soon be ready to commence smelting.

The Murray mine (H. H. Vivian & Co, Swansea) is making slow but steady progress in development.

Rat Portage District.

The building of the new reduction works at Rat Portage proceeds apace, and the engines are now being placed in position. A number of American capitalists are in the district with a view to securing claims.

Port Arthur District.

The action of the Ontario Government in placing the sale of mining lands in the hands of the local agents will be a great boon to the investors and explorers, who will now be able, on arrival here, to learn exactly what lands have been taken up and what lands are available for entry, and be able to conclude on the spot all transactions necessary to secure a title.

The Torrens title system, we understand, has also been amended so as to accommodate the requirements of our mining districts.

The railway into the mining region is getting well into shape, so that in a few weeks trains will be running from Port Arthur direct to the famous Beaver and Badger mines, and by 1st October to Silver Mountain. Everything is being done to expedite matters as the waggon roads are at present well nigh impassable.

The rush of prospectors has begun unusually early this spring, many having already gone out, although the snow is still deep in places. The iron fields are at present attracting the most attention, and commencement of work on the branch line of the C. P. R. to the Atikokan iron range will doubtless creae at rush into that valuable gold and iron section.

The Badger mine is working an increased force and continues shipping high grade ore. Better results will doubtless follow the improvement of the stamp mill, and the operations of the air compressors are now being arranged for. Drifting is being carried on westward on the lower level, and is now in 300 feet in the shaft. The vein increased from 4 feet at the shaft to 7 feet at the drift, and is carrying good pay ore, composed of blende, argentite and native silver. As soon as the compressed air plant is installed, the working force will be largely increased. At present seventy men are employed.

On 9th inst. a deputation consisting of Messrs S. J. Dawson, M.P. Conmee, M.P.P. Senator Clemow and others waited upon Sir John Macdonand, and urged a grant to aid in the extension of the last 15 miles of the P. A. D. & W. Ry. Sir John promised to give the matter careful consideration. As soon as it is absolutely known that aid has been granted by the Dominion Government for this much needed branch, work will commence on at least six of the different gold lodes in that section of country.

Capt. Hooper, of the Beaver mine, is making preparations for stoping out the 20,000 tons of ore now in sight. The engineers are pushing the repairs to the mill, and expect to have everything in readiness to start it up by the 15th of April. Its capacity is ten head of stamps, and will be doubled about the 1st of May, and if the developments turn out as they are expected to at the North Bluff vein its capacity will be trebled. The increased amount of water necessary for its increased capacity will be brought by syphon from a lake on North Bluff as soon as the mill starts. The force of miners will be largely increased, and there are facilities for hoisting 30 tons of ore per hour. The shipments during last month are expected to realize $20,000.

The Shuniah Weachu Mining Co. held its annual meeting last February. and the report shows a more prosperous condition of affairs than in 1888. Shipping of rich ore still continues, and the dumps are accumulating an enormous quantity of mill rock.

The West End Co., although in very rich ore, are working only a small force, which they are arranging to increase so soon as the roads improve or the welcome whistle of the railway engine is heard.

The Elgin mine still continues in rich ore, and is steadily advancing in favor.

The Crown Point mine is making good progress, and the ore continues to improve.

The Silver Glance and Mink Mountain mines are reported to have been lately bonded to Belgian and American syndicates for large sums.

The Star, Stirling, Black Hawk, Medicine Bluff, Lone Pine, Y4, are all being developed, and although only in their infancy are attracting considerable attention —showing up well in silver.

The Murilla mine pumps being unable to overcome the rush of water, the mine has been temporarily closed down.

The copper deposits in Blake Township so ably referced to by Dr. Lawson, late of the Geological Survey, in the *American Geologist* for March last, are showing up better as developments proceed.

Several bids have been received by parties holding mine properties, and the Black Bay lead and silver deposits will this spring be actively worked.

The following are the Custom House returns of silver exports from Port Arthur for quarter ended 31st March, 1890:—

1890.	Silver Ore.		Total.
January.....	27 tons	$18,050	$18,050
February	1 "	1,525	1,525
March.....	.....	100	100
So far as rep't d			
Total.....	28 "	.....	$19,675

North-West Territories.

From returns received by the Dominion Lands Agent's, the member of applications for Coal Lands during the year 1889 was 125, and 26 of the applicants were given the privilege of purchasing, within a specified time, the location for which they applied, and 43 of the applicants were given permission to prospect thereon. Only two of them bought the land applied for, or a portion thereof, and 4 of the applicants being homesteaders were permitted to mine coal by paying 5 per cent. royalty on coal mined.

The revenue for the year derived from the sale of coal lands was $1,662.50, being $73,037.50 less than the previous year. The total area of coal lands sold up to date is 12,261.63 acres, and the total amount received therefor $126,171.32.

Ten leases for twenty-one years were issued in 1882 and 1883, of land within the Souris Coal District, but as the lessees had not complied with the provisions thereof these leases have been cancelled.

By an Order in Council dated the 11th of July, 1888, the regulations for the disposal of coal lands in the Province of Manitoba and the North-West Territories were made to govern the disposal of Dominion coal lands in the Railways Belt in British Columbia.

By Order in Council dated the 17th September last, several amendments have been made to the coal mining regulations, and provision has been made for the disposal of coal and other minerals under lands patented, the mining rights of which have been reserved. By the same Order in Council, all patents from the Crown for lands in Manitoba and the North-West Territories shall reserve all mines and minerals which may be found to exist within, upon or under such lands, together with full power to work the same. This is an extension of the Order in Council of the 31st of October, 1887, which made the same provision with respect to lands in Manitoba and the North-West Territories situated west of the Third Meridian.

Returns from the Dominion Lands Agents show that during the past year 41 entries were made for mining locations other than coal. The revenue from mining lands other than coal for the year was $184,15, received in payment for fees for entry, and for registration of assignments. The total area of mining locations sold up to date is 108,086 acres, which realized $5,406.50.

No amendments have been made to the regulations since October, 1887, with the exception that the regulations do not now govern the disposition of gold and silver under Dominion lands in the Province of British Columbia.

The North Western Coal and Navigation Company at Lethbridge has very considerably extended its operations by completing the shaft for hoisting, and making new galleries, levels or drifts, further switches, &c., so that although the output for the past twelve months may not have increased very considerably over the year preceding, the company is now in a position to increase its output to probably 1,000 tons per diem, and in a short time to double that quantity should the demand increase to that extent. It is anticipated that there will be during next season railway connection to the south, giving access to the reduction works at Great Falls, Helena, Butte and Anaconda in Montana, which will afford this company a large and profitable market for its coal.

Mining at Anthracite point has not until recently been pushed with the energy with which it was formerly conducted, the hesitation being caused by negotiations which have been going on with a view to disposing of this property to a strong English company. These negotiations have not yet been completed, and the present owners have for the past three months been pushing as vigorously as possible new slopes and galleries, so that in a year the output can he worked up to 1,000 tons a day if necessary. In doing this the output of the mine has been greatly reduced temporarily, but in the near future it can be increased. The present proprietors have unlimited faith in this property, and even should the negotiations referred to fail, there is no doubt that capital will be forthcoming to work the mine, and, in about one year, to quadruple its previous output. During the past season three new seams have been discovered at Anthracite, two of which, so far as one can judge from their present openings, are from five to seven feet in thickness and of first class quality. The third would appear to be thinner and possibly not of so good quality, but it has not been opened sufficiently for a correct idea to be formed.

At Stair, near Medecine Hat, two companies are in existence. The old mine at Stair, originally known as the Woodworth, subsequently the Stair coal mine, has, within the past few months, passed into new hands, and mining and shipping coal has been in progress to some extent. Opposite this mine, on the south bank of the river (South Saskatchewan), a company, known as the Medecine Hat Coal Mining Company, has certain land on which, during the past season, a shaft was sunk to enable mining operations to be carried on. No mining of any appreciable extent has, however, been done, nor can it be done with profit till a branch line of railway, some six miles in length, is constructed, connecting this point with Medicine Hat. The construction of this switch or branch the company states, will in the near future be proceded with.

The development or output at the Cochrane mines here formerly owned by Messrs. Chaffey and Vaughan and also by Mr. T. B. Cochrane, has in the case of the former been *nil*, in that of the latter not appreciable. A company has been floated in England with, it is reported, a capital of about half a million dollars to purchase and develop the properties of the latter gentleman at Cochrane, which, besides mining property, represent also some lumbering interests. This company has now a mining engineer from England making examinations as to the most economical means of development, and also respecting the establishment of coking furnaces, it being anticipated that next season will see a demand for coke for smelters to the west.

Considerable development has taken place near Canmore during the past season, and the number of seams which have been brought to light and their dimensions border on the marvellous. One cannot realize it without a personal inspection, and if late reports are reliable, the area of the coal basin in the Bow River, west of the gap, is very much greater than was heretofore supposed. The output has not been extensive; but sufficient explorations have been made to enable the proprietors to acquire a correct estimate of the quality, of the enormous quantity, and also of how to open out the works to the best advantage.

There has been considerable local excitement manifested on the east slope of the Rocky Mountains, north of the 49th parallel, respecting the discovery of petroleum; but development will be required to enable one to estimate the value of the discovery. In this connection it is worthy of consideration whether it is not advisable in the public interest that petroleum lands should be treated in the same way as coal lands: that is, sold outright at a fixed price per acre. The ordinary regulations requiring on each claim development equalling $5 per acre per annum does not meet the case. To put down a test hole means an expenditure of several thousand dollars; anything less would be a mere waste of labor and money, and no one will go to that outlay unless a considerable area be secured.

At two points on the Canadian Pacific Railway line, viz., Langevin and Cassils, gas wells have been in existence for nearly six years; the flow has not preceptibly diminished though the wells were piped for water not gas. The probabilities are that if thorough tests were made, combined with correct piping, it would be found that gas exists in sufficient quantity for fuel and lighting purpose. The impetus which the establishment of this fact would give to the progress of the district would be great.

The contract for sinking the new shaft of the North-West Coal Co., at Lethbredge has been awarded to Messrs H. and A. Kerr at $47.50 per yard. The site for this shaft is situated about three-quarters of a mile north of the station, and the shaft will be sunk three feet below the coal, about 300 feet altogether. The new air shaft is going ahead well. It is down now over 60 feet, and the windlass has been replaced by a gin worked by horse-power. Two more shafts are to be sunk, one an air shaft, almost immediately.

The Line of Railway to connect the Medicine Hat Coal Co. Mines to the Canadian Pacific Railway will be begun at once.

"Owing to the heavier fall of snow this winter, says the Edmonton Bulletin," it is not likely that the opportunities for mining on the river in the spring will be as favorable as last season, as the water will probably be higher. There will, however, be a considerable number of miners at work in any case, and no doubt if high water covers some of the bars so as to prevent their being worked it will prevent the working of others which could not be worked in low water. It is estimated that last season between $15,000 and $20,000 worth of gold dust was taken from the Saskatchewan, of which about $6,000 was taken from the immediate vicinity of Fort Saskatchewan. Several hundred dollars also were taken from the Macleod river, a tributary of the Artabasca, about 125 miles west of Edmonton, on the trail to Jasper House. The gold of Macleod is in even lighter flakes and is of lighter yellow color than the gold of the Sackatchewan. The skimmings of its bars are fairly rich, but it does not promise so permanent diggings as the Saskatchewan. Thomas Smith, of Edmonton, is now in Eastern Canada preparing to make another attempt at mining on the Sackatchewan by machinery. The attempts hitherto made have always failed, but as Mr. Smith has more practical knowledge of the requirements of the case than other promoters of like enterprises he has that much better chance of success.

Major Stewart reports that by the end of next month the anthracite mines at Banff will in all probability be in active operation again, mining having been suspended pending negotiations for the transfer of the company to the Englfsh syndicate. It is thought that the new machinery will be in place by that date, and everything in readiness for a renewal of active work. The new concern will be styled the "Pacific Anthracite Coal Co."

British Columbia.

Vancouver Island.

The coal exported from Nanaimo, Departure Bay, and Comox, was shipped principally to San Francisco and ports in California; other shipments were made to Oregon, Alaska, Petropavloski, Hawaiin Islands, China and Japan (per C. P. R. Steamers). H.M. Navy and U. S. War and Revenue vessels have been supplied with coal, and ocean mail steamers and other vessels calling for fuel.

The returns of the collieries show about 124,574 tons under the head of consumption in 1889, as against 115,953 tons in 1888; but it should be understood that the coal used in collieries is in most cases included in such returns.

The following statement of output and export of coal from 1887 exhibits a very gratifying rate of progress by the coal industry of British Columbia in the year 1889, viz:—

	OUTPUT.	EXPORT.
1887	413,360 tons.	334,839 tons.
1888	489,300 "	365,714 "
1889	579,830 "	443,675 "

The following comparative statement compiled by Mr. Archibald Dick, Government Inspector of Mines, affords a view of the standing of the provincial coal trade in its best market (the State of California). Mr. Dick is of opinion that the prospects are that the province will maintain the position which the superior quality of its coal commands for the future:

	1887. Tons.	1888. Tons.	1889, Tons.
British Columbia	324,949	345,681	417.904
Australia	155,649	271,612	408,032
England and Wales	91,248	126,167	32,890
Scotland	12,615	10,680	12,727
Eastern States	24,102	30,118	18,950
Puget Sound	569,710	568,948	372,514
Cow Bay and Mt. Diable	39,155	81,194	87,600
Japan	....	13,808	1,340
Total	1,217,428	1,448,208	1,351,957

Kootenay District.

The completion of the works belonging to the Kootenay Smelting and Trading Company inaugurates a new era of prosperity in the history of the interior of this Province. They are situated a short distance below the town of Revelstoke, convenient to the river for the unloading of freight from steamers, and have a sampling and smelting capacity of 100 and 60 tons, respectively. Without going into details, it may be stated that they are supplied with the latest improvements, and contain all the necessary appliances for the efficient prosecution of the work for which they are intended, with the utmost economy of labour. The best of workmanship has been expended on the buildings, which are of a substantial character, under the supervision of Mr. R. Litster. The officers are Dr. Campbell, manager, and Mr. F. Roeser, assayer, two gentlemen of long experience in the departments over which they preside, to whom mine owners can entrust their business with the assurance of being honourably dealt with.

Dr. G. M. Dawson, who was, last season, again occupied in continuing the geological exploration of the province, expresses the following opinion of the mineral wealth of the West Kootenay region:—"Speaking generally of the district, I may say that the result of my examination has been to convince me that the importance of the mineral discoveries made has not been exaggerated, while their number and the area over which they are distributed is such as to guarantee a large and continuous output of good ore so soon as an adequate means are provided for the transport of the product to the market. The majority of the ores met with are to be classed as silver ores, and in the vicinity of Hot Springs and Hendryx these are for the most part auriferous galenas, which, in a number of instances near Hot Springs, are decomposed to a considerable depth, forming so called 'carbonate ores.' These possess a certain value owing to the ease with which they are worked and their importance in the process of smelting the unaltered galenas. The aggregate quantity of such 'carbonate ores' to be found in the deposits already proved must be great, but all will no doubt pass in depth into sulphide ores.

"At Hot Springs or Ainsworth a truly remarkable number of metalliferous veins has already been brought to light within a very limited area, and additional discoveries are still being made from time to time even within this area. Near the lake shore the country rock is a coarse mica-schist which is overlain further back by green and grey schists, and these in turn are followed by limestones and black argillaceous schists, a mass of granite bounding the whole at a distance of two or three miles inland. In evident relation to the change in the country-rock is the circumstance that the ores improve almost uniformly in respect to content of silver in crossing the series of veins in a westward direction from the lake and rising higher above the lake-level. Some of the deposits associated with the limestones hold more or less native silver in a filiform condition, and very high assays are frequently obtained from these. It is not yet possible to quote assays of the ores of this vicinity made from specimens collected by myself, but it is safe to say that from several of the claims, considerable quantities of ore can already be obtained by ordinary hand picking which yield from 50 to over 100 ounces of silver to the ton, in addition to a high percentage of lead.

"At Hendryx, the only considerable developments made are those of the New Haven Mining and Smelting Company. The principal feature at this place is a lode of very great size, consisting largely of galena, but classing in respect to silver as a low-grade ore. So soon as efficient means are provided for handling and smelting this ore and shipping the product, a very large output may be counted on.

The Toad Mountain ores differ from the foregoing in containing a large amount of copper and less galena. The Hall Brothers' property, known as the 'Silver King Mine,' from the name of the claim on which most work has been done, is so far the leading one here, and has turned out a considerable quantity of ore which has approached or surpassed $300 to the ton in total value as sold at the smelter. Other claims are, however, being opened out, some of which present a very favourable appearance.

"At the end of Toad Mountain, a wide belt of rusty schistose rocks, containing more or less quartz and much iron pyrites, has been discovered. The superficial portions of this belt have been completely oxidised and afford free-milling gold. This property has been acquired by an English company, known as the Cottonwood Company, and a Huntingdon mill has been erected for the purpose of treating, in the first place, the decomposssd surface material, of which there is, in the aggregate, a great quantity in sight. The results of trials so far carried out have not been made public. Should it prove, however, that the deeper pyritous portion of the deposit contains sufficient gold to pay for concentration, roasting and chlorinatlon, the quantity of the ore appears to be almost unlimited. Another gold-bearing deposit, in the from of a well.defined vein traversing a granitic rock, is situated on Eagle Creek, toward the west end of Toad Mountain. Work is being carried on here and a stamp mill is in process of erection.

"Beyond the neighborhood of the better known centres, a great number of discoveries, chiefly of silver ores, are reported throughout the district. Most of these isolated localities time did not permit me to visit. Mention may be made, however, of an extensive deposit of copper-pyrites, on the north side of Kootanie River, nearly opposite Forty-nine Creek, and of a peculiar and apparently important occurrence of magnetic iron-ore on the same side of the river below the lower fall.

"No large quantity of ore has yet been shipped from the deposits of the vicinity of Kootanie Lake and Toad Mountain, but small shipments of hand-picked rich ores have been made from time to time during the two past summers, representing a total value of over $75,000. The ore has been carried down to the lake-shore on horses or mules, taken by steamer to Bonner's Ferry in Northern Idaho, thence over thirty miles by waggon to the nearest point on the Northern Pacific Railway, and then, as a rule, to Montana, where it has been sold and smelted. The cost per ton of transporting the ores to smelter by this route has been not less than $30, and when to this is added the cost of mining and cobbing the ore, it is evident that very high-grade ore alone can thus be utilized, while even in the case of deposits capable of yielding a considerable proportion of such high-grade material, the greater part of the ore extracted, embracing the lower grades and requiring concentration, must at present be put to one side.

"It may thus be said that the West Kootanie district is at present waiting merely for some satisfactory outlet for its ores, and the developments already made, though for the most part merely of a preliminary character, are such as in my opinion to justify the expenditure necessary to provide such an outlet at once. It might be added, that capital for the proper development of the various discoveries is also required; but this will naturally follow so soon as the district is rendered more accessible, and can only he prevented from doing so, for a longer or shorter time, by the exaggerated ideas of the value of undeveloped properties too apt to prevail among the holders of claims in such new districts.

"The construction of a railway twenty-four miles in length along the unnavigable portion of the Kootanie River, between Nelson on the West Arm of Kootanie Lake and Sproat's Landing on the Colnmbia, would connect the navigable waters of this lake with those of the Columbia and Arrow Lakes, and would enable ores to reach the Canadian Pacific Railway at Revelstoke. A still more efficient and permanently satisfactory route would, however, be afforded by a direct line of railway from the north end of Kootanie Lake to Revelstoke, a distance of about eighty-six miles by the route which would have to be followed. Of this length of line, however, only that part between Kootanie Lake and the North-east Arm of Upper Arrow Lake need be constructed in the first instance, with a length of about forty-eight miles; the remaining portion of the distance being for a time served by steamer on the Columbia. Still another alternative outlet may also eventually be supplied by a branch line from the Northern Pacific Railway; but it is of importance to the prosperity of the district that it should have a means of communication independent of the rulings of the United-States Customs as to the introduction of silverlead ores. &c., into that country. The metals likely to be produced in quantity in the district are silver, lead and copper, all of which may be sold to advantage at first hand in the markets to which the same metals are exported by the United States.

"For the purpose of treating the ores from the East and West Kootanie districts, a large and well appointed smelter has just completed at Revelstoke, while arrangements for the erection of a second are in progress at Golden.

Cassair District.

Mr. J. L. Crimp in his annual report to the Minister of Mines gives the following approximate estimate of the gold yield of this district:—

Dease Creek	$11,200
Thibert "	10,800
McDames "	16,360
Quartz "	10,950
Snow "	600
Gold "	400
Poor Man's "	100
Stickeen River	1,000
Desultory	3,500
Total	$54,910

The amount would have been very much larger if the season had been more favourable for mining. Since the middle of July there have been continuous heavy rains, which caused the different creeks to rise so high that all the wing dams were swept away, and the consequence was very little gold was taken out from the beds of the creeks. The principal portion of the yield was from tunnels in the different hills.

Cariboo District.

Williams Creek, with tributaries, worked for nearly thirty years, still continues to yield more gold than any other creek in the Province. The gold is now taken principally from the hills and sides of the creek by means of hydraulic pipes, as the creek channel has been pretty well worked out by drifting, although upper streaks are frequently found to pay, and hence the lasting nature of the creek.

Messrs. Taylor and Boyce, working about half-a-mile above Richfield, have been fortunate enough to come upon a portion of the old channel of Williams Creek hitherto unworked, and from the result of working a small piece of ground, have high expectations for this year's operations.

Mr. John Bowron, Gold Commissioner at Richfield, is our authority for the following statistics which give a tolerably good impression of the result of the alluvial operations last year in the various sections of the Cariboo country:—

Barkerville Division, 1st January to 15th November	$78,542
Lightning Creek " " " "	41,150
Quesnelle " " " "	37,000
Keithley and Harvey " " "	61,200
Desultory, of which no account is obtainable	7,000
Whole District, from 15th November to 31st December	10,000
Making a total for 1889 of	$234,892

"The yield of gold," continues Mr. Bowron, "from Grouse Creek has been better than for some years past, principally owing to a discovery made by Messrs. Jarvis, McAlinden & Co., which bids fair at the present writing to be of considerable importance, and will probably lead to the opening up of from half to three-fourths of a mile of a lead lost on this creek, as below the Heron Company, which paid so well in 1866-7, the lead could not be found. The discovery of Jarvis & Co. is apparently a channel of about 20 feet wide (with well-defined rim-rock) running into the hill nearly opposite McAlinden's store, from which the company have already taken some four thousand dollars, and will continue the work during the winter.

"The Nason Co., driven out of their works last winter by an insufficiency of water to drive their machinery, owing to the frost, started again in July, and barely got the water out of their diggings when one of the gudgeons (a heavy casting) broke, which had to be replaced by a new one from the foundry at Victoria; the necessary repairs were made and the water is once more out of the diggings, and there is now a prospect of the value of the claim being proved."

Mr. Bowron writes hopefully of the quartz interests of this section, which he thinks must be regarded as the main source from which the future wealth of this district

must flow. The successful treatment of the quartz from the Black Jack Mine, to which some reference is made elsewhere, proves conclusively that the Cariboo ores will repay the attention of capitalists. The destruction of the Government Reduction Works at Barkerville was most unfortunate, and is greatly to be deplored, inasmuch as their rebuilding will occupy fully a year's time, and miners who were awaiting their turn to test their ores will be compelled to wait until the new works are completed.

The Black Jack Quartz Mining Co., commenced crushing ore on June 1st in their one stamp Kendall Mill, and managed to put through 202 tons before the frost compelled them to close down. The ore averaged $4.50 in free gold and $13 in sulphurets per ton of rock crushed. In blasting the rock in the shaft the sulphurets were shattered very fine, which then mixed with the waste rock, and it was found almost impossible to separate the ore from the waste, so that nearly all the rock taken out was sent to the mill, and accounts for the low grade of the ore. The endeavour in this case was to develop the mine, and to mill what ore was taken out to pay running expenses. Sinking the shaft and milling the ore from it cost more than double what it will cost to mine and mill the ore when the mine is thoroughly opened. A shaft was sunk 42 feet deep, and a drift of 22 feet run on the ledge, when it was found that the ledge changed its course, which made it necessary to stope up an incline shaft to the surface, from which the ledge can be worked to better advantage. The incline shaft had reached within five or six feet of the surface when the mine was closed down for the winter.

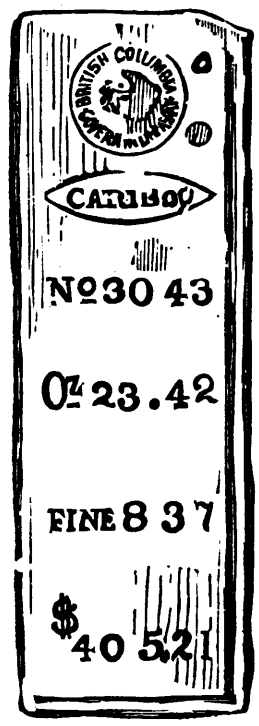
Gold Mining as an Industry.

Gold mining as a speculation has received a shock; why not try it now as an industry? It suits the unscrupulous promoter and the gambling operator to manipulate a gold mine, but the investing public's interest lies in its being scientifically and honestly worked. The present position of South African gold shares in the market is a telling although painful illustration of the first method; some of the Indian gold mines may be taken as an apt instance of the second.

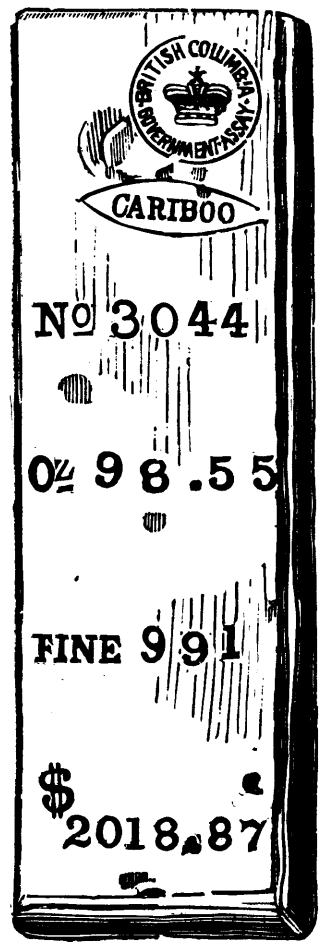
The mad rush to acquire claims in the Witwatersrandt, to float companies in Johannesburg or London, to set up standing machinery, to crush the best and most easily got at ore, to send home the highest returns of gold extracted, to declare fancy dividends, and, as the end and aim of all, to rig the market, has ended, as was inevitable, in wreck and ruin to many an unwary speculator. It is an old story, which will continue to be repeated until mining for the precious as well as every other metal is carried on as an industry, or, in other words, on commercial principles. As businesses are not built up by those at their head always keeping their eye on the Stock Exchange, so gold mining is not likely to be successful while the directors and managers think more of the market quotation than the steady development of their property. Mines apparently rich—such as the Salisbury, which extracted over 2,000 ounces in one month a little over a year ago—have now to stop milling, in order that necessary work which should have been done at the outset may now be undertaken. This is by no means a solitary instance of palpably bad management, reflecting as it does upon the skill, if not the honesty, of those in charge. Mining engineers may not have always a free hand, and may be required to do many things against their better judgment; but they too not unfrequently add to a want of knowledge and practical experience a desire to mke a brave show, to the eventual undoing of those who place their dependence thereon. A determination to go straight through with the work, opening up and developing the mine as they proceed, doing the dead work that is essential at the outset, will not produce bloated dividends, but it will, if the conditions are favorable, make the property a steadily remunerative one, and add to their own reputation in the long run.

Gold Bricks from Barkerville.

Below we present our readers with illustrations of the first two gold bricks—the advance guard it is hoped of a host of others—the result of the treatment of one hundred tons of quartz from the Black Jack Mine, near Barkerville. The test was the only complete one made by the Government Reduction Works before their destruction by fire. The value of the small bar is $405.21, the gold being .837 fine and is that saved on the plates from the free-milling ore. The larger brick is that extracted by the chlorination process from the concentrates, its value being $2,018.80, the gold being .990 fine. Included in the 100 tons treated were some 20 tons of concentrates previously treated, but from which only 60 per cent. of the gold had been taken. These were again treated and



another 30 per cent., or about $325.00, secured. This would make the value of the Black Jack ore per ton to be $21.00, a price at which it would pay well to work. Ninety per cent. of the gold in the concentrates was se-



cured by this process. These results prove conclusively that the ores from Cariboo will repay the attention of capitalists, for that they can be profitably worked is placed beyond question. We are indebted to the courtesy of the publishers of the *Colonist* for the use of the cuts represented above..

The Training of a Geologist.*

By John C. Branner, Ph.D.

The fitting of a young man for his work in life is worthy of our serious study and consideration, and while much that I may say is equally applicable to men in any calling, I can only undertake to speak of some of the demands that the times are placing upon geologists.

It is to be expected, of course, that there are plenty of persons of intelligence in the world who have no conception whatever of a geologist's duties, those who imagine that geology as a profession can be picked up just as the duties of certain civil offices, or of clerical positions, may be readily learned and performed by any man of ordinary intelligence. Among the applications I have received for employment one man gave as a reason why he should be employed that he was a consistent member of the Presbyterian church; another that he was a graduate of a famous military school; another was interested in geology and had read many books upon the the subject, among which he cited some of the vaporings of Ignatius Donnelly; still another used to be acquainted with Professor Winchell, and another was in poor health and thought field work would be good for him. At least half of the applicants have asked for employment because they understood ordinary land surveying, and one of them admitted that he had no other qualification than that he was "a good hand to camp out."

The general academic training of a geologist during the first two or three years of his college course is not essentially different from that of any man of culture. I am not disposed to side with those who think that if a man is to be a specialist the sooner he begins his specialty the better. In a general way this proposition is correct, but in making such an admission it must be distinctly understood that all things which tend to broaden a man's scholarship form essential parts of his specialty.

That a man should have a knowledge of history, philosophy, social science, and of literature in general goes without saying. But as bearing directly upon his professional career he should understand, of the languages, at least the Latin, French and German. In mathematics he should have the general instruction required by civil and mining engineers, and should give special attention to astronomy and geodesy. In chemistry the more thorough his training the better, and beside the usual work required of students of chemistry, in which especial attention should be given to inorganic chemistry, he should be a skilled mineralogist and should be well acquainted with metallurgical processes. In physics the student should give attention to optics, especially as employed in the construction of mathematical instruments; to hydraulics and hydrostatics, to dynamics, and to hypsometry.

I have sometimes thought that to be a good and snccessful geologist one should first be a good civil engineer and then a good mechanical and mining engineer. This thought has been suggested to me by the fact that among the students I have had to train in geological work those from the engineering courses have, almost without exception, proven themselves by far the best qualified. This is due to the fact that a large part of a field geologist's work consists in tracing out in the field, and the delineation upon maps and cross sections, of structural features. In this work topographic features—the elements of horizontal and vertical distances—have to be so constantly dealt with that unless the student has pretty thorough training as an engineer he will find the work very tedious. I should make it plain, however, in referring to the desirability of a geologist having an engineer's training, that I do not mean to imply that an engineer can always step into geology and make a success of it, for it is only the very young engineer who can or will make the proper use of his technical training. As a rule, the man who has been a practising engineer for a number of years is no longer sufficiently pliable in habits of work and thought to make a successful geologist. In geology various degrees of detail are required. Sometimes our measurements need to be made with a micro-meter, at others with a foot rule, while at other times an error of several feet is of no consequence, but a civil engineer who has been accustomed to the degree of accuracy required in railway construction can not always bring himself to use now a less accurate method, and now, another of great precision, just as circumstances may require. But whether the student receives the full training of a civil and mining engineer or not, he will need to acquaint himself with practical and theoretical land surveying. He should have practical knowledge of the various methods of doing topographic work and of map making. He should be a good draftsman; he should be so trained in drawing that he can, if necessary, make his own drawings and sketches, and will know, at least, how to direct the work of others. Careful attention should be given to the preparation of rock slides and their microscopic study. In paleontology he should not only be instructed

* Presidential address before the Indiana Academy of Sciences.

in the best methods of investigation in and the application of paleontology to geologic work, but he should also have a pretty thorough acquaintance with fossil forms and their range in the geologic column.

I take it for granted that no one in this audience has any doubt in his mind about the necessity of laboratory work in training a naturalist, and I would not refer to this point at all were it not that within a couple or three months the faculty of a prominent educational institution in this country "after an exhaustive debate of three and one-half hours, decided by a vote of 6 to 5 that laboratory work in the scientific courses should not be abolished as requested by the professors of languages." Of course, one would as well try to teach a student swim without letting him go nigh the water, as to undertake to teach him natural history, chemistry or physics without laboratory work.

Besides laboratory work there is, perhaps, no branch of natural history which more emphatically demands field work for its students than does geology. This is due largely to the fact that the little indoor or laboratory work the geological student can do is directly and entirely dependent upon his field work. Then, too, in other studies we can have and do have our laboratories in which nearly all the student's observations are made. In botany and in zoology, in histologic studies and in chemistry and physics, the materials may be successfully studied in the laboratory, but the geologist, whose studies are often valuable in proportion to the range of his direct observations, can not take his stratigraphy and his topography into a laboratory. His laboratory, except in certain parts of petrographic and biologic studies and in the office work on his maps, is out of doors.

In its professional bearing the most essential part of a geologist's training should be to the end *that he observe well, and that in his deductions he properly subordinate his facts.* His preliminary technical training should therefore be for the purpose of teaching him accuracy and detail. The necessity of accuracy should be so deeply impressed upon his mind that accuracy will become a part of his nature. After this lesson is learned he must be taught speed, without sacrificing in the least his accuracy.

I believe Dr. Chamberlin, president of the University of Wisconsin, recently delivered an address before the Western Society of Naturalists upon multiple working hypotheses. I have not seen this address, but I can readily imagine that he presented in detail the advantages of this method of scientific investigation, in the use of which I am, myself, greatly Dr. Chamberlin's debtor. In my own experience I have found it of the greatest value, and I know of no better way of developing the reasoning powers or of anticipating difficulties, or of reaching right conclusions than by the proper use of hypotheses. As the whole professional training of the geologist is for the purpose of enabling him to reach correct conclusions, he should be trained in the use of every method of investigation that will aid him, and and among these aids I count as of great importance that of multiple working hypotheses.

Besides having a broad general culture, a geologist must be *par excellence* a geologist, and besides being a geologist he ought to know more about some particular branch of geology than anyone else. The material progress of our times is due largely to the division of labor which enables each individual to perfect his skill. Progress in science is due in no small degree to a similar division in scientific work. Though I can not dispense with a knowledge of chemistry, specialization by my neighbor who devotes himself to chemistry relieves me of the necessity of devoting a large part of my time to chemistry; the devotion of another to physics gives me my time for geological work proper, which, without the specialist in physics, I should be obliged to devote to physical studies. The astronomer hands me the results of his special investigations and saves me my time for geology, which, without his help, I should be obliged to give to astronomy. And so it is all around. On the other hand I trust that my attention to geology will, in its turn, come to the aid of the chemist, the physicist and the astronomer.

In saying a word for specialties I am fully aware of all that has been urged against this kind of scholarship. President White, of Cornell University, said to me in a private conversation a few years ago, that he had his doubts and fears about the outcome of this modern tendency among scientific men to specialization. Said he: "If this thing goes on, we shall have after a while, a man who will know all about the stripes on a trilobite's tail, but he won't know anything else." It is very easy to ridicule a specialist, especially if the aims of his studies are not comprehended. Galvini studying the twitching of a frog's legs, Darwin breeding pigeons, and Agassiz planting sticks on a glacier, are inspiring or ridiculous in proportion as we comprehend the bearing or end of their studies. Whether studying the twitching of a frog's legs or the stripes on a trilobite's tail is an unworthy and contemptible occupation for an intelligent man depends, therefore, upon the ultimate objects of the study. And in regard to special work by those who aspire to broad culture in science I can only repeat what I have always held upon this subject: that a man who is incapable of doing and has not done special investigation is not capable of taking a broad view of science in any of its relations. Mr. Darwin has done some of the best generalizing of our age, but before he did it he had done some of the best of specializing, and that, too, on such unpractical, uninteresting and useless animals as the barnacles.

A lofty structure can not be built upon a narrow foundation, neither can a man be great in science who hasn't broad culture. And as only close attention to minor details in the material used can secure a great building against calamity, so care and skill in special investigation—in little things as it were—are essential to a great and broad-minded man of science.

You will probably exclaim that the requirements of which I speak and which I find essential are entirely too many to be complied with; that life is too short to allow one to undertake so much purely preliminary work. It can not be denied that to become a good geologist is a serious undertaking, and all I have to reply is that this is the kind of geologist I have been seeking and am still seeking. How many have you found? you will ask. Not many, I must confess. Indeed, men with such preparations are few, and when one finds them, he doesn't find them "looking for a job;" their services are always in demand. I may say, however, that it is not to be expected that the student should get all this training as undergraduate work. College men going into law, medicine and theology, if they get the technical training required by their professions, spend two or three years in law, medical or theological schools. The geologist must do what amounts to the same thing—that is, he must, beyond his general training, qualify himself specially for geologic work. When our geologists are so trained we shall have a better science, better geologists and better results all around.

The demands that are made upon a geologist require no particular kind of an intellect, save, of course, that it be a good one, but broad culture and broad mental grasp are essential to the pronounced success of any man in any calling. A man is wanted not to work up this or that deposit as it may occur in some limited area, or this or that formation, and much less some county or other artificial area, but who, in working up a topic, can and will take up the problem as a whole, and study it as a whole, not in one locality, but wherever it may be found in the world, who can work up the bibliography of his subject, and who can sift and put to good use the facts gathered by others in his deductions, and whose knowledge of allied sciences will enable him to draw proper conclusions from his facts, while his knowledge of affairs will render his judgment upon economic questions of the greatest value.

But it is not my purpose to confine any remarks to the technical training of the geologist, but refer also to certain general and ethical features of his work which call for a training or fitness to which educators give too little attention. I hardly know whether any instructor ever troubles himself to impress his students with the ordinary requirements of professional etiquette; I don't remember ever having heard the subject mentioned in a class-room. We seem to have depended upon men's instincts as gentlemen for shaping their professional conduct.

To be a sucessful geologist one must be a geologist very largely because he can't help it—because he can't keep out of it. I mean, of course, that the science must so fill the demands of his mind, his temperament, and his health, that in another occupation he feels that he is not where he can make the most of himself and of his energies. Such men will have that professional pride without which everyone is doomed to a fatal mediocrity. The man who goes into geology because there is money in it will, in nine cases out of ten, make a total failure of it. To be sure a living must be had, but he who has the right training and the right interest in his work will never lack for lucrative employment for any considerable length of time. It may sometimes happen, however, that a geologist is without such employment for a while, but it should be distinctly understood that such times are not to be given over to demoralizing idleness. The world is too full of problems of scientific interest for any man having a scientific spirit to stand idle for a single day or a single hour, and no one having such a spirit will stand idle.

In the balancing of the essentials and the non-essentials in the training of a geologist certain economic considerations have, almost without exception, to be faced. Those of us who devote ourselves to pure science are constantly being wearied with that most tiresome of all questions about the practical value of what a man reads about, thinks about, or does. So long as the young see around them examples of men who have become wealthy by the successful application of some law in science, by the invention or discovery of something that people are willing to pay handsomely for, just so long shall we have these young men asking how this and that study, this and that bit of training are going to be of any *use* to them. As men who love science for its own sake, we get weary of such questions, and some of us feel driven, in order to emphasize our warnings, to avoid the useful altogether. Thus we occasionally have, on the one hand, men who have a horror of doing anything that is liable to be of pratical value, and on the other, men who have no patience with an investigation which does not promise some tangible, material reward for their pains. My opinion is that there is little to choose between in these two types. One of them is just as far wrong as the other.

There are many pitfalls in the pathway of the geologist—many inducements for him to profit just a little too much by his experience. His duties are often of a very delicate nature. He is called upon to examine and report upon properties where large sums of money are involved, and where the information obtained in his professional work might be used by him for his personal advantage. The importance of a right way of thinking and acting in this connection is of the utmost importance, for if one does not conduct himself properly just here he is liable to gain a good share of the whole world "but to lose his own soul." I am reminded to quote the man who advised his son to avoid the appearance of evil: "Never mind the evil itself, but avoid the appearance of evil." This is, of course, a perversion of good advice. "Avoid the very appearance of evil and evil will avoid you," is good advice for the geologist, as well as for other folks.

I may say briefly that a professional geologist, especially if he is in a public place, such as State geologist, or is in any way connected with a State or national survey, has no moral right to have a personal interest in any mining property, or in any other property a knowledge of the value of which might come to him through his knowledge of geology. Abstaining from such interests is a duty the geologist in public employ owes to himself as well as to the public, and the public has the right both to expect and demand that its employés shall not walk off with the profits of its investments, just as a manufacturer has the right to demand that his employés shall not appropriate the articles they make. The geologist not in public employ who becomes personally interested in miniug operations, even when he does it in the frankest, most open, and most upright manner, and with no idea of doing otherwise than as any citizen may honorably do, does nothing wrong in itself, but he must remember that he does so at the risk of his reputation and standing as a consulting geologist.

The man who is not willing—does not try—to save his energies, may be relied upon to not give the world the benefit of his best services. How often we see men who had an idea that there is some virtue in doing a thing the hard way, who, when suggestions are made for the purpose of saving their energies, assure us that that is all right, that they'll get it done, and if their way is a little harder, they are the losers by it.

A certain engineer has a three-sided scale in his drafting room. There are six different scales cut upon it. A person using this scale is liable in taking it up to turn the wrong division upon his line, and, in order to avoid this risk, and to save the time and thought that must be used in watching to see that one doesn't get the wrong side, a simple piece of metal has been devised to clasp it in such a way that it is impossible to use the wrong side. Some of his assistants remove this safety attachment, because they are not "used to it" and insist on running the risk of making mistakes and of using up the time they are paid to work, in examining their scale to see whether they have turned it over. Another man doing topographic work doesn't want to signal to his assistant, preferring to call out his directions to him at long distances, often more than a quarter of a mile, so that at the end of the day he has done three-quarters of a day's work on the topography, and the other quarter in yelling—a bit of labor the geologist can not utilize. These mistakes are unpardonable errors of judgment, and young men should be warned against such. If we spend our time and energy in unnecessary work we shall have just so much the less energy for the essential. There may be some excuse for the man who isn't able to discriminate between the essential and the non-essential, but in such cases as those referred to, and indeed in the majority of cases that arise, there can be no such question. In his methods the geologist must always be willing to profit by the experience of others. Methods and appliances of research are constantly being improved, but these improvements are made, not by disregarding the experience of others, but by making every possible use of it.

There is sometimes a tendency among the newly fledged to imagine that those who have gone before them have not taken the greatest pains in their work, that their conclusions have not been warranted. They therefore begin with the idea that by the application of superior, or, at anyrate, new methods of investigation, they are going to upset everything done before they began. Such persons often succeed in making asses of themselves, and end their careers before they begin them—that is, they make careers impossible.

I had occasion recently to go over the work of one of our older geologists—work done under the most adverse circumstances. This work had but a short time before been very sharply criticised by an aspiring young geologist, and I was prepared to find either one of them right. I not only found the work of the older geologist well done, but I was astonished at the clearness of his perceptions and the general reliability of his conclusions. The young man had committed a blunder from which his reputation can never recover.

The necessity of caution on the part of the young geologist in publishing conclusions that one feels to be open to criticism, or when he sees that important facts may be overlooked, can not be too strongly emphasized. The publication of facts is generally useful, but deductions can afford to wait until they are properly matured. A most valuable piece of advice once given me was to the effect that young people would better not begin pumping out their intellectual reservoirs before something has been pumped into them. Life is too short, and progress all along the line is too slow for us to cumber the march of science with verbose discussions which help toward strife and contention instead of towards truth and union To be sure "ignorance is no reason with a fool for holding his tongue," but my advice is not intended for fools, who will be fools in spite of everybody and everything. but for those who, having sound sense, desire not to appear fools or to bring discredit upon themselves or upon the science to which they are devoted.

Science is not infrequently charged with vacillation. Apropos of this, one of our humorists has the following: "Science says—but no matter what science says, for the next time she says anything she'll say just the opposite." We cannot deny the justice of the criticism, but this bad repute is to be attributed entirely to premature utterances. We have some sad examples in this country of poor geologists whose premature conclusions, drawn from too hasty or incomplete work, have kept half a dozen good geologists busy for years in correcting their mistakes and in putting the truth before the world. Their excursions into geologic fields are like the inroads of lawless and unclean animals that require a score of persons to clean up and put things straight after them. These busy bodies have, almost without exception, an itching for notoriety that leads them to seek some scientific short-cut by which to arrive at distinction, but if there is a balancing of accounts either here or hereafter, these men are destined to have a distinction in the scientific world of quite another sort from that for which they are pining. They are usually men of good enough intentions, but, as one of my preceptors once reminded me: "we have a right to expect something more than good intentions of men." All people mean well; it is our business to *do* well.

Sensationalism has done and is doing great injury not only to geology but to other branches of science. There are certain features about every science that impress the ignorant with their novelty, and there are certain persons who are always ready to make capital out of them. This gives rise to a sort of "O my!" class of men, and to an "O my!" kind of science. They delight in the startling. None of the more radical theories of science, theories put forward by the right thinking with great caution, stagger them. Man's descending from a monkey never troubled them; they always thought so, and can point out cases of dissent that would make Mr. Darwin or Mr. Wallace catch his breath. This skimming the surface, this dilettanteism is strong in our times. In the geologist's training the less we have of the sensational the better it will be for the science and for the man.

It is not a pleasant thing to be obliged to destroy the delusions which people hold so lovingly close to their their hearts, but the conscientious geologist has a good deal of this disenchanting to do. And nobody even thanks him for it. The very persons he may hope to serve in telling them the truth, will, in all probability, never believe him and never forgive him. But a good geologist has to face a great many disagreeable duties, and if he hasn't the moral courage to tell the plain, unvarnished truth, and to take the consequences, when a white lie would smooth matters over all around, he will find his troubles increasing as time goes on. One lie, whether it is a white one or a black one, only makes room for two others, and the man who makes two lies grow where but one grew before deserves no good of mankind.

Those who are at once workers in science and teachers of science know how difficult it sometimes is to draw a sharp line between what we know and what we simply believe, but as far as possible this distinction should always be kept before the minds of students, and no effort should be spared to prevent that dazzling of their minds which prevents them from weighing evidence and from distinguishing between simple truth and simple figments of the imagination.

And now just a word about our responsibilities to our own intellects. Intellect is the tool with which the geologist has to do his work. If that tool is bent out of shape or dulled by improper use it cannot perform its functions properly. It is highly essential, therefore, that he keep his intellect unimpaired. He should strive to keep his mind free from those tricks of logic, rhetoric and sentiment by which so many of us allow ourselves to be imposed upon. Those of us who are naturalists and investigators at heart, as well as by profession, are not satisfied with declaring, like the humorist, that we are "open to conviction," while parenthetically we add, but we'd just like to see the man who can convince us." We are bound by every sentiment of honesty to go where our evidence leads us, whether it takes us to a pleasant place or not. Truth must be our companion whether she be an agreeable or a disagreeable one—a handsome or an ugly one. We cannot honestly say to reason "thus far shalt thou go, but no farther." We can't reasonably follow the science of geology to a certain point and then abandon it for the divining rod or spiritualistic seances or clap-trap appliances of any kind. The man who has no notion of accepting the results of his reasoning would just as well not reason at all, while the man who undertakes to reason within certain limits insults his intelligence. All honest men are seeking the truth; and is it not our duty to help others in this search when we can? We may be sure that if we wait till all the world thinks alike, the world will never care what we think.

I have said that the profession of a geologist requires certain proficiences that are common to successful men in any and all occupations in life. Good judgment, clear insight, business habits of thought, and promptness of decision and action are as essential in geology as anywhere else, and it has often seemed to me to be even vastly more so. It is enough that one should plod faithfully ahead with a task—though faithful plodding is not to be underestimated at all. The man who grasps a subject in all its bearings, takes hold of it with judgment and solves its problems with courage and logic is the one who really advances the cause of truth, the cause of science, and the cause of humanity.

Once upon a time a business house employed a young man whose energy and grasp of the business of the firm induced the head of the house to promote him more rapidly than an old and faithful employé. The old employé felt deeply hurt that this dapper young fellow, who parted his hair in the middle and wore eye-glasses, should be advanced over him, and he took occasion to complain of it to the senior partner, The senior partner felt it to be a case that he couldn't very well argue with so faithful and tried a servant. There happened to be a lot of waggons passing the door of their building at the moment, and, as if changing the topic for a minute, he asked the old clerk what was making all that noise. He went forward and returning told the partner that it was a lot of waggons going by. He then asked the clerk what the waggons were loaded with. He went out again and returned and reported that they carried wheat. He sent him again to know how many there were of them. He returned with the reply that there were 16. Again he sent him to ascertain whence they came, and he returned saying they were from the city of Blank. The senior partner then asked the clerk to be seated, and, sending for the young man complained of, said: "Will you see what the meaning is of that rumbling noise in front." The young man replied: "It will not be necessary, for I have already ascertained. It is caused by some waggons—36 in all—16 in this lot, but 20 more to pass to-morrow. They belong to Pinto & Rosa, of the city of Blank, and are loaded with wheat. They are on the way from Blank to Zee, where the supply of wheat is short, and is now fetching $1.15 a bushel, while it costs but 90 cents at Blank. The waggons gets 15 cents a bushel for hauling it, and each one carries 100 bushels." The young man was then dismissed, and the senior partner, turning to the old clerk, said: "My friend, you see now why Mr. So-and-so has been promoted over you."

This illustrates the demands, not of business men alone, but of geologists, and of everyone who employs others, either directly or indirectly, or who associates others with himself in his work. We all want men who can not only do the very best and most comprehensive scientific work, but who comprehend their duties in all their relations, meet emergencies, with prompt and clear judgment, and save us and our energies for other affairs. And we don't want to be obliged, in order to get out of a man what there is in him, to stand over him constantly and to direct his every effort.

Coal Mining Machines.—Mr. G. Blake Walker at a recent meeting of the Federated Institute of M. E. of Great Britain, said that the function of all these machines was to undercut the coal in the same way as had hitherto been done by hand labor, but with more rapidity and less waste. So long as seams of fair thickness were worked, and skilful holers were obtainable, there was little advantage to be looked for in the introduction of machinery, but as thinner seams were opened out, and the skilled workmen became rarer, the amount of waste caused it to be absolutely necessary to adopt some expedient, as under the old system half the output of a tender seam would pass through the screens. Mr. Walker went on to make a comparison of the actual cost of coal-cutting by hand and by machine, based upon experience. He assumed that in a 3 ft. seam, with a favorable holing material, the quantity of slack made when the holing was done by hand was 25 per cent., and when done by machine 15 per cent. In a seam 1 ft. 6 in. thick he had taken 45 per cent. for hand labor and 30 per cent. for machine, as in the case of so thin a seam the coal would be more broken, from the difficulties inseparable from its working. Actual experience pointed to 100 yards per eight hours shift as being a satisfactory performance when the ordinary conditions of working a coal face were in force. The general result showed a saving of from 8½d. to 1s. 6d. per ton, of which two-thirds roughly were obtained from the reduction of small, made when machines were used.

British Columbia Collieries in 1889.

Mr. Wm. Dick, Inspector of Mines for the Province of British Columbia, contributes to the report of the Minister of Mines a mass of interesting and valuable information respecting the progress of the coal trade during the past year. We reproduce his description of the various colliery workings:—

Nanaimo Colliery.

The coal in this colliery was in good demand up until the last two months, when the mines had to stop work, owing to there being no ships to take away the coal.

No. 1 Pit, Esplanade, in Nanaimo.—This mine, forming part of the Nanaimo colliery, belongs to the New Vancouver Coal Mining and Land Company, Limited. The working in this pit is by what is known as the No. 1 and No. 3 North Levels. The No 1 Level is in a north-westerly direction about one mile, and in this district of the mine there has not been much coal mined during the past year; but there has been some extensive prospecting done, and the company, to all appearance, is going to be rewarded for their perseverance, as they have now got into thick coal, that, from the prospect and regularity of the seam, I think, will prove to be a large and profitable coal field; they have now got into this coal 200 yards, and it averages about seven feet thick, clean and hard. The great part of the coal got out of the mine in the past twelve months came from No. 3 North Level, and in this level they have the prospect of getting into the same coal soon that they have got in No. 1 Level. Ventilation in this mine is very good. When I was down in December I found 49,000 cubic feet passing per minute for the use of 60 men and 14 mules. The motive power of the above air is a Murphy fan. There is very little gas now found here, the mine being free from dust; and there are pipes to conduct water when required.

No. 3 Pit (Chase River).—This shaft takes its name from being near to the mouth of Chase River; it is about two and a half miles from Nanaimo and forms part of the Nanaimo colliery. The coal in this mine has been, and is at present, hard and of a very good quality, although varying in thickness from four to ten feet. All the workings are by way of a slope starting from near the bottom of the shaft, the levels branching from the slope. The coal is worked here on what is termed the pillar and stall system, for which it seems well adapted. Ventilation is very good; motive power, a large fan on the top of the upcast shaft. When I last inspected this mine there was 46,800 cubic feet of air passing per minute for the supply of forty-six men and twelve mules, and it is well conducted into the face by brattice or otherwise. This mine has been free from gas since it started; the mine is also free from dust, being wet throughout. In this mine, as in all the other mines of the Nanaimo colliery, a deputation of men is sent to examine the mine, under section 79, general rule 31. The finding of the condition of the mine is recorded in a book kept for that purpose, and a notice is put up where all may see it.

South Field Mines, Nos. 1 and 2.—These mines are nown known as the South Field Mine, both places being worked into each other and have jointly one ventilating shaft. During the past year a few men have been taking out coal along the outcrop of the No. 1 tunnel, but the bulk of the coal came out of the No. 2 slope. This slope is down over 700 yards with an easy grade until approaching near the face, when it goes off with much greater pitch. About one-half of the output of the Nanaimo colliery came from this mine. The coal is of very good quality, and from a series of bore holes put down from the surface to the coal, some distance ahead of the working, they have proved that they have a great extent of coal yet before them. This is also mined on the pillar and stall system. There is now a long range of stalls in good coal.

Ventilation is very good; motive power a large fan on the up-cast shaft. This mine is ventilated on the separate split system, with two divisions to the east side

and one to the west side of the slope, the intakes being the Nos. 1 and 2 slopes with a shaft between the two slopes for the return. The last time I was down this mine I found that there were 67,500 cubic feet of air going past per minute for the use of 74 men and 7 mules. There is very little gas found in this mine, and it is free from dust, being damp throughout. Here the workmen also take the privilege of section 79, general rule 31.

No. 4, SOUTH FIELD MINE.—This is the new slope mentioned in a former report, situated about half a mile in a southerly direction from No. 3 pit. They have gone to a great expense here. The slope is now down about 700 yards, the coal being thin in some places, and at other times no coal; but it was reasonably expected that good coal would be found as in No. 3 pit, coming towards this slope the coal was hard and from five to nine feet thick; it is, however, to be hoped that they will come on the coal soon. NORTH FIELD MINE.—This is the northern part of the estate, owned by the New Vancouver Coal Mining and Land Company, Limited, and is situated in Mountain District. In the year 1888 the company put down a series of bore-holes to the coal, and among them was one near to their boundary line, which adjoins the Wellington property; the prospect they got seemed to justify them in putting down a shaft. The contract was taken by Mr. R. Scott to find the coal. Great preparation was made, clearing away timber and levelling off the surface, and a steam engine was erected. Everything being in order, work was commenced in the shaft on the 8th January, and continued without any great stoppage or drawbacks, when on the 31st July, coal was struck, the same as is known both here and in California as the Wellington coal. This was at the depth of 424 feet from the surface. In passing through the coal they found that it was of very good quality and hard; there were three plys of coal with rock between them, making about seven feet of coal. The shaft was continued until they got down 445 feet from the surface. Everything having been got in order both on top and at bottom they then started in the coal, when they found they had a small fault; but now that they are getting fairly started with levels and a slope opening out to both sides they find that the coal varies in thickness from three feet eight inches to four feet four inches, and is very hard and of a good quality. They have got out a few thousand tons of the coal and it looks well. When Mr. Scott ha t the shaft finished he received charge of opening out the mine, which is to be carried on, on what is called the long wall system; and it appears as if it should work well, as the roof is stronger than the roof of this vein generally is.

Ventilation is good; motive power, a fan on the Murphy principle. The last time I was down there were only four men in the mine, so that they had the fan running slow; but at that time there 10,000 cubic feet of air passing per minute. There has not yet been any explosive gas found in this mine, and everything is being done to make the workings as safe as possible.

The shipping place from this mine will be Departure Bay Point, where a large wharf has been erected by the company, so that the largest ships may load at any stage of the tide. From this wharf to the mine, with sidings, there are five miles of railway of standard guage. There is also a railway in connection with the Esquimalt and Nanaimo railway.

In starting a new work like the North Field Mine, a large outlay of capital is required, and it is desirable that the enterprise shown by the company will meet with the success that it deserves financially; it will also give new life to this district. I may here be permitted to remark that the prospect of the company for coal in their several mines for the coming year exceeds any that I have ever seen them have, and I trust that it will continue so.

Wellington Colliery.

"No. 3 PIT.—This is the pit mentioned in a previous report as being in the valley of the Millstone River, and, as I have stated in former reports of this mine, is all by the way of a slope on the south side of the shaft.

The coal was worked on the pillar and stall plan, which is the general method in this colliery. There are now very few stalls being worked, but there is considerable mining being carried on at the pillars, which will last for quite a long time, as the pillars are fully one-half of the coal.

Ventilation is very good. When I was last down, in December, upon taking it I found that there were 40,000 cubic feet of air passing per minute for the use of 37 men and 6 horses. The mine is ventilated on the separate split system, going direct down the slope and returning by way of the pillars and stalls; motive power, a large fan. In ordinary times there is little gas found, but sometimes, when the roof breaks when they have taken out the pillars, then considerable gas comes away. When, however, there is the least danger the men are sent out of the mine. Here, as in the other extensive mines of the Wellington colliery, a deputation from the men goes through the mine once a month, to examine all the mine to know its condition as to its safety, and the result of their examination is recorded in a book which is left open so that any person may see it.

No. 4 PIT.—This pit is put down on the top of the bluff which overlooks the Millstone River Valley. They have been working steadily here the greater part of the year. The coal is worked from what are known as the north and south side workings. All the working in this mine has been on the pillar and stall principle, excepting a small place in the south side, which is now back again to the old style. The coal generally in this extensive mine has been very good, yet the mine has not been without its faults. This mine and No. 3 pit are connected at different places with open roads from one to the other, that is, on the south side. Beside the connection they have their fan shaft, by which men could be taken out if emergency required it.

Ventilation is very good; motive power, a large fan on the top of the upcast shaft, worked by a steam engine. This mine is ventilated on the separate split system—the two main divisions at the shaft and again further in the workings. The workings here are very extensive, spreading over a great area, but the air is well kept under control by the overman, so that one district is not overdone at the expense of another. After the air has travelled round its several districts, it is again merged into one volume, and then ascends the up-cast shaft, worked by a steam engine. Sometimes I find the air passing a given place at the velocity of 1,500 (one thousand five hundred) feet a minute, and the last time I was down, in December, I found that there was 110,000 cubic feet of air passing per minute for the use of 150 men and 10 mules and horses.

This mine gives off some gas, which comes from the roof where they are taking out pillars, but is not allowed much chance to collect. The fireman, in going his rounds in the mine, seldom finds any gas in the stalls. The mine is free from dust, as there is throughout the mine, where they may be required, a regular system of pipes, so that water can be turned on at any time, either to lay dust or in case of fire.

In addition to the overman and fireman, there is a staff of men called shot lighters. They use and have only safety lamps to ascertain if a place is safe and if a shot is properly prepared before they will light it. In this mine there is a monthly examination by a deputation of workmen made in the manner before described.

No. 5 PIT,.—This is the only pit of the Wellington colliery which has a railway connection with the Esquimalt and Nanaimo railway, and it plays a good part in supplying the Victoria market with this famous coal. This is now about the most extensive mine in the district. The coal is brought to the shaft from the east and west levels incline from the south, and a slope on the north side. In all those places the coal has been and is now very good, and they send out fully 500 tons in one shift. The workings here have all been on the pillar and stall principle, except a small piece in the slope, which seems to work very well.

Ventilation is very good, and well conducted into the face and where they are taking out pillars (coal) by brattice or otherwise. When I was down in December I found that the instrument registered 118,420 cubic feet passing per minute, that is to say: 45,230 on the east side, 51,460 on the west side, and 21,730 cubic feet per minute passing in the slope, but the above mentioned currents of are again divided further in in the workings so that each district will have fresh air. The total number of men employed here on one shift is 195, and 14 mules. This mine is free from dust, and no expense is spared to keep it so. They have a regular system of water works or pipes to take water to any part in the mine where they think it may be required, and, as I have said in a previous report, the mains are along the levels and main roads, with small pipes and hose to the stalls, with sprays of water blown off at different places in the mine, the air carrying the moisture along, so that everywhere it is not only damp but wet in top, bottom, and sides. The pipes are supplied with water from a large reservoir on the surface, the pressure being the depth of the shaft—260 feet.

This mine is examined monthly by a deputation from the miners here, and chosen by them, to look into and examine every part of the mine under the section and rule already referred to.

No. 6 PIT,.—This pit was mentioned in a former report as No. 6 Sinking Shaft, about 900 yards east of No. 4 pit. They continued at work without anything serious happening, when, about the 1st of May, coal was struck at the depth of 340 feet from the surface. The coal was found to be eight feet thick, very hard, and of the usual good quality of the Wellington seam. Since that time they have been opening out to all sides, and have now got quite a distance away from the shaft all around. They are mining on the pillar system, as this seems to be adapted to the purpose, all things being considered. The coal has proved to be very regular and good, some places not quite so thick, but other places much thicker. This is now a valuable mine, and is proving an acquisition to this district, there being a large number of men working here.

Ventilation is good; motive power, a steam jet, but they are now preparing to erect a fan. They are at present restricted to a certain number of men, so that the output of coal is small to what it will be in a short time, as they are mining with all haste to get a connection with their No. 5 pit. Then we may expect to see the output of No. 6 pit come to the front, for, from what can be seen, they have here got the coal to work on.

No. 2 SLOPE,.—This is a new mine started by Messrs. Dunsmuir & Sons in the Sabiston and Horne property in Mountain District, and to the east of the East Wellington colliery. This slope is now down 150 yards. At the top they soon got into the coal, which was about five feet thick, good quality and hard; but after going some distance they got down through it, which put the coal away below the line of the slope which continued in the rock. They now again expect to get into the coal soon. If it is as good and as thick as it was above the fault, and there is no reason why it should not be, it will make a valuable work in this locality, and is not far from Nanaimo.

East Wellington Colliery.

This is the property of the East Wellington Coal Company. In this colliery there are two shafts known as No. 1 and No. 2 pits, although both are connected by by their workings underground. By the windings of those works they are 1,400 yards apart, but by a direct course they are only about half a mile distant. The No. 2 is west of No. 1.

In the west side of the No. 1 shaft they are not now doing much mining, as they are only employing a few men, coal being thin. What coal they do take out is of a first-class quality, with a strong roof, well adapted for long wall work, which has been their method of working since they started. In the east side they have during the past year done much prospecting, which is looking favourable for having good coal on this side, although they have drifted through considerable bad and barren ground.

On August 24th there was a serious fire in this shaft. Everything went on as usual until away in the afternoon, when volumes of smoke came out of the shaft, shortly after followed by flames. Then it was apparent that the ventilating furnace had set fire to the timbers of the shaft, and in a short time the head gear was on fire, and a large bin of coal near the same, while the machinery and boilers were only a few yards off. The men were got out by No. 2 shaft, that being afterwards covered and thus shutting off the air from below. By this time the fire engine was brought out from Nanaimo, and after placing it in the bed of the Millstone river they commenced work. It then became evident that the fire on top was not going to last long. As soon as possible they got No. 1 shaft covered, and in this way the fire was put out. Considerable damage was, however, occasioned by the fire burning out some of the shaft timbers, and also to the head gear, which took a few weeks to put in working order.

No. 2 PIT, EAST WELLINGTON COLLIERY.—In this pit work has been going on steadily all the year, except for a few days when the fire was at the No. 1 pit. The coal here has been kept good and continues so. The roof, however, is not quite so strong, yet it is well adapted for long wall work, and this is the system that has been generally worked here.

Ventilation is good. Motive power up to the time of the fire was a furnace with a steam jet; since that time it has been a fan, worked by a steam engine, that does its work very well. When I was down in Decem ber, I found 20,000 cubic feet of air passing per minute for the use of 60 men and 6 mules, this being the air and men of both pits, No. 2 being the intake and No. 1 pit the outlet. This mine gives off some gas, but chiefly when the roof breaks. As the air goes along the coal face the gas has not much chonce to collect and the works are well filled up. Every precaution is used to preven accidents of any kind.

Union Colliery, Comox.

You will have seen in a former report that this colliery is the property of the Union Colliery Company. Their present mines are only a few miles from the flourishing Comox settlement.

In this property the coal is exposed in various places, and at present they are mining at three different places and in two veins of coal.

No. 1 and 2 tunnels go into the hill, being adit levels on the south side of the railway. They are in about 500 feet each, coal being about the same quality, which is very good and hard, and on an average three feet thick. This is worked on tbe long wall system. The roof is very strong.

Ventilation is good; motive power a furnace, the air going in by the level road and coming out by the way along the face of the workings. There is no gas gas found in here. The mine is free from dust, being wet throughout.

No. 1 SLOPE, UNION COLLIERY.—When previously reporting on this slope I stated it as being down 1,000

feet. It is now extended to about 2,000 feet. They have been considerably troubled with faults of one kind and another. The coal, when free from faults or troubles, is about four feet high, of good quality and very hard. The workings from this slope are at the present time by four levels, one to the south side, and three to the north side. In some of these levels the regularity of the coal has been, and is still improving as they go in.

Ventilation is good; motive power a fan on the upcast shaft, built on the Murphy principle and driven by a steam engine. The last time I was down there were only three or four men in the mine, and they had the fan running slow, as it was not required at the time to go fast, yet I found that there were 20,000 cubic feet of air passing per minute. This mine gives off some gas, but it has very little chance to accumulate. There is no dust in this mine, which is wet throughout. Everything is in good order.

NO. 1 SHAFT, UNION COLLIERY.—This shaft is about half a mile south of No. 1 Slope, and is about forty feet deep. There has been much prospecting done at this place, but they do not seem to have got right on the coal yet, although it has much improved of late, and to all appearance they will get on to a good seam soon. In this district the coal has not yet proved to be quite as thick as was expected, but the quality is all that could be desired. It is to be hoped that the company's expectations will be fully realized and that the coal may get thicker. They have put down to the coal a series of bore-holes. These bore-holes are away ahead and to the dip of the slope. In some of those holes they found a good and encouraging prospect. After the large expenditure of money here, and in view of the outlay still required to prove the property, it would be a serious matter for the province as well as for the company if these mines were not a success; but it is only a question of a short time in my belief, judging from the indications, when these mines will be successful and when there will be flourishing collieries in this district of Comox.

Tumbo Island Coal Mining Company.

This island, lying at the south-east entrance of the Straits of Georgia, is being prospected for coal by the above named company. They commenced by putting a bore-hole down close to the water's edge; in this they passed through about five feet of hard coal. This prospect so encouraged them that they went down to the dip and started to sink a shaft, in which they are now down fully 100 feet. They have a steam engine, pit head gear, and other necessary appliances. Owing to the location of this shaft being so far to the dip of the bore-hole they do not expect to get to the coal at less than about 600 feet from the surface. This is a large undertaking, and will take a large amount of capital to reach the coal and put everything in order. It is to be hoped that when they get the shaft down they will find the coal as good as expected.

Prospecting.

There has been some very extensive boring in this district during the past year. Amongst them was the continuation of the bore-hole referred to in my previous report in No. 2 Esplanade Shaft. This was put down to the depth of 1,263 feet, the depth of shaft being 617 feet, makes the total from the surface 1,880 feet. From not having struck any coal, there was another bore-hole put down by the same company in the South Field. In this bore they passed through a seam of hard coal 12 feet thick, at 469 feet from the surface. This bore has been continued till the present time, and is 1,460 feet down. This bore shows a good prospect, and is very encouraging.

Oyster Harbour Coal Company.

Exploration with two diamond drills has been in progress at Oyster Harbour and Chemainus Bay during nearly the whole of this year. The first bore, commenced in January, was put down at the head of Oyster Harbour, on the north-west side, and pierced a depth of 1,300 feet through sandstone and shale, and was stopped in a fine-looking sandstone. The rocks at this place are tilted at a high angle, the cores from the bore showing a dip of some 25 degrees. While in process of boring, inflammable gas extended from this hole in sufficient quantity to burn with a bright flame when a match was applied. A second bore was started on the eastern side of the harbour, which, after going down 690 feet, was stopped for want of water. The stream which fed the drill dried up and the machinery was removed. A third hole was bored on the north-west side of Chemainus Bay, close to the water's edge. This hole was sunk to a depth of 1,600 feet, using up all the rods available, and operations were suspended. The rocks, as shown by the cores, which are sandstone, mostly, with shale bandy, are all said to be of the right kind, and we may expect to hear more of operations in this neighbourhood. At Chemainus Bay, after getting down 300 feet, measures were found to be lying horizontally, and very nicely bedded the whole depth of the bore."

Outbursts of Gas in Metalliferous Mines*

(By Bennett H. Brough, Assoc. R.S.M., F.G.S., F.I.C.)

The recently published volume of the Reports of the Inspectors of Mines to Her Majesty's Secretary of State contains an account of a lamentable accident, caused by a fire-damp explosion, at the Mill Close lead mine, at Darley in Derbyshire, on November 3, 1887. This mine, which is the largest and most productive in Derbyshire, is one of the oldest in the district, the records of the quantity of ore raised going back as far as the year 1684. The vein is frequently many yards in width, and traverses hard limestone overlain by shale. Ore is also found extending into many of the beds of shale. Fire-damp has occasionally been found in this mine, but only in small quantities. In 1886, however, two explosions occurred, by which two men were burnt. Since that date the quantity of gas emitted from the shale largely increased, and led to the use of locked safety-lamps. The account of the recent explosion given by Mr. Stokes,† H. M. Inspector of Mines, is substantially as follows: On the morning of the accident, six miners went to work at a part of the mine called the forefield. They descended at midnight on November 2. Upon their arrival at their working place, the men tested for and found gas in and about the ends of the forefield. They thought, however, that the use of safety-lamps protected them from all danger. A shot was fired during the early part of the shift, and at 3 a.m. three shot-holes were bored, within 3 or 4 feet of where the gas was known to have accumulated. These holes were charged with dynamite, and ignited by touch-paper, and a fuse carried down from the upper to the lower workings. After lighting the fuse, the men retired to what they thought was a place of safety about 50 yards away in the lower level or waggon way. At this point they were joined by the two waggoners, and all awaited the firing of the shots. Suddenly an explosion occurred, and immediately 5 of the 6 men were buried and killed by a large fall of timber and stone. The sixth man escaped with burns and serious bruises. This man stated at the inquest that the explosion took place immediately after he heard the first shot go off, and from his evidence there can be little doubt that the first dynamite shot fired the gas.

The Yoredale shale, whenever it occurs in beds of 25 to 35 fathoms in thickness, always gives off a little gas. Probably this gas had collected in the fissured limestone, and, becoming ignited by the shot, forced down the rock masses upon the unfortunate miners.

This illustration of the disastrous effects of a fire-damp explosion in a metalliferous mine clearly proves that fire-damp, unfortunately, is not confined to collieries. In a number of cases it has been met with in mines of lignite, salt, diamonds and metalliferous minerals. It has, therefore, been thought that it would be of interest to collect the records of cases in which outbursts of gas have been observed in metalliferous mines, with a view to arriving at an explanation of the phenomena.

Numerous cases are recorded in which, as at the Mill Close mine, fire-damp has been emitted from the Yoredale shales of Derbyshire. According to J. Farey,‡ in Eyam registry, there are records of men having been killed in Stoke sough (adit-level) in 1732, 1734 and 1778 by explosions of fire-damp. Pilkington§ records several men having been killed by an explosion of "inflammable air," in driving the famous Hillcar sough, near Youlgreave. This adit-level passes through the Yoredale shale for two or three miles, and, with a candle at the end of a stick, up to a very recent date, visitors used to light the thin stream of gas along the roof. This would flash along almost the whole length of the level. The gas is now exhausted, or is present in very small quantities, but, when new ground is cut, there is a decided emission of gas.

The emission of fire-damp from the Yoredale shales can be easily accounted for when the bituminous nature of these shales is considered. The occurrence of solid and liquid hydrocarbons in the Yoredale shales, and in the veins near or under them, has been noticed for many years. Dr. T. Short,‖ writing in 1734, gives the following account of the Hucklow Edge vein near Eyam:

"It is remarkable that in the lead mines . . . was a bed of boulder stones, any one of which being broken into contains from half a pint to a gallon of soft bitumen like Barbadoes Tarr, it melts before the sun or fire to oil; there were also several springs in the mines, that took fire with a candle and would burn a week or fortnight, and all the water drilling through this stratum of boulder stones will take fire and burn many days. This bed was continued between two or three miles, all along Hucklewedge with its burning waters. Several damps have happened at these mines without any preceding visible cause or sign, but all being serene and clear in the works without fog or mist; the sulphur in the air would fire at the miners' candles, the flame run from one end to the other, with a thundering noise, making the earth shake, and in two moments the sulphur was spent, the fire extinguished of itself, and all clear again. The only shift the workmen have is to clap down on the earth instantly on their faces till it is over."

The explosions here recorded are undoubtedly similar to that at the Mill Close mine. At the latter mine, a hard, black, brittle variety of bitumen is of frequent occurrence.

Similarly, the fire-damp explosions that have occurred in salt mines are due to the presence of hydrocarbons produced by the decomposition of vegetable substances. The grey or blue colour so frequently met with in rock salt is due to the presence of bitumen. In several localities, notably at Stassfurt, in Prussian Saxony, and at Wieliczka, in Poland, the salt contains bubbles filled with various compressed gases (hydrogen, carbonic acid, and carbonic oxide), which, when the salt is dissolved, give rise to a crackling noise. Liquid inclusions in rock salt are extremely frequent. Some are visible to the naked eye, others are microscopic. The enclosed material is usually a hydrocarbon. According to J. N. Bremer,* combustible gas was evolved in large quantities from a fissure in the marl in the rock salt at the Szlatina mine, Marmaros county, Hungary, and was used for lighting the workings. At Gottesgabe, near Rheine, in Westphalia, the gas evolved was used in 1826 for lighting the workings, and even conducted through wooden pipes to the manager's house, and there used for lighting and for cooking purposes. Similar outbursts of gas were utilized at Zugo, near Klein Saros, in Transylvania†; and at the Bex salt mines in the canton of Vaud, Switzerland, fire-damp has, according to Brunet,‡ been used for lighting the workings, being received from the fissures in sheet iron pipes. The gas probably comes from the enclosing limestones, which are possibly bituminous. It is a curious fact that the first fire-damp explosion recorded is shown by Professor F. Posepny,‖ to have occurred at a salt mine at Hallstadt, in Austria, on September 9, 1664, twenty years before what is generally supposed to be the first historical evidence of the presence of fire-damp, given by Robert Plot,§ in 1684.

In iron mines, several explosions of fire-damp have been recorded. A. Daubrée¶ met with fire-damp in the mines of pisolitic iron ore at Gundershoffen and Winckel in Alsace. At Gundershoffen the pisolitic iron ore, which was worked up to 1825, occurs disseminated through a yellow clay overlying marls of Upper Liassic age. The ore-bed is covered by a greyish blue clay, some twenty yards in thickness. In the bed, numerous nodules of gypsum are met with, and the clay immediately above the deposit is impregnated with grains of iron pyrites. In the bed, which was worked in 1818 at a depth of 33 yards, insignificant gas explosions were of frequent occurrence. In 1824, however, a serious explosion occurred, by which a number of miners were seriously injured. The Winckel bed is deposited in a hollow in white limestones of Upper Jurassic age. The pisolitic iron ore is disseminated through a grey clay, and the whole is overlain by a limestone conglomerate. In 1832, an explosion occurred when some workings, that had been suspended for a time, were entered. Wooden planks were ejected from the shaft and thrown to a distance of 10 yards from the mouth, and the only workman in the mine at the time was badly burnt. An explosion of a less serious character occurred on June 27, 1846. At the end of a level, a great influx of water was observed, and in raising his light to see whence it proceeded, the captain ignited the gas, and was thrown violently to the ground and slightly burnt.

Castel** mentions an explosion of fire-damp which occurred on November 15, 1853, at the Voulte iron mine by which many miners were seriously burnt. The ore-bed at Voulte is enclosed in black marls of Middle Jurassic age, underlain by mica-schists in uncomformable stratification. The gas was ignited by a spark from a miner's pick. In this case the presence of gas appears to be due to the existence of a gasey lignite in the marl at a slight distance from the ore-bed. In mines working true fissure veins, numerous explosions have been recorded. In March, 1845, an explosion occurred in old workings that had not been entered for some years, at the now abandoned copper mine of Grand-Saint-Jean, near Giromagny, in Alsace. Gas has been noticed on several occasions at Pontpéan, in Brittany, where it is

*Nov. No. of Eng. Inst. of Mining and Mech. Engineers.

†Reports of the Inspectors of Mines for the year 1887, London 1888, p 377.

‡General View of the Agriculture and Minerals of Derbyshire, London, 1811, p. 333.

§A View of the present state of Derbyshire, 1789, p. 174.

‖The History of the Mineral Waters of Derbyshire, 1734, p. 96.

*Poggendorff's Annaley der Physik und Chemie, vol. vii., 1826, p. 131.

†Gilbert's Annalen der Physik, vol. xxxvii., 1811, p. 1.

‡Comptes rendus mensuels de la société de l' industrie minérale, 1882, p. 129.

‖Oesterreichische Zeitschrift für Berg- und Hüttenwesen vol. xxxiii. 1885, p. 606.

§Natural History of Staffordshire.

¶Annales des mines, 4th series. volume xiv. 184, p. 33.

**Ibid., 5th series, vol. vi., 1854, p. 94.

still occasionally met with.†† The vein consists of argentiferous galena and blende, and traverses, in a north and south direction, the ancient clay-slate. As there is a dislocation that has brought a portion of the deposit to the level of the Tertiary strata, it is possible that the gas outbursts are due to the influence of lignite deposits, which may exist in these beds.

Charlton* reports the occurrence of inflammable gas in the copper pyrites deposit of Rocca Federighi, in Tuscany. In 1875, a timbered level that had been abandoned for two or three years was encountered by a cross-cut. On holing, large quantities of water were ejected, and, immediately afterwards, an explosion occurred by which three workmen were seriously burnt. Again, in 1877, at the same mines, an explosion occurred on opening an old adit level that had been abandoned for fifteen years. In this case a thin parting of rock separated the old level from that in which the men were working and matter having an unpleasant odour percolated through. A piece of the roof fell, and the captain, raising his lamp to see what was the extent of the disaster, exploded the gas, the three men in the level being very seriously burnt. From this description it appears that, under certain conditions, the decomposition of wood in water or in moist air may give rise to the formation of inflammable gas in exactly the same way as marsh gas is produced in stagnant pools. The explosions that have occurred in some of the Saxon mines when old workings were entered, may be explained in this way. The archives of the Royal Saxon Mining Bureau, quoted by Tittel,† record several explosions of this kind. At the St. Johannes mine, at Rehhübel, in the Schwarzenberg district, a cross cut was driven from the Urbanus adit level, at a distance of 760 feet from the mouth of the adit. On March 11, 1872, two miners were working at the end of this cross-cut, and at noon a quantity of water burst through. At 3.45 p.m. an explosion of gas occurred. One of the miners, though badly burnt about the head, face and hands, found his way in the dark out of the adit and escaped. The dead body of the other miner was found at a distance of 643 feet from the mouth of the adit. It was subsequently found that the water from an old shaft accompanied by marsh gas, which had in all probability been formed from the decaying timbers, had burst through an aperture, and become ignited by the miners' lamps.

At the Churprinz Friedrich August mine, at Grossschirma, in 1859, a brick dam was put in to keep out the surface water. In 1882 the system of drainage was changed, and the dam was bored through in order to insert an iron pipe provided with a cock for letting off the water as required. While the boring was in progress water and gas burst through, and an explosion followed by which the miners engaged were seriously injured. Similarly, at the Alte Hoffnung mine at Schonborn, a dam built in 1868 was opened in 1870 in order to ascertain whether there was as much water as formerly. The gas issuing with the water, ignited, and the flame extended for 20 feet and burned for several seconds. Behind the dam, the level had been timbered for some 30 yards.

The presence of fire-damp in metalliferous mines cannot always be traced to the decomposition of timber under water. There was very little timber in the Winckel levels. and none at all in the Giromagny mine. In many mines, too, containing an enormous quantity of timber partially submerged, no trace of gas has been observed. This was the case at the Alter deutscher wilder Mann mine, near Grund, in the Upper Harz. This mine was under water for 200 years, and was visited by the writer in 1882, immediately after the water had been pumped out.

Another explanation must be sought for the presence of fire-damp in the Monte Catini mine in Tuscany, where in 1845 many miners lost their lives by an explosion, and in the celebrated Van mine near Llanidloes. The latter mine is the most productive lead mine in the United Kingdom. The vein occurs in rocks of Lower Silurian age. The occurrence of gas at this mine has been noted by Dr. C. Le Neve Foster.‡ Fire-damp was found at the adit, and in nearly every level below while tapping or making the first drivages on the lode. The gas rushes out with the water, making a great noise, and always appearing to come from below. The miners regard it as a sure harbinger of lead ore. The quantity has sometimes been sufficient to cause slight explosions, by which miners have had their hair and beards singed. It is not improbable that sulphuretted hydrogen has also been emitted.

T. Macfarlane§ describes the occurrence of fire damp in the Silver Islet mine, situated on a small rocky island in Lake Superior. On December 28, 1875, while a party of miners were engaged in drilling a hole in the end of the drift at the 8th level, the drill suddenly broke into a crevice, from which water at once commenced to flow, but not in great quantity, and not being aware that it was accompanied by an emission of gas, one of the miners took a candle to look at the hole. The gas instantly took fire, sending out a flame of more than forty feet in length. The hole was subsequently stopped with a wooden plug, and when a lighted candle was applied to the imperfectly plugged hole, the gas again ignited, giving a jet of flame about a foot in length, which continued to burn for several weeks.

In these cases, it appears probable that the gas has been derived from beds beneath the ore-vein, from which it has ascended through fissures into the workings.

Sulphuretted hydrogen has, in many place, been disengaged in sufficient quantity to become ignited. This occurred during the sinking of a well at Gajarine, near Conegliano, in Lombardy, and is described by L. E. F. Héricart de Thury.† The explosions described above cannot, however, be attributed to this cause, for if sufficient sulphuretted hydrogen had been present it would at once have been detected by its characteristic odour, and by the odour of the sulphurous acid formed on its combustion.

The oldest description of the occurrance of sulpnuretted hydrogen in mines is given by A. A. Bärba, the director of the mines at Potosi, in Peru, who in 1640 published a Spanish treatise on mining.‡ The description, as given in the Earl of Sandwich's translation as follows:—

"Some do think that there is some matter in the bowels of the earth so stinking and abominable, that it doth correspond with the ordure of animals: the truth is, that there be places in the earth that instantly kill, with a pestilential smell. And setting aside the stories of this kind, both ancient and modern in remote countries, I shall relate two examples, where I myself was present, which was at the discovery of the rich country of San Christoval de los Lipes; at that time, in a beautiful high hill, that together with others encompass the dwelling of the miners, two Galleguares found a mine, which at first they called after their own names, but ever since, to this present, it is called from its effects, *The stinking Mine.* At first they got out of it very rich ore between white chalk; and as they began to sink deeper they were forced to give over by reason of a most abominable ill smell they met withal, which killed several of the miners, Indians; and so it lay unwrought for four or five years; after which time another miner (I being then in the country) undertook to proceed in the working of it; thinking that having lain so long after its first opening, the ill quality would have been evaporated; but that experiment cost the lives of two Indians more, whereupon they forebore the work, and have done so unto this day. The which I have not so much wondered at, as to see with my eyes the ground opened in several other parts of the mountain, at a great distance from the forementioned mine, and in digging scarce a yard deep, such a stink came out of the ground as forced the labourers to give over; and as I passed by those pits a few days after, I saw divers birds and serpents dead in them, having been intoxicated by that poisonous smell."

"In the famous country of mines, Verenguela de Pacages, in which the Indians procured a patent to dig, before that of Potosi was in use, because its veins were esteemed much richer than Potosi, and upon trial were found to be so; and the ore gotten there inferior to none in the Indies. In the hill of that country, called Sancta Juanna, a miner followed a very rich and plentiful vein of silver, and intending to discover more of the like, he determined to break a hole into an old vault, and set two Indians upon the work, who after a few blows discovered a vacuity, out of which came so pestilential a stink, that killed the two Indians presently, and almost stifled others that were at a distance from them in the mine, who nevertheless ran out and told their master what had happened. He made haste to the mine, hoping to save the Indians, but at first entrance into the ground, upon the stairs by which they went down into the mine, he fell down dead, and his body remained there, nobody daring to go down to take it away to bury it."

In these cases, the gas was probably produced from the decomposition of pyrites ores. This decomposition may be detected in many old mines. The writer has observed the presence of large quantities of sulphuretted hydrogen in abandoned workings at the Rammelsberg mine in the Harz, at the Falun mine in Sweden, and at several of the Hungarian mines. In other cases, the acid waters produced by the oxidation of pyrites act on limestone and produce carbonic acid. Emanations of carbonic acid in the iron ore mines of the Upper Erzgebirge are described by H. Müller.* Similar outbursts have been observed at the mines of Massa Maritima, in Tuscany, where a thick vein of pyrites and quartz traverses clay slate enclosing limestone beds. The hanging wall of the vein is formed by a band of clay that conducts a quantity of water into the workings, and serves as a receptacle for gas, principally carbonic acid, probably produced in the manner indicated. A similar reaction may have produced the large quantities of carbonic acid given off from crevices in the south wall of the lode at the Foxdale lead mines in the Isle of Man. In 1883, when the writer visited these mines, the amount of gas given off at the eastern end of the 185 fathom level was so great that, notwithstanding the large volumes of compressed air continually forced in from two air pipes, candles would not burn and the work was carried on under great difficulties.

In the same way, carbonic acid was met with in 1875 in the Johannis Stehenden vein, in the Himmelsfürst mine, at Freiburg, in Saxony. Here, too, lights would not burn before a freshly opened cavity.

Carbonic acid, produced by the action of acid waters on limestone, is of not unfrequent occurrence in the Derbyshire lead mines. At a mine near Youlgreave, the writer has seen this gas being raised in buckets attached to a windlass. An early account of the occurrence of carbonic acid is given by William Hooson, a Derbyshire miner, in a quaint work* published in 1747. The effect of the gas on the miners is described in the following terms:

"All miners both ancient and modern give this account, that they never feel any sensible pain or disorder, but after a most pleasant way, it takes the whole use of all their limbs, and they settle down, as a man falling asleep, feeling nothing at all, but an extraordinary sweet and lushious taste and smell, that beguiles and ravishes the senses in a moment.

"This is the whole account that we the miners can give of it; and this so far as the memory continues, after being seased or tapished with it, and being drawn up by the heels for dead, yet have recovered; but never could such men remember, or give any account of the least pain they ever felt in it. And now give me leave to tell you the best preservative we miners know of, and verily think is of great force against it, we have it delivered to us by the old miners, and many I have known to confirm the same; but here are two examples, the first I was not present at, being more than two miles from where I then was; the other in our Liberty, and my brother one of them, the former was thus: Two miners sinking a shaft in hard shale near 20 yards deep, it happened the ground-damp bred in it; one of them went down, his partner of a considerable time after hearing nothing of him, and knowing it was windless, began to suspect the matter, and forthwith calls his next neighbours, and tells them what he feared; having now some company, down he goes to see what the matter was, and soon was damped likewise; and now more company coming in, one young bold man ventures down and has the same fate; and after him (the depth of the shaft being so small) two more, and those damped likewise; this put the whole company to a stand, and as they were considering to carry wind down in trunks, by chance a tinker seeing a crowd of people, turns out of his way to see what was a doing there; having heard the matter, he said it was no difficulty to fetch them up; (the man had been drinking all night, he feared no danger, nor could any persuasions stay him from his design) he throws by his budget and pulls off his coat, and down he goes, ties the dead men in the rope one by one by the heels, and after climbs up himself, without any damage, only when he came up again into the fresh air, he vomited most violently, and was most deadly sick; therefore it was concluded that the fumes and strength of the ale preserved him, according to the old miners' opinions."

In the second case described, an old miner ties the bodies of three miners, suffocated by the gas, to the rope, and finally comes up himself. "This man," writes Hooson, "had been drinking all the day before, and most part of the night, so that it should seem not to work so soon upon a man well steeped in ale. Many men's lives have been saved after this manner, which seems to be an act of Providence rather than any foresight, or care that a man has of himself, and indeed I never yet knew nor heard of any man that was sober, durst be so bold to take a sufficient dose of ale on purpose that he might the better encounter it."

SUMMARY.

From the various records collected in this paper, it is believed that there is sufficient evidence to show that the gas outbursts, that have been observed in metalliferous mines, are not all due to the same cause, and may be explained by the following hypotheses:—

1. The decomposition of timber in a mine, in a similar manner to the decomposition of vegetable matter in marshes, may produce fire-damp which would accumulate in cavities that are ultimately broken into. This is evidently the explanation of the explosions in the Saxon

††Rapport de M. Haton de la Goupilliére au nom de la commission d'érude des moyens propres a prévenir les explosions du grison, Paris, 1880, p. 39.

*Comptes rendus mensuels de la société de l'industrie minérale, 1879, p. 6.

†Berg. und Hüttenmannische Zeitung, 1882, p. 226.

‡Transactions of the Royal Geological Society of Cornwall, vol. x., 1879, p. 33.

§Transactions of the American Institute of Mining Engineers, vol. viii, 1880, p. 226.

†Annales des mines 3rd series, vol. iv, 1833, p. 515.

‡Art de los metales, Madrid 1640.

§The Art of Mettils, London, 1670

*Gangstudien, vol. ii, p. 502.

*The Miner's Dictionary. explaining not only the terms used by miners, but also containing the theory and practice of that most useful art of mining, more especially of lead mines. Wrexham, 1747.

mines, and in the Rocca Federighi mine.

2. In iron mines, where the iron is not entirely in the state of peroxide, water might be slowly decomposed, and hydrogen be produced. This, if the ventilation of the mine was defective, would accumulate in the upper portions of the underground excavations. This is a possible explanation of the explosions at Gundershoffen and Winckel.

3. In these cases, however, it is more probable that the gas was fire-damp, which emanated from beds beneath the ore deposit, and found its way, through fissures, into the workings. The gas would thus be produced in the same way as the natural gas of the United States, China, and other countries, where it is given off from rocks of varied age enclosing bitumen. The Upper Liassic marls on which the Gundershoffen deposit rests are often sufficiently bituminous to enable them to be burnt. At Winckel, however, no such beds are met with below the deposit, though they occur in the Jurassic rocks of the vicinity. The same explanation is therefore feasible. At the Mill Close, and other mines in Derbyshire the gas is derived from the Yoredale Shales, which are undoubtedly of a bituminous character. Bituminous matter has occasionally been found in mineral veins, and would appear to have been derived from the adjacent rock at the time of the filling of the vein fissures. In the Snailbeach lead mine in Shropshire, small nests of bitumen abound in the vein, and the writer has found the same substance in geodes in some of the abandoned metalliferous mines of Alsace, near Mollau and St. Amarin, in the Vosges. The explosions at Monte Catini, Silver Islet, and the Van mines would appear to be due to natural gas derived from adjacent rocks.

4. Fire-damp may be produced from the decomposition of organic matter, in the same way as the hydrocarbons met with in salt mines. At Pontpean, and at the Voulte mine, the fire-damp was apparently derived from beds of lignite in the vicinity.

5. Explosions have in some cases been caused by outbursts of sulphuretted hydrogen, produced by the action of acid waters on pyrites ore.

6. The outbursts of carbonic acid met with at Foxdale, Freiberg, and Massa Maritima, may have been caused by the action of acid waters, produced by the oxidation of pyrites, on limestone or metalliferous carbonates.

The Quarter's Yield from Nova Scotia Gold Mines, as per Official Returns.

District.	Rock Crushed.		Gold Yield.		
	Tons.	Cwts.	Ozs.	Dwts.	Grs.
Sherbrooke—					
January	281	...	83	13	..
February	150	...	73	.	..
March	...	...	...	..	..
Total	431	...	156	13	..
Salmon River—					
January	650	...	181	..	..
February	500	...	160	..	..
March	400	...	173	10	..
Total	1550	...	514	10	..
Lake Catcha—					
January	94	10	103	..	..
February	96	86	10	..	..
March	170	131	5	..	..
Total	371	7	118	..	..
Whiteburn—					
January	175	...	115	7	2
February	35	...	52	2	3
March	103	...	91	19	16
Total	313	...	259	8	21
Caribou—					
January	551	4	122	17	14
February	369	7	98	8	16
March	243	3	63	6	..
Total	1163	14	284	12	6
Uniacke District—					
January	177	...	92	5	2
February	220	...	175	17	15
March	260	...	104	1	..
Total	657	...	372	3	17

Nova Scotia Gold Quartz Yield.—(*Continued*).

District.	Rock Crushed.		Gold Yield.		
	Tons.	Cwts.	Ozs.	Dwts.	Grs.
Malaga—					
January	314	...	276	..	..
February	520	...	302	..	..
March	...	...	...	..	..
Total	834	...	578	..	..
Central Rawdon—					
January	175	...	177	..	..
February	...	...	....	..	..
March	110	...	95	..	..
Total	285	...	272	..	..
Montague—					
January	120	...	362	5	..
February	76	...	140	11	..
March	...	...	...	..	..
Total	196	...	503	6	..
Renfrew—					
January	233	...	64	9	..
February	...	...	...	..	..
March	21	10	23	18	..
Total	254	10	88	7	..
Leipsigate—					
January	...	...	...	..	..
February	15	...	25	15	14
March	10	8	4	9	20
Total	25	8	30	5	10
Wine Harbor—					
January	98	10	50	16	..
February	60	...	18	1	..
March	...	...	...	..	..
Total	158	10	68	17	..
Oldham—					
January	67	12	155	7	..
February	77	18	52	10	19
March	91	10	133	7	..
Total	237	...	341	4	19
Moose Head—					
January	...	...	...	.	..
February	...	...	...	..	..
March	80	...	2	10	..
Total	80	...	2	10	..
Gold River—					
January	...	...	...	..	..
February	...	...	...	..	..
March	100	...	40	..	..
Total	100	...	40	..	..
Brookfield—					
January	326	...	192	3	..
February	...	...	...	..	..
March	...	...	...	..	..
Total	326	...	192	3	..
15 Mile Stream—					
January	120	...	63	..	..
February	168	...	116	15	..
March	175	...	127	10	..
Total	463	...	307	5	..
Stormont—					
January	199	...	109	8	..
February	257	...	138	3	..
March	255	...	134	10	..
Total	711	...	382	1	..

Facilities in the Engine-Room.—Owners of buildings and machinery are, frequently, thoughtless respecting the requirements in an engine-room. However costly the plant, however carefully erected, however elaborate in detail and perfect in finish, however intelligent and skillful the engineer, there will always be occasions when something in the repairs, adjustment or alteration will have to be done and done quickly. Just then it is no time to cast about for tools and appliances. These should be on the premises. We have heard complaints from many engineers about the parsimoniousness of their employers when tools, materials, stores and appliances were highly necessary in the engine and machinery department. Those corporations and wealthy mill-owners who practice extreme parsimoniousness and an impolitic policy in the care of their machinery plants, act upon a penny wise and pound foolish system which is discreditable to modern engineering. Repairs are often done promptly and well at little expense by an engineer and his fireman when the appliances and materials are at hand. No engine-room should be without its vise, bench, and drawer full of files, chisels, taps, dies and drills. Give engineers a chance to save money for their employers by a constant use of machinists' hand-tools, and, where circumstances permit, to keep their engines and engine-rooms in the neatest and cleanest manner possible. A noisy engine and a slovenly engine-room inqicate that there is more than one screw loose somewhere.

Four Big Boilers Made in Canada.—The Polson Iron Works Company, of Toronto, 28th ult., shipped to Owen Sound the last of four large boilers constructed by them for the car ferry they are now building at their shipyard there for the Canadian Pacific Railway Company. These boilers are the largest ever made in Canada, and also the largest ever carried by rail on this continent. They are of the cylindrical return multitubular type, and are 13 feet 3 inches in diameter and 14 feet long, weighing 37 tone each. The shell-plates are 11-16 of an inch in thickness, and were specially rolled in Scotland. The tubes are of German manufacture, and are 4 inches in diameter, 11 feet long, and 148 in number. There are in each boiler three of Fox's corrugated furnaces, 42 inches in diameter and 10 feet 11 inches long. The Government test showed an allowance of 94 pounds working-pressure. The rivetting of these boilers was done by a Tweddell hydraulic riveter, with a gap of 8 feet 4 inches, lately erected in the company's shops. The boilers, when completed, were lifted bodily on to the cars by a large overhead traveling crane, which has a lifting capacity of 50 tons.

A Great Steel Plant's Record.—The union of several rolling-mills and steel works into the Illinois Steel Works, which was effected last year, illustrates once more the advantage of joining conflicting or mutual interests. The following splendid showing is the immediate result: The total value of finished products shipped in the eight months of 1889 after its organization was $15,275,529. The company received a total of 2,048,688 tons of raw material, and shipped over half a million tons of finished products. The total pay roll amounted to $3,660,888, and the purchase of miscellaneous stores and supplies of all kinds amounted to $693,000. The company received 88,554 cars of material, and shipped 40,954 cars. There were employed directly at all the works on an average per day, 8,360 men, besides the employment given indirectly to a large additional force in the production of coke, coal, iron ore, limestone and other materials.

The Decreasing Cost of Aluminum.—Aluminum, one of the most valuable and useful metals, and at the same time one of the most plentiful in its crude state, is now being produced, by different processes, at a comparatively low price. When the metal was first shown in Paris, by Denille, in 1855, it was priced at $15 per ounce. In 1857 it was sold at $2 per ounce, and in 1884 its production had been so cheapened that the metal for the tip of the Washington monument was bought for $15 per pound. At the close of last year it was for sale at $4 per pound, and developments are now being made which still further reduce its cost. There are few of the metals that are of such intrinsic value, or that can be put to such a variety of uses as aluminum, and if its production can be cheapened to correspond with that of other metals, it will become one of the most extensively used and easily obtained articles of manufacture.

Graphite as a Blast Furnace Lining.—An experiment was tried at the Crown Point Iron Co.'s plant, some time ago, on the occason of their relining and starting in blast one of their large furnaces. After the fire-brick were in place, a cheap article of graphite or plumbago was bought, reduced to a paste with water, and the interior of the furnace washed with the plumbago paste. It gave a slippery glaze—incident to the lubricating quality of the plumbago—to the fire-brick lining, which lessened the time necessary to a heat quite a percentage. The slippery surface refused to be coated with slag or other refuse, and the charge passed down in less time and left the lining free and clear. The Crown Point managers claim quite a success for their scheme. The expense of rhe trial was very small compared with the value of the result.

Iron Ore in British Columbia.

In one of his recent reports Dr. G. M. Dawson states that most of the ores hitherto discovered are magnetites, which occur in association with the older metamorphic rocks of the province Clay ironstone, however, is of frequent occurrence in the coal series of Vancouver and Queen Charlotte Island, as well as in the tertiary rocks of the interior. The only iron ore deposits which have yet been worked are those of the south-west side of Texada Island, the largest exposures of ore occurring about three miles north-west of Gillies Bay. Here the ore mass is from 20 to 25 feet in thickness. It constitutes an irregular contact deposit between limestone and granite. The ore is magnetite of excellent quality, concontaining nearly 70 per cent. of iron.

At the principal deposit of the ore a wharf has been built. The ore is brought down from the quarry to the wharf by an incline, the height of the quarry above sea level being 250 feet, and the length of the incline ¼ mile. The shipments in 1885 amounted to 190 tons ; in 1888 the quantity shipped was 7,300 tons, valued at £3,680. Magnetite is also found at the Queen Charlotte Island. the ore being, as a rule, very pure, and exceptionally good specimen yielding on assay 69.88 per cent. of iron. Very pure ore containing 71.57 per cent. of iron was also found at an island in the Walker Group, Queen Charlotte Sound. Other deposits exist at Sooke Harbour, Vancouver's Island, and at a number of other places.

Persia: A Probable Field for Mine Managers and Mining Engineers.

Colliery Manager.

Manufacturers and factors in other industries are anxiously looking about for new markets; capitalists are everywhere in search of new countries in which they may more profitably use their means than in our own, and the rapid increase in our population causes thousands to sigh for, if not to look for, fresh fields of labor in which the number of workers shall not be so disproportionate to the work to be done. The reason for this state of things is that all our professions, trades, and occupations are sadly overmanned. In the industry we represent it is too painfully true that of those who have lately obtained, or who are now studying for, colliery managers' certificates of competency, the number who can secure satis factory appointments at home will be comparatively limited.

These and other like considerations have invested the recent meeting of the Imperial Bank of Persia with great interest. Persia appears to be likely to furnish a fruitful field for our capitalists, manufacturers, and employees of every character and of almost every grade. It is not so much as a bank as in its capacity of a State institution that the Imperial Bank is likely to contribute to the commercial prosperity of Persia, and at the same time to assist in the development of mutually advantageous commercial relations between the Persian empire and Great Britain. The concessions possessed by the corporation are of a most comprehensive character. It has been granted the exclusive right of working throughout the empire the iron, copper, coal, lead, asbestos, and all other mines, which belong to the State and have not already been conceded to others. The corporation has thus virtually botained the sole privilege of getting minerals in Persia, for all mines are State property, and the concessions made to others are few and insignificant.

These large concessions may be regarded as the most important part of the bank's charter, and while they are sure to be a source of considerable profit, they are also calculated to infuse a spirit of commercial enterprise and business activity throughout the empire. Fully alive to the requirements of the vast territory through which they have to deal, the board are now considering a road and transport service concession, which will require the formation of a company of an international character for its construction and management, and from which the bank will reap important direct advantages. This question of road making—especially the construction of a serviceable roadway from Teheran to the river Karun—is of the first importance, and is properly being dealt with at once, and affords an opening for the employment of a large amount of imported skillful aid. But the point to which we desire to call the attention of our readers is the development of the vast mineral wealth of the empire. The directors of the Imperial Bank, upon whom this development now devolves, have the assistance of General Houtum-Schindler, a mining engineer of considerable experience, and who has long been employed by the Shah. He has reported that coal is very abundant, and that there are many places in which it can be economically worked. It is, in fact, already being mined in the neighbourhood of Teheran, and the returns are said to be good, although the arrangements and appliances are of a very indifferent character. Many causes, some of them local, are likely to render a native supply of coal most useful, and consequently very profitable. It has already been found necessary to import fuel from India, so that the mining of coal will be of immediate advantage. It is also within the range of possibility that the development of the coal deposits in the locality of Bushire will provide supplies for steamers calling there. Coal for that station is now sent from Great Britain. The importance of coal production on a large scale will be understood when it is remembered that there are, according to recent reports, prolific veins of copper, iron and lead. Copper smelting is carried on now, but with such imperfect apparatus that plates are imported on a large scale. A large supply of coal will induce extended and improved smelting operations. The getting of coal abundantly and economically must be a first consideration where it is so essential for the successful treatment of the numerous other minerals which abound. There is a bright future for the Persian empire if coal deposits and iron ores are found in such convenient juxtaposition as is reported.

The Imperial Bank will not—indeed, we think we are right in saying it cannot, according to its constitution—undertake the development of mines on its own account. It is certain, however, that it will speedily concede the right to do so to some other body, and there will, we think, be an opportunity for many mining engineers and colliery managers to obtain advantageous engagements in Persia, who may have to wait many years before any come within their reach in Britain.

Loadstone in Sweden.—In the western portion of the Timansberg mining field has been found magnetite exhibiting the unusual property of attracting magnetism, fragments some 132 lbs. in weight being able to support a needle 2½ inches in length.

Removal of the Tariff on Imports of Mining Machinery.—In the present state of the industry the best possible machinery should be got with the least restriction possible, and the Government has decided to allow the importation, duty free for three years and no longer, of such mining machinery as is not made in Canada at the time of importation.

The Treatment of Wire Ropes.—" Under this head" writes T. H. Deakin, "I would call attention to the fact that rope manufacturers pay a high rate of railway carriage, to ensure the rope being kept dry and conveyed with care to its destination. It is equally necessary that in arriving at the colliery it should be stored in a house where it will be kept perfectly free from wet, steam, and noxious fumes. I have heard of a rope suddenly breaking after being in work but a short time, and when there appeared to be no apparent reason for the failure, unless it be that it was kept at the colliery stores for a long time prior to its being put to work. If ropes are kept in stock any length of time, they should be in the dry and turned over and oiled from time to time with a good and pure oil, to insure them against rust. When wanted for work, the rope should be placed on a turn-table or reel so that it may be uncoiled. If treated in any other way the strands are certain to be more or less opened, and there is great risk of damage to the rope by kinking ; and if a slight kink is once made, that portion of it is irretrievably damaged. The rope having been kept free from rust while in the stores, it is important to keep it so as far as possible whilst in use. This can best be done by making up a thick oil, and as the rope is being wound slowly on the drum, and before it becomes wetted, this mixture should be applied, and care taken to work it well into the crevices of the rope, so that it has the appearance of a solid bar. Ordinary rope oil should then be applied for a few days consecutively, and afterwards, under ordinary conditions, an oiling once a week will keep it in good order. If this course be adopted, it will be found to add immensely to the life of the rope. Some people object to having the ropes greased, because they say broken wires cannot be detected ; but I, for one do not subscribe to this doctrine. Ropes, will of course, stretch considerably on being first put to work, and for a time the engineman should be careful to start gently, so as to feel the load, before putting on much strain."

Failure of Steel Flat Cars.—The Cleveland, Akron & Columbus Railroad recently ordered five hundred coal cars for that line, and the first cars were delivered last fall. The cars are quite handsome in construction and captivate at sight. Some years ago an attempt was made to build iron cars, but they went to pieces so much quicker than wooden cars that the manufacturers were obliged to discontinue their construction. The builders of these new coal cars believe they have surmounted obstacles in the way, and have placed trusses and braces at every conceivable point to give the cars strength. The trusses and supports give them the appearance of an iron bridge. It seems, however, that there is a difference between an all iron bridge on wheels and an all iron bridge which remains stationary. It is now only about four months since these new cars were placed on the road, and the car inspector, Mr. Chrisman, reports that they require constant repairing. The truss-rods are shearing and the nuts falling off on every trip. The average life of a wooden coal car is about seven years, but these new cars will not last half as long with constant repairing. This seems to settle the question whether all steel can take the place of a combination of wood and steel and iron in cars, waggons or harvesting machines.

The Proper Care of Boilers.—To clean the boiler, remove all the covers of the manholes ; scrape, or if there is much hard incrustation, chip the interior surface, thoroughly loosening and removing all sediment and dirt. Pass a quantity of clean water through the manhole. Examine and clean all feed-water and other pipes periodically ; remove and scrape fusible plug, and renew if necessary. Keep all flues or tubes thoroughly clean and free from soot, &c. Examine all cocks and fittings, and see that they are in order and free from leakage. Examine the flues and see that the boiler seatings are dry, and that there is no leakage either from the seams or from the roof. Tubular boiler tubes should be swept once a day, or twice if the fuel be bad. This can be readily done with a jet of steam.

Production of the Victoria Gold Field. — The Victoria gold field up to the present time had produced 64,000,000 ounces through a period of thirty-eight years, chiefly alluvial gold—but the quartz reefs promise to yield gold profitably for more than a hundred years, reports the Government geologist who is of the belief that the quartz mines may be worked profitably to 2,000 feet and made to supply at least as much gold in the future as the placers have done in the past. It is not generally known, we fancy, that the largest single silver mining property in the world at this time is the Broken Hill Proprietary Company's property in Queensland, upon upon which more than 800 men are employed underground alone. A vast quantity of ore is exposed. Some of the lodes, kaolin carrying silver, are 230 feet wide. There is every indication that untried ground owned by the company will prove equally rich with any as yet worked. Thousands of tons of ore are ready for the ore-dressing mills before being sent to the smelters. At some points are large bodies of massive lead ore that does not require dressing. Carbonates and galena abound, there are also seams of native copper met with. The underground openings are enormous.

Life Preserver for Miners.—Mr. A. Upward, an Englishman, has invented an apparatus for ascertaining the contiguity of water or gas to workings in mines and for passing food to imprisoned miners and for rescuing them. *The Colliery Guardian* thus describes the invention :—" The apparatus for ascertaining the state of a mine as regards approaching danger is firmly held to the face of the coal by means of struts and a piece of timber fixed vertically to the rear between the roof and the floor of a mine. It consists of a chamber fitted with a slide valve, which can be opened and closed at pleasure. Through a stuffing-box in the chamber on the working side passes a boring tool, with which the miner drills a hole in the coal to the distance inwards to which he intends to work. Assuming this to be, say eight feet, when he has reached that distance he withdraws the boring tool, and if neither gas nor water has made its appearance he knows he can safely work so far in. Should he tap water or gas during the boring there would be an inrush of the one or the other into the chamber of the apparatus, and its presence would be indicated by a pressure gauge. The boring tool would then be withdrawn as far as the stuffiing-box, the safety valve would be closed in front of it, and steps would be taken to ensure safety in the workings. It is proposed by Mr. Upward that the detector should be used each day when the men proceed to their work, in order to ascertain whether or not the elements of danger are present, and only waiting the stroke of a pick to be released. The further modifications of this apparatus relate to the passing of food to imprisoned miners and to their bodily delivery. The apparatus in each case is similar in principle to that already described, but much larger. By means of the first a large hole is drilled through the coal, the drill is withdrawn and a tubular vessel containing food and messages is passed through. By the second a larger hole is bored and a larger tubular chamber passed through, into which the imprisoned men can creep, and thus be rescued one after another. Mr. Upward proposes that a testing apparatus should be kept at every colliery, and that depots should be formed in the different mining districts where relief and rescue apparatus should be deposited, and from whence they could be rapidly forwarded to any spot when required. These depots are to be furnished with medical and surgical appliances adapted for mining casualties, and with such stores as experience of the district suggests as being the most useful in cases of mining accidents."

The Enormous Strength of the Forth Bridge.—As showing the immense size and strength of the Forth bridge, in Scotland, a prominent English engineer has made a contrast in the following simple terms: As a grenadier guardsman, put at the average height of 5 feet 10½ inches, is to a new-born infant, about 19.34 inches, so is the Forth bridge to the largest railway bridge yet built in this country. To give an idea of the material used in the construction of the bridge, it may be mentioned that it included about 51,000 tons of steel, of two qualities—one to resist tensile and the other compressive strains, having strengths, respectively, of 30 to 33 and 34 to 37 tons per square inch of tension—and, as we stated before, upwards of 21,000 tons of cement, 707,000 cubic feet of granite, 117,000 feet of masonry and concrete for the foundations and piers, while 1,000,000 cubic feet of timber were used for temporary purposes. As many as 3,800 men were employed at one time in the construction. The stability of the bridge is assured, as far as human foresight can make it, and this will be apparent when it is mentioned that Mr. Baker, one of the engineers for the work, considers that half-a-dozen ironclads could be hung from the cantilever ends. Experts stated that the gale to which the Tay bridge succumbed did not give a higher pressure than 30 lbs. per square foot. In the case of the Forth bridge, a pressure of 56 lbs. per square foot has been allowed for acting over the whole surface—greater than ever has been experienced in this country. As to the cost, it is estimated that £2,250,000 has been spent on the bridge and the north and south railway approaches, but, including the construction of various connecting lines, nearly £3,000,000 (say $15,000,000) will have been consumed.

MONEY ORDERS.

MONEY ORDERS may be obtained at any Money Order Office in Canada, payable in the Dominion and Newfoundland; also in the United States, the United Kingdom, France, Germany, Austria, Hungary, Italy, Belgium, Switzerland, Portugal, Sweden, Norway, Denmark, the Netherlands, India, Japan, the Australian Colonies, and other countries and British Colonies generally.

On Money Orders payable within Canada the commission is as follows:

If not exceeding $4	2c.
Over $4, not exceeding $10	5c.
" 10, " " 20	10c.
" 20, " " 40	20c.
" 40, " " 60	30c.
" 60, " " 80	40c.
" 80, " " 100	50c.

On Money Orders payable abroad the commission is:

If not exceeding $10	10c.
Over $10, not exceeding $20	20c.
" 20, " " 30	30c.
" 30, " " 40	40c
" 40, " " 50	50c.

For further information see OFFICIAL POSTAL GUIDE.

Post Office Department, Ottawa.
1st November, 1089

TENDERS.

SEALED TENDERS marked "For Mounted Police Provisions and Light Supplies," and addressed to the Honourable the Minister of Railways and Canals, Ottawa, will be received up to noon on Tuesday, 3rd June, 1890.

Printed forms of tender, containing full information as to the articles and approximate quantities required, may be had on application at any of the Mounted Police Posts in the North-West, or at the office of the undersigned.

No tender will be received unless made on such printed forms.

The lowest or any tender not necessarily accepted.

Each tender must be accompanied by an accepted Canadian bank cheque for an amount equal to ten per cent. of the total value of the articles tendered for, which will be forfeited if the party declines to enter into a contract when called upon to do so, or if he fails to complete the service contracted for. If the tender be not accepted the cheque will be returned.

No payment will be made to newspapers inserting this advertisement without authority having been first obtained.

FRED. WHITE,
Comptroller, N. W. M. Police
Ottawa, April 22nd, 1890.

North-West Mounted Police.

RECRUITS.

APPLICANTS must be between the ages of Twenty-two and Forty, active, able-bodied men of thoroughly sound constitution, and must produce certificates of exemplary character and sobriety.

They must understand the care and management of horses, aud be able to ride well.

The minimum height is 5 feet 8 inches, the minimum chest measurement 35 inches, and the maximum weight 175 pounds.

The term of engagement is five years.

The rates of pay are as follows:—

Staff-Sergeants.....$1.00 to $1.50 per day.
Other Non-Com. Officers.. 85c. to 1.00 "

	Service pay.	Good conduct pay.	Total.	
1st year's service,	50c.	——	50c.	per day.
2nd "	50	5c.	55	"
3rd	50	10	60	"
4th	50	15	65	"
5th "	50	20	70	"

Extra pay is allowed to a limited number of blacksmiths, carpenters and other artizans.

Members of the force are supplied with free rations, a free kit on joining and periodical issues during the term of service.

Applicants may be engaged at the Immigration office, Winnipeg, Manitoba; or at the Headquarters of the Force, Regina, N.W.T.

THE

BELL TELEPHONE CO.

OF CANADA.

ANDREW ROBERTSON, - - - - - - - - PRESIDENT
C. F. SISE, - - - - - - - - - - - VICE-PRESIDENT
C. P. SCLATER, - - - - : - - - SECRETARY-TREASURER

HEAD OFFICE, - MONTREAL.

H. C. BAKER, - - - - - Manager Ontario Department, HAMILTON.

This Company will sell its instruments at prices ranging from $10 to $25 per set. These instruments are under the protection of the Company's patents, and purchasers are therefore entirely free from risk of litigation.

This Company will arrange to connect places not having telegraphic facilities with the nearest telegraph office, or it will build private lines for firms or individuals, connecting their places of business or residences. It is also prepared to manufacture all kinds of electrical apparatus.

Full particulars can be obtained the at Company's offices as above, or at St. John, N.B., Halifax, N.S., Winnipeg, Man., Victoria, B.C.

CANADA ATLANTIC

RAILWAY.

THE SHORTEST PASSENGER ROUTE BETWEEN

Ottawa & Montreal

AND ALL POINTS EAST & SOUTH.

The only road in Canada running trains lighted with electricity and heated by steam from the engine. Luxurious Buffet Pullman Palace Cars on all trains between Ottawa and Montreal. Only line running through Sleeping Cars between

OTTAWA, BOSTON AND NEW YORK

And all New England and New York points.
Baggage checked to all points and passed by Customs in transit.
For Tickets, Time Tables and information apply to nearest agent, or to
S. EBBS, City Passenger Agent,
GEO. H. PHILLIPS, Gen. Agent, 24 Sparks St., OTTAWA.
VALLEYFIELD.
A. E. CAIRNS, General Agent,
136 St. Jcmes St., MONTREAL.
Or at 260 Washington St., Boston, and
317 Broadway, New York.

E. J. CHAMBERLAIN, General Manager,
C. J. SMITH, General Passenger Agent.
General Offices, Ottawa.

SUBSCRIBED CAPITAL, - - - $100,100. | **FULL GOVERNMENT DEPOSIT.**

SIR ALEX. CAMPBELL, K.C.M.G. PRES.
(Lieut Govr. of Ontario)
JOHN L. BLAIKIE ESQ. VICE PRES.

THE BOILER INSPECTION and Insurance Company of Canada.

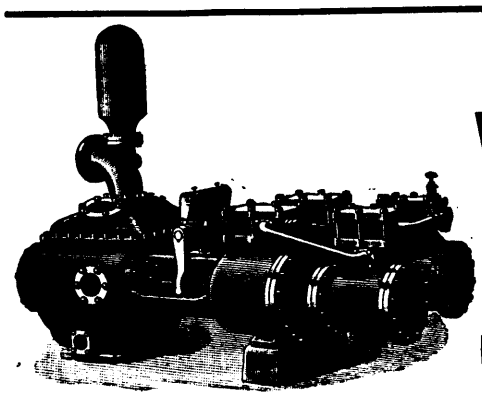
CONSULTING ENGINEERS.

G.C. ROBB. Chief Engineer. A. FRASER. Secy. Treas

HEAD OFFICE. 2 TORONTO ST.
TORONTO.

The Prevention of Accident and Attainment of Economy in the Use of Steam, our Chief Aims.

Agents at Montreal, J. W. GRIER & MUDGE, 1725 Notre Dame Street.
Agent at Ottawa, J. K. STEWART, Sparks St. | Agent for Nova Scotia, G. W. JONES, Halifax.
Agent for New Brunswick, R. W. W. FRINK, St. John.
M. CREELMAN, Inspector, Montreal. W. J. COLESTON, Inspector, St. John, N.B.



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WORTHINGTON DUPLEX

Steam Pumps,

—FOR—

MINES, QUARRIES AND OTHER PURPOSES

Machinery of all kinds.

R. H. BUCHANAN & Co., 64 Craig St.,

Builders of Water Works. **MONTREAL.** Send for Circular.

PHOSPHATE LANDS FOR SALE

600 ACRES

IN THE

BOBB'S LAKE DISTRICT, ONT.

These lands are on the Surveyed extension of the proposed Brockville, Westport and Sault Ste. Marie Railway, and are located within four miles from Station on the Toronto and Ottawa Division of the C. P. Ry.

Splendid show for developments made. Highest grade of ore. Half interest for sale; or owner will convey an interest for cost of slight further developments.

Further particulars by addres sing,

P.O. Box 126,

SAULT STE. MARIE, ONT.

TENDERS.

SEALED TENDERS addressed to the undersigned, and endorsed "Tender for Indian Supplies," will be received at this office up to noon of MONDAY, 21st April, 1890, for the delivery of Indian Supplies, during the fiscal year ending 30th June, 1891, consisting of Flour, Beef, Bacon, Groceries, Ammunition, Twine, Agricultural Implements, Tools, &c., duty paid, at various points in Manitoba and the North-West Territories.

Forms of tender, containing full particulars relative to the Supplies required, dates of delivery, &c. may be had by applying to the undersigned, or to the Indian Commissioner at Regina, or to the Indian Office, Winnipeg.

Parties may tender for each description of goods (or for any portion of each description of goods) separately or for all the goods called for in the Schedules, and the Department reserves to itself the right to reject the whole or any part of a tender.

Each tender must be accompanied by an accepted Cheque in favor of the Superintendent General of Indian Affairs, on a Canadian Bank, for at least five per cent. of the amount of the tender, which will be forfeited if the party tendering declines to enter into a contract based on such tender when called upon to do so, or if he fails to complete the work contracted for. If the tender be not accepted the cheque will be returned.

Each tender must, in addition to the signature of the tenderer, be signed by two sureties acceptable to the Department for the proper performance of the contract based on his fender.

This advertisement is not to be inserted by any newspaper without the authority of the Queen's Printer, and no claim for payment by any newspaper not having had such authority will be admitted.

L. VANKOUGHNET,
Deputy of the Superintendent-General of Indian Affairs.

Department of Indian Affairs,
Ottawa March 1890.

Mining Regulations

TO GOVERN THE DISPOSAL OF

Mineral Lands other than Coal Lands, 1886.

THESE REGULATIONS shall be applicable to all Dominion Lands containing gold, silver cinnabar, lead, tin, copper, petroleum, iron or other mineral deposits of economic value, with the exception of coal.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting for mineral deposits, with a view to obtaining under the Regulations a mining location for the same but no mining location or mining claim shall be granted until the discovery of the vein, lode or deposit of mineral or metal within the limits of the location or claim.

QUARTZ MINING

A location for mining, except for iron on veins, lodes or ledges of quartz or other rock in place, shall not exceed forty acres in area. Its length shall not be more than three times its breadth and its surface boundary shall be four straight lines, the opposite sides of which shall be parallel, except where prior locations would prevent, in which case it may be of such a shape as may be approved of by the Superintendent of Mining.

Any person having discovered a mineral deposit may obtain a mining location therefor, in the manner set forth in the Regulations which provides for the character of the survey and the marks necessary to designate the location on the ground.

When the location has been marked conformably to the requirements of the Regulations, the claimant shall within sixty days thereafter, file with the local agent in the Dominion Land Office for the district in which the location is situated, a declaration or oath setting forth the circumstances of his discovery, and describing, as nearly as may be, the locality and dimensions of the claim marked out by him as aforesaid; and shall, along with such declaration, pay to the said agent an entry fee of FIVE DOLLARS. The agent's receipt for such fee will be the claimant's authority to enter into possession of the location applied for.

At any time before the expiration of FIVE years from the date of his obtaining the agent's receipt it shall be open to the claimant to purchase the location on filing with the local agent proof that he has expended not less than FIVE HUNDRED DOLLARS in actual mining operations on the same; but the claimant is required, before the expiration of each of the five years, to prove that he has performed not less than ONE HUNDRED DOLLARS' worth of labor during the year in the actual development of his claim, and at the same time obtain a renewal of his location receipt, for which he is required to pay a fee of FIVE DOLLARS.

The price to be paid for a mining location shall be at the rate of FIVE DOLLARS PER ACRE, cash, and the sum of FIFTY DOLLARS extra for the survey of the same.

No more than one mining location shall be granted to any individual claimant upon the same lode or vein.

IRON.

The Minister of the Interior may grant a location for the mining of iron, not exceeding 160 acres in area which shall be bounded by north and south and east and west lines astronomically, and its breadth shall equal it length. Provided that should any person making an application purporting to be for the purpose of mining iron thus obtain, whether in good faith or fradulently, possession of a valuable mineral deposit other than iron, his right in such deposit shall be restricted to the area prescribed by the Regulations for other minerals, and the rest of the location shall revert to the Crown for such disposition as the Minister may direct.

The regulations also provide for the manner in which land may by acquired for milling purposes, reduction works or other works incidental to mining operations.

Locations taken up prior to this date may, until the 1st of August, 1886, be re-marked and re-entered in conformity with the Regulations without payment of new fees in cases where no existing interests would thereby be prejudicially affected.

PLACER MINING.

The Regulations laid down in respect to quartz mining shall be applicable to placer mining as far as they relate to entries, entry fees, assignments, marking of localities, agents' receipts, and generally where they can be applied.

The nature and size of placer mining claims are provided for in the Regulations, including bar, dry, bench, creek or hill diggings, and the RIGHTS AND DUTIES OF MINERS are fully set forth.

The Regulations apply also to

BED-ROCK FLUMES, DRAINAGE OF MINES AND DITCHES.

The GENERAL PROVISIONS of the Regulations include the interpretation of expressions used therein; how disputes shall be heard and adjudicated upon; under what circumstances miners shall be entitled to absent themselves from their locations or diggings, etc., etc.

THE SCHEDULE OF MINING REGULATIONS

Contains the *forms* to be observed in the drawing up of all documents such as:—"Application and affidavit of discoverer of quarts mine." "Receipt for fee paid by applicant for mining location." "Receipt for fee on extension of time for purchase of a mining location." "Patent of a mining location." 'Certificate of the assignment of a mining location." "Application for grant for placer mining and affidavit of applicant." 'Grant for placer mining." "Certificate of the assignment of a placer mining claim." "Grant to a bed rock flume company." "Grant for drainage." "Grant of right to divert water and construct ditches."

Since the publication, in 1884, of the Mining Regulations to govern the disposal of Dominian Mineral Lands the same have been carefully and thoroughly revised with a view to ensure ample protection to the public interests, and at the same time to encourage the prospector and miner in order that the mineral resources may be made valuable by development.

COPIES OF THE REGULATIONS MAY BE OBTAINED UPON APPLICATION TO THE DEPARTMENT OF THE INTERIOR.

A. M. BURGESS,

Deputy Minister of the Interior

DEPARTMENT

OF

Inland Revenue.

AN ACT RESPECTING AGRICULTURAL FERTILIZERS.

The public is hereby notified that the provisions of the Act respecting AGRICULTURAL FERTILIZERS came into force on the 1st of January, 1886 and that all Fertilizers sold thereafter require to be sold subject to the conditions and restrictions therein contained—the main features of which are as follows:

The expression "fertilizer" means and includes all fertilizers which are sold at more than TEN DOLLARS per ton, and which contains ammonia, or its equivalent of nitrogen, or phosphoric acid.

Every manufacturer or importer of fertilizers for sale, shall, in the course of the month of January in each year, and before offering the same fertilizer for sale, transmit to the Minister of Inland Revenue, carriage paid, a sealed glass jar, containing at least two pounds of the fertilizer manufactured or imported by him, with the certificate of analysis of the same, together with an affidavit setting forth that each jar contains a fair average sample of the fertilizer manufactured or imported by him; and such sample shall be preserved by the Minister of Inland Revenue for the purpose of comparison with any sample of fertilizer which is obtained in the course of the twelve months then next ensuing from such manufacturer or importer, or collected under the provisions of the Adulteration Act, or is transmitted to the chief analyst for analysis.

If the fertilizer is put up in packages, every such package intended for sale or distribution within Canada shall have the manufacturer's certificate of analysis placed upon or securely attached to each package by the manufacturer; if the fertilizer is in bags, it shall be distinctly stamped or printed upon each bag; if it is in barrels, it shall be either branded, stamped or printed upon the head of each barrel or distinctly printed upon good paper and securely pasted upon the head of each barrel, or upon a tag securely attached to the head of each barrel; if it is in bulk, the manufacturer's certificate shall be produced and a copy given to each purchaser.

No fertilizer shall be sold or offered or exposed for sale unless a certificate of analysis and sample of the same shall have been transmitted to the Minister of Inland Revenue and the provisions of the foregoing sub-section have been complied with.

Every person who sells or offers or exposes for sale any fertilizer, in respect of which the provisions of this Act have not been complied with—or who permits a certificate of analysis to be attached to any package, bag or barrel of such fertilizer, or to be produced to the inspectors to accompany the bill of inspection of such inspector stating that the fertilizer contains a larger percentage of the constituents mentionod in sub-section No. 11 of the Act than is contained therein—or who sells, offers or exposes for sale any fertilizer purporting to have been inspected, and which does not contain the percentage of constituents mentioned in the next preceding section—or who sells or offers or exposes for sale any fertilizer which does not contain the percentage of constituents mentioned in the manufacturer's certificate accompanying the same, shall be liable in each case to a penalty not exceeding fifty dollars for the first offence, and for each subsequent offence to a penalty not exceeding one hundred dollars. Provided always that deficiency of one *per centum* of the ammonia, or its equivalent of nitrogen, or of the phosphoric acid, claimed to be contained, shall not be considered as evidence of fraudulent intent.

The Act passed in the forty-seventh year of Her Majesty's reign, chaptered thirty-seven and entitled, "*An Act to prevent fraud in the manufacture and sale of agricultural fertilizers*," is by this Act repealed, except in regard to any offence committed against it or any prosecution or other act commenced and not concluded or completed, and any payment of money due in respect of any provision thereof.

A copy of the Act may be obtained upon application to the Department of Inland Revenue, as well as a copy of a Bulletin which it is proposed to issue in April, 1888, concerning the fertilizers

E. MIALL,
Commissioner.

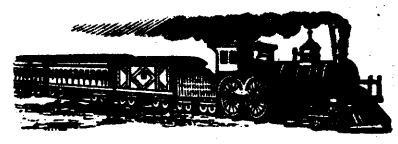
January, 1889.

NOTICE

Is hereby given that all communications in respect to matters affecting the Department of Indian Affairs should be addressed to the Honorable E. Dewdney as Superintendent General of Indian Affairs, and not as Minister of the Interior, or to the undersigned. All Officers of the Department should address their official letters to the undersigned.

L. VANKOUGHNET,
Deputy Superintendent-General of India Affairs.

Department of Indian Affairs,
Ottawa, 11th May, 1889.



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EXPRESS TRAINS leave Montreal and Halifax daily (Sunday excepted) and run hrough without change between these points in 30 hours.

The Through Express Train cars of the Intercolonial Railway are brilliantly lighted by electricity and heated by steam from the locomotive, thus greatly increasing the comfort and safety of travellers.

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The attention of shippers is directed to the superior facilities offered by this route for the transport of flour and general merchandise intended for the Eastern Provinces and Newfoundland; also for shipments of grain and produce intended for the European market.

Tickets may be obtained and all information about the route, also Freight and Passenger rates, on application to

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OTTAWA.

D. POTTINGER,
Chief Superintendent.

Railway Offices, Moncton, N.B
14th November, 1889.

J. S. HOSSACK, President. C. ANDERSON, Secretary-Treasurer. T. J. CARROLL, General Manager.

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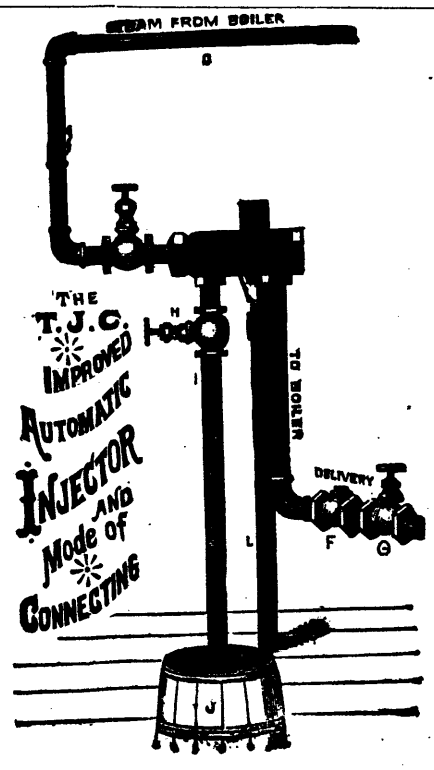
As the body will last for years, it is only necessary to order working parts to make Injector good as new. Every purchaser can repair his own Injector without sending it to the factory.



NUMBER.	PRICE.	HORSE POWER.
7½	$ 4 50	4 to 8
8¾	6 00	8 to 12
10	7 00	12 to 16
12½	9 00	16 to 28
15	10 50	28 to 40
17½	14 00	40 to 57
20	15 00	57 to 72
22½	21 00	72 to 93
25	22 50	93 to 120
30	27 00	120 to 160
35	30 00	160 to 220
40	35 00	220 to 290
45	38 00	290 to 308