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EXTENSION OF PROVINCIAL BOUNDARIES.

In 1908 the Government of Canada proposed to extend the boundaries of the Provinces of Ontario and Manitoba by the addition to each of a part of the territory of Keewatin, and to add to Quebec the territory of Ungava. In order to have the proposal carried out it was necessary to have it accepted by the provinces concerned, but at the time Manitoba and Ontario declined. Representatives of the former province desired to have settlement of other questions notably the amount of the annual subsidy, before accepting the new territory, and Ontario felt that she was unfairly treated in the division, an extraordinary boundary line being run between her and the sister province to the west. At the session of parliament just ended, the provinces being agreeable, the proposed extension of four years ago has been enacted into law.

By the enactment Quebec receives 354,981 square miles and becomes the largest province or state in North America. Manitoba, the former "postage stamp" province, receives 178,100 square miles, and Ontario 146,400.

According to statistics published by the Department of the Interior, the three largest provinces now are Quebec, 706,834 square miles; Ontario, 407,262; and British Columbia, 357,600. These areas are, of course only approximate. The largest state in the Union is Texas, with 265,780 square miles, then follow in order of size California, with 158,360, and Montana, with 146,080.

The additions to Ontario and Quebec extend immensely their prospective mining fields, and bring under the mining laws and regulations of these provinces vast regions, which up to the present have been subject to the "order-in-council" regulations of the Dominion, there being no federal mines act.

The early construction of a railway to Hudson Bay, to which both of the great parties in the House of Commons appear to be committed, will make readily accessible to the prospector and the explorer the regions surrounding our inland sea. It also seems likely that a branch line will be built from the Transcontinental Railway to James Bay, the southern extremity of Hudson Bay. The accessible prospecting and mining territory of Canada will thus be more than doubled. Both Ontario and Quebec should reap the benefit of increased mineral output.

At present Manitoba, Saskatchewan, and Alberta, unlike British Columbia and the older provinces, do not control the natural resources—land, timber, and minerals—within their borders, these resources being

still vested in the Dominion. The same condition holds as regards Manitoba's rights in the territory recently put within her boundaries. The government now in power at Ottawa is committed, however, to the policy of giving the natural resources to these three provinces. The transfer will likely be made within a few years, and it will benefit both the mineral industry and the provinces. In Alberta, for instance, under present conditions there is the peculiar and unsatisfactory arrangement of the Dominion Government officials collecting royalty on the output of the mines, and the provincial authorities making laws and enforcing them as regards the safety of employees, and so forth. Provincial governments should be much more competent to look after the development and conservation of local natural resources than is a distant Federal Government, especially one that has under its control so vast a country as Canada.

AMENDMENTS TO THE MINING ACT OF ONTARIO.

A bill has been introduced in the Ontario Legislature by Hon. W. H. Hearst, Minister of Lands, Forests and Mines, to amend the Mining Act of Ontario. These amendments do not make any radical changes in taking up mining claims, but cover such points that have been found necessary in the administration of the Act. One of the changes is that where the first 30 days' work required to be done on a claim falls due between the 16th of November and the 15th of April it may be postponed until the expiration of that period.

Another clause provides for the granting of jack-pine on a mining claim, on land not under timber license or in a forest reserve, to the owner of the mining claim without payment of government dues. Additional requirements are made for surveyors, in surveying a claim, for examining the ground to ascertain if there is any subsisting claim which conflicts with the claim being surveyed.

A number of amendments are made to the parts of the Act relating to the operation of mines, to provide for the better protection of the workmen at mines, quarries and metallurgical works. Boys under the age of 17 are not permitted to be employed underground, and boys under the age of 14 are not allowed to be employed around any mine. The rules relating to the thawing of explosives are made more rigid and prohibit the keeping of fuse, caps, electric detonators, etc., in any thawing house. A new principle has been adopted in prohibiting the use of ordinary fuse in sinking shafts or winzes. This is now made possible by the recent introduction of delay fuse which combines all the advantages of both former methods of blasting. Crushing plants are allowed to be erected in connection with the shaft house provided there is a proper auxiliary exit. New rules have been formulated for the proper safeguarding of

all moving machinery and for the keeping of articles at the mines suitable for first aid to the injured.

Provisions have also been made for the removal or allaying of dust both in mills and working places underground. With the introduction of the hammer-drill the dust problem has become quite serious in some of the mines and will become more serious with the opening up of the quartz veins in the new gold camps. Old mining countries have already taken steps to mitigate this danger, and it is well that Ontario is taking up this matter before the dreaded disease phthisis has made its inroads in the ranks of the miners. Another section provides that no person under the influence of or carrying intoxicating liquor shall enter a mine or be in proximity to any working place on the surface.

Another section has been amended to make clear who are responsible for offences against the Act and to designate the amount of penalty for such offences.

Provisions are also made that, where required for or in connection with the working of a mine or quarry, the owner may acquire the right to drain or bring in water through adjoining lands and construct roads, tramways and power lines through adjoining lands on compensation fixed by the Mining Commissioner.

INSPECTION OF EXPLOSIVES.

We regret to note that the session of the Dominion Parliament has come to a close without taking up the question of the inspection of explosives. This neglect is inexcusable. Even while Parliament was in session the country was shocked to hear of a premature explosion near Fort Frances, where some 14 men while engaged on railway construction lost their lives. According to the report of the Chief Inspector of Mines for Ontario 50 per cent. of the fatalities in the mines of Ontario for 1911 were due to explosives. The report further states:

"There has never been in Canada any legislation dealing with the inspection of explosives, which is a matter coming within the jurisdiction of the Federal Government. At present anyone who has a substance that will explode may sell it, if he can get a buyer. Before the quality of the explosive is proven accidents may result. It is not only the small dealer who needs inspection, but also the large producers. In the competition for making sales and the desire for large profits, the grade of the explosive may not be kept up to the standard. Improper mixing, improper proportion of ingredients, improper packing, all tend to render the explosive unsafe and to increase the accident rate. Old explosives that have been in storage for more than a year are sometimes shipped into the less accessible camps in the winter time, and have to be used by the mining companies during the summer, as no others can be obtained. When an accident occurs now from an explosive, there is no way by which this ex-

plusive may be thoroughly tested, to ascertain where in the fault lies."

We would urge that the Explosives Bill be prepared during the recess and brought up at the next

session at the earliest possible moment. In the meantime all arrangements should be made by the Mines Branch to have the bill brought into operation at an early date after its passage.

CORRESPONDENCE

South Porcupine, April 8, 1912.

To the Editor The Canadian Mining Journal,
Toronto, Ontario.

Sir,—I notice in your issue of April 1st an article by G. W. Thomson on the diamond drill results at the Pearl Lake mine. This article, while containing many points of interest, seems to me to be open to criticism on two grounds.

First, the method of taking and calculating sludge samples will probably lead to wrong conclusions.

Second, the assumption that the holes continue to depth at the angle at which they were started is also apt to be incorrect.

The sludge is formed from the cuttings of the drill bit, and consists of material in a more or less fine state of division. During the time this material is being cut a portion of it is very finely ground and forms what is commonly known as slime. Due to the rotating of the drill rods this sliming process also takes place while the rising water is lifting the sludge to the surface. The water flowing from the top of the casing and carrying with it the ground material, passes through a box where the sludge is deposited. The finely ground sludge, in the form of slime, does not, however, have time to settle, and passes off with the water. It can readily be seen that the material which is left in the box will not give a true sample of the formation passed through. The rising current of water will also have a concentrating action on the sludge, and thus give results which are misleading.

The only way in which an accurate sludge sample can be taken, is to collect all the water which comes from the hole, thus getting the slimes as well as the sands, or to have a sample cutter which will divert a part of the stream for the sample. In either case the

water should be evaporated or filtered, the residue constituting the sample.

Considering the results in Table 1, Mr. Thomson figures \$8.20 over 10 feet in width, while in Table 1a he figures the sluge assays to give \$8.50 over the same distance, which is apparently a good check. In order to obtain this latter result, however, he discards the assays between 50 and 375 feet as being possibly the result of a cave. Too much reliance can not, however, be placed on this assumption and it seems to me reasonable to take the assays as extending over the whole distance. Including these and following his method of calculation gives an average of \$9.27 over a distance of 10 feet, which is considerably higher than the original figure. It should also be noted that the values in this hole were from a distance of only 350 feet from the surface, where the concentrating action would not be as noticeable as it would be in the deeper holes. In these the factor of error would probably be much greater.

There is also a probability of error in the assumption that the holes continued to depth in the same plane at which they were started. The character of the rock formation in Porcupine is such that one would expect decided changes in the dip of the holes. In surveying over twenty diamond drill holes of different depths and angles on the Dome property, not one was found which did not show considerable change. In one instance the end of a 1,300 foot hole started at an angle of 69 degrees, was found to be 600 feet from its supposed location. Vertical holes are, however, found to be the ones which show the greatest changes, and unless the true angle is known, estimates of the widths of veins cut by these holes are apt to be incorrect.

Yours, etc.,

G. C. BATEMAN.

PERSONAL AND GENERAL

Dr. Adams and Dr. Barlow were in Halifax recently, attending the annual meeting of the Mining Society of Nova Scotia.

Mr. Arthur P. Scott has been appointed superintendent in charge of the steel department of the Dominion Iron and Steel Co.

Mr. Jas. G. Ross, consulting mining engineer, of the Milton Hersey Co., Ltd., Montreal, is in British Columbia on professional business.

Mr. Norman H. Beaton, Denver, Col., was in Toronto recently on business.

Mr. D'Arcy Weatherbee, M.I.M.M., Mem. Can. Soc. C.E., has become a partner of the firm of Bainbridge, Seymour & Co., mining engineers, Salisbury House, London, E.C.

Mr. R. W. Brock, director of the Geological Survey of Canada, attended the recent meeting of the Mining Society of Nova Scotia in Halifax.

Mr. Jay P. Graves, vice-president and general manager of the Granby Consolidated Mining, Smelting and Power Company, will shortly return to Spokane, Washington, after having spent part of the winter in Southern California.

The Mining Magazine, published in London, England, recently mentioned the presence in that city of Mr. W. H. Trewartha-James, late general manager of the Tye Copper Company, and Mr. Ernest Levy, manager of the mines at Rossland, B.C., of the Le Roi No. 2, Limited, and in Silverton Camp, Sloean, B.C., of the Van Roi Mining Co., Ltd.

Mr. Howard W. Dubois is making arrangements to start hydraulicking gold-bearing gravel at the Quesnelle Hydraulic Gold Mining Company's placer mine in Quesnelle division, Cariboo District, B.C., as soon as the season shall open. It was expected that the steel plate for paving part of the sluiceways would be in place by April 1st, so that no delay is looked for in connection with the work of substituting the high-carbon steel for the diorite boulders used last season.

Mr. Wm. Watson, vice-president and manager of the company owning the Mother Lode Gold Mine and 10-stamp mill at Sheep Creek, Nelson Mining Division, B.C., was expected to arrive at the mine late in March to commence preparations for the ensuing season's mining and milling work.

Colonel John Carson and Mr. Samuel W. Cohen, president and general manager, respectively, of the Crown Reserve Mining Company, Limited, Cobalt, have gone to Europe for two months on business for the company.

Mr. W. E. Duncan, consulting engineer, formerly of Merritt, B.C., has removed his office to Vancouver, where he proposes to undertake mining engineering work.

Mr. M. C. H. Little, Cobalt, was in Toronto recently. Mr. Little is leaving Cobalt for the Sudbury district.

Mr. E. B. Paul, formerly M.P.P. for Cumberland County, has been appointed a Deputy Inspector of Mines, Nova Scotia.

Mr. W. J. Loring, of Messrs. Bewick, Moreing & Co., visited California in March in connection with the development of the Plymouth Consolidated Mine.

Mr. J. B. Woodworth, mining engineer, Lyndhurst Avenue, Toronto, has recently returned from a professional visit to Arizona.

Mr. S. N. Graham, mining engineer, a graduate of the School of Mining, Kingston, who has had experience both in Mexico and Canada, is taking an office in Toronto. His temporary address is in care of the Canadian Mining Journal.

Mr. D. H. MacDougall, assistant general manager of the Dominion Coal Co., has returned from a two months' absence in England and Scotland.

Mr. J. R. McIsaac, superintendent of shipping for the Dominion Coal Co., and the Dominion Iron and Steel Co., has returned from a trip to England, after an absence of a month.

Mr. John A. Reid, mining engineer, is in Toronto, having returned from Mexico after a year's residence in the State of Jalisco.

Mr. J. B. Tyrrell is leaving in a few days for an extended visit to the mining districts of southern British Columbia.

Mr. J. E. McAllister, of New York, formerly general manager of the British Columbia Copper Company, has gone to England on a business visit.

Mr. Grant B. Schley, of New York, who is largely interested in the Britannia Mining and Smelting Company, operating an important copper mine and concentrating works in the vicinity of Howe Sound, B.C., recently visited the company's property at Britannia Beach.

Mr. Herman C. Bellinger, a well-known metallurgist, who has for years engaged in copper smelting in British Columbia, and who is now general manager of the Great Cobar, Limited, with mines and smelting works in New South Wales, Australia, has been elected president of the Australasian Institute of Mining Engineers.

Mr. David King, in bygone years editor of "The Kootenaian" newspaper, published at Kaslo, Ainsworth Mining Division, British Columbia, and long active in giving publicity to information relative to the mines and mineral resources of Slocan District, now resides at Lake Hopatcong, about 50 miles from New York.

Hugh Parke, manager of the Nipissing Mines, Cobalt, was in Toronto last month, on his way to England, whence he went via New York.

GOWGANDA DURING 1911

By G. M. Colvocoresses.

Gowganda has been plodding along in a very quiet and unobtrusive manner and, in places at least, has made a steady progress.

When the effort to secure a railroad last spring failed and Gowganda was soon after separated from the outside world by fifty miles of wagon-road, extremely uncomfortable for passengers throughout, and in many places almost impassable for either stage or freight; every one who had the good fortune to be out of the camp was only too glad to forget about it altogether until such time as it might become more easy to visit and more agreeable to inhabit.

The working mines, although few and far apart, kept quietly on with their developments, and from the Miller Lake-O'Brien and the Millerett Mines a steady production was made, while small shipments came also from the following properties: Bartlett, Boyd-Gordon, Reeves-Dobie (concentrates), Calcite Lake and Canadian Gowganda. It is an unfortunate fact that these last-named properties did not operate

continuously or with much vigor throughout the entire year, but where one mine was closing down, another was nearly always starting up to take its place and the beginning of 1912 sees a production being made by the Mann Mines, the Hudson Bay, and the Powerful (all three of which should ship during 1912), while the reopening of several properties is anticipated in the near future.

Aside from producing mines a certain amount of surface prospecting and underground development has been carried on in the various sections of the camp. At East Shining Tree and Wapoose there was considerable activity during May and June, and several good surface finds were made, while two companies sunk to a depth of more than fifty feet. However, during July and August owners and prospectors completely deserted this district in order to try their fortunes at West Shining Tree.

South of Gowganda (near Smooth Water Lake), the Willing Mining Company is developing some claims

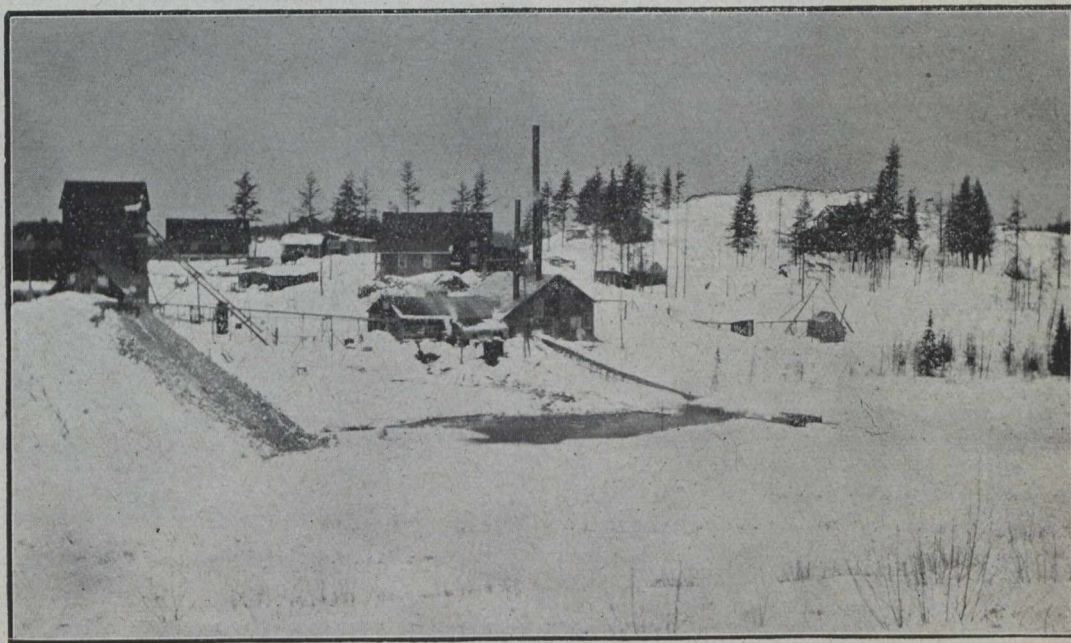
under option and promise to give this section of the camp a thorough tryout. Northwest of Gowganda the Gamey-Thompson has been driving an adit drift which is intended to intercept their exceptionally promising vein at a depth of 150 feet. At date of writing this adit has not yet arrived under the ore shoot. Near Obushkong Lake the Homestake Mining Company has been working on some very strong veins carrying copper and silver with some gold values. This company has just installed a steam and compressed air plant and promises to push the development of its property vigorously during the present year.

On the Gowganda Ridge there was very little activity until December, when the Mann Mine was reopened after several months of idleness, and almost immediately very excellent ore was produced from an open cut in the bottom of which the ore shoot has a length of close to 100 feet. This property had previously found a good ore shoot on the 90-foot level and if provided with an adequate plant it bids fair to become the third steady shipper of the camp.

In the Miller Lake district, the Northern Mining Company continued development work by hand and found some ore on the 100-foot level and also in a

the last-named property, a narrow vein of very rich ore has recently been struck on the 150-foot level, and it is to be expected that this company will ship before spring. The Calcite Lake has already made one shipment and prospects for future production would seem fairly good, while some encouragement was met with by both the Flynn and Bishop properties, and several new finds are reported on other claims in this vicinity.

The most important development of the year was made by the Miller Lake-O'Brien mine, which has opened up its vein system (entirely in the diabase) for a length of 500 feet and to a depth of 250 feet. The ore body has a maximum length of 300 feet on the 140-foot level and promises to be equally long on the 250-foot level. This has now been driven for over 100 feet in most excellent ore, which bids fair to hold strong to a considerably greater depth. Also, on the lowest level, there are found a series of off-shoot veins, branching at nearly right angles from the main system and carrying good values into the wall for a distance of 30 or 40 feet, possibly much further. Values in this mine are still largely confined to the veins proper, which have a width of 2 inches to 5 inches, but a certain amount of milling ore is being opened up,



Main Shaft, Plant and Camps of Miller Lake-O'Brien Mine

second shaft which was sunk to a depth of 50 feet. The Canadian Gowganda reopened in the fall after an inactivity of more than a year and made some encouraging finds on the 58-foot and 100-foot levels, besides which they produced eight tons of good ore which was shipped out in December. Here, also, it is a question of providing a plant in order to carry on the mining operations which the prospect certainly justifies. Stripping and a small amount of sinking was done on the Hart claims, and very extensive surface work was carried on by the Olcott, near Flatstone Lake, where the regular net work of veins was shown up. Several of them carry cobalt and silver in spots.

Near Calcite Lake, the principal exploration was carried on by the Ottawa-Gowganda, Flynn, Bishop, Calcite Lake and Powerful Mining Companies. On

more particularly on the lower levels. The mine is now equipped with an exceptionally complete sorting plant and also jigs and tables for concentrating the undersize from the grizzly. The O'Brien mine is producing two grades of ore, a high grade running close to 4,000 ounces per ton and a second grade averaging 1,000 ounces per ton and the shipments aggregate 15 to 20 tons per month.

At the Millerett mine, the first half of the year was largely devoted to the installation of a new mining plant and the construction of a ten-stamp concentrating mill, which was put in operation the latter part of June. This mill has a capacity of from 900 to 1,000 tons per month and has been running steadily since the day it started, having produced 120 tons of concentrates, averaging considerably better than 1,000 ounces to the ton.

The underground work was largely confined to the diabase section of the property, where one vein was opened up to a depth of 200 feet and for a length of 300 feet. The ore shoots in this vein have proved erratic and unlike the ore at the O'Brien mine, the bulk of the values is generally in the wall rock. In the aggregate, a considerable tonnage of good concentrating ore has been blocked out as well as some high grade, which is hand-picked underground. The mill is being fed, both from the development work in the diabase, and from the wall rock of the conglomerate vein, which furnished the high grade ore shipped in 1910, and which has also been opened up to a depth of 200 feet.

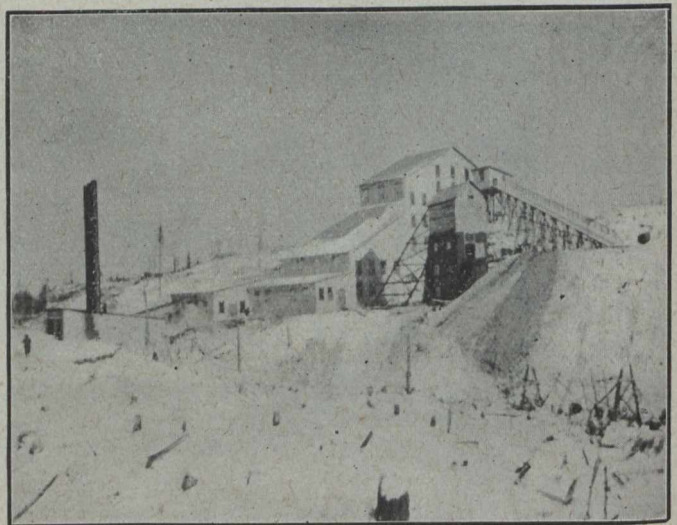
A very interesting geological development was made while connecting up the underground workings of the Millerett mine, and this is shown by the accompanying sketch. The long drift which passes through the property on the 70-foot level, starts at the east end in Keewatin greenstone and passes almost immediately into the Huronian formation (Conglomerate, Graywacke and Arkose) the contact dipping at an angle of 75 to 80 degrees toward the west. The Huronian formation has a width of 420 feet at this point and it is again terminated by the Keewatin. The contact here is somewhat irregular, but appears to dip to the east at approximately 45 degrees. It seems highly probable, therefore, that the Huronian rocks were laid down in a basin or gully of the older Keewatin and the maximum depth of the Huronian at this point may be assumed to be between 300 feet and 500 feet. The diabase sill rose from the east and the hanging wall contact with the Keewatin is very clearly defined, dipping at an angle of 30 degrees to the east. The diabase sill or flow extends on the surface for a distance of two-thirds of a mile westward from the contact, the thickness of this sill is not yet determined.

Reference to an article by Professor W. G. Miller, published in the Engineering and Mining Journal for September 30, 1911, will show a close parallel between the geological relations shown on the Millerett property and those which have been found to exist at Cobalt, but throughout the Gowganda and the Mont-real River districts, all the producing veins have been found in the diabase or (in one case) in the Huronian rocks above the diabase sill. Professor Miller states that at Cobalt, 85 to 90 per cent. of the production has come from veins found in the foot wall of the diabase sill, and it is strange that up to the present time, absolutely nothing has been found in the foot walls of the several diabase intrusions which carry silver in the Gowganda district. The Huronian rocks underlying the particular sill on which the O'Brien and Millerett are located are very clearly defined less than a mile west of these properties, and the prospecting done there has so far had no good results. It would seem nevertheless that the claims thus located would merit particularly thorough development if Professor Miller's theory as deduced at Cobalt is in any measure applicable to the Gowganda district.

The total shipments from Gowganda during 1910 and 1911 amounted in round numbers to 750 tons of ore and concentrates, containing 1,000,000 ounces of silver. At the present moment, the output of the camp is approximately 50 tons per month, containing 60,000 ounces of silver. It is perhaps unfortunate for Gowganda that the steady shipments and the great part of the entire production has so far come from

only two mines, operating adjoining claims, and one of them owned by an individual and the other by a close corporation. The general public, which includes the majority of the investors or possible investors, lost all interest in Gowganda after the failure of the numerous stock companies that started operations during the boom, and no one takes much interest in the doings or fortunes of the two mines mentioned above. Some of the stock companies failed because they had explored their claims and found no pay-ore, but the great majority failed because they could not sell stock fast enough to satisfy the promoters, pay for their properties and do any mining work at the same time. Several well advertised and highly capitalized companies never had any claims at all and never did a single stroke of work as far as any one can find out, and many others merely owned a working option on their claims and as they were never able to complete paying the purchase prices, these have lapsed back to their original owners.

The operators at Gowganda look forward to better working conditions in the future. Next spring it is confidently expected that a serviceable wagon road will be built from Elk Lake to Gowganda, while at the same time, the T. & N. O. Railroad will construct



No. 1 Shaft, Power Plant and Mill, Millerett Mine

their branch to Elk Lake. After that is completed, Gowganda will be reached with ease in twenty-four hours from Toronto and the cost of freighting in and out of the camp will be cut in half. There are strong possibilities that a little later the T. & N. O. Railroad may extend further westward and pass through Gowganda, and then the conditions will be approximately the same as at Cobalt and Porcupine, and this camp will have an equal chance to stand or fall on its own merits.

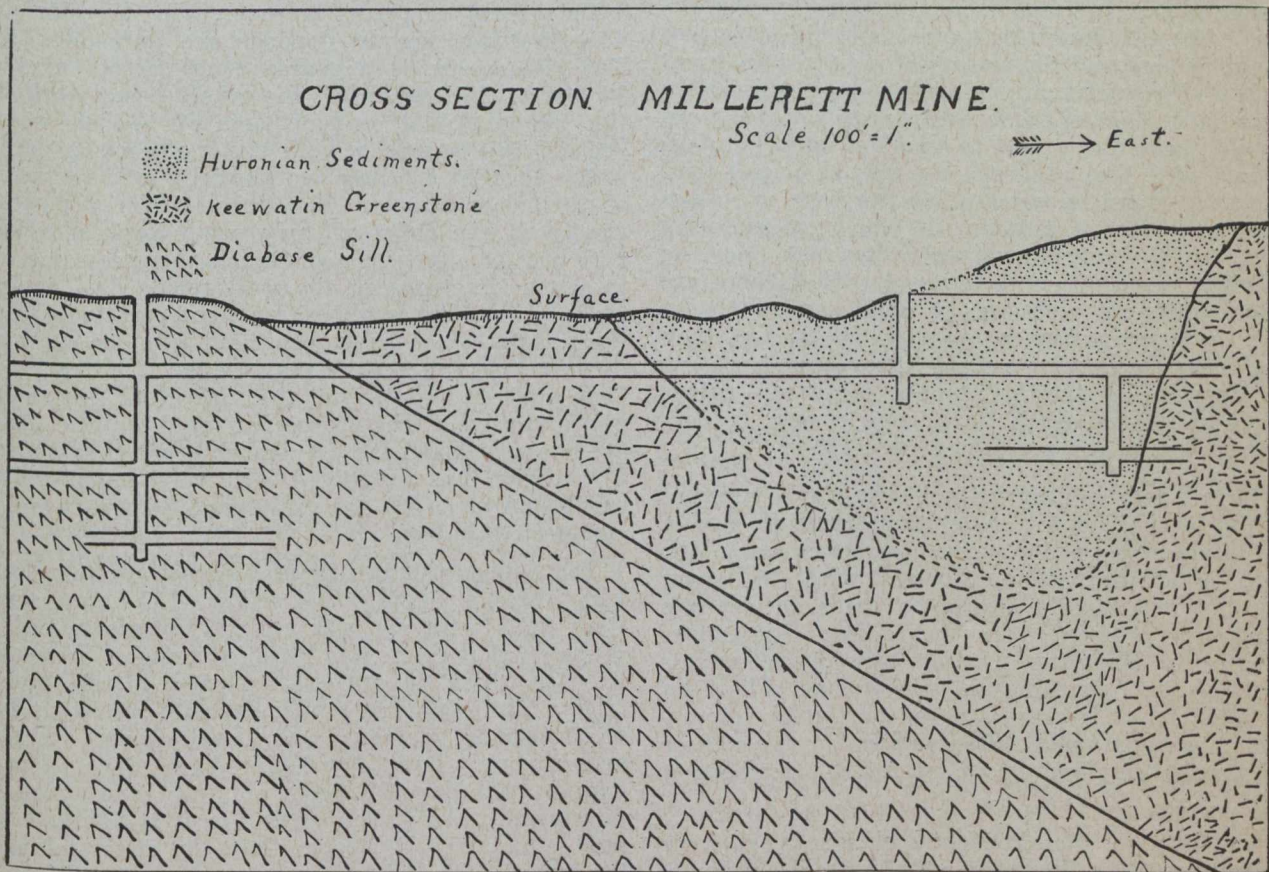
As to its future prospects, nothing very definite can be said. All the way from Cobalt west beyond Shining Tree Lake, the same geological formations occur and the same geological conditions appear to repeat themselves. Three hundred square miles of this area may properly be spoken of as the Gowganda district, and after eliminating the areas covered by Laurentian rocks, by muskegs and lakes and by heavy overburden, there still remains one hundred square miles of diabase, Huronian and Keewatin formation. On nearly every square mile there has been at least one, and sometimes several discoveries of silver, and all this area may be classed as likely prospecting ground, al-

though probably productive veins will be developed only in the intrusive diabase areas and in the portion of the Huronian and Keewatin formations immediately adjoining these intrusions. Of the 100 square miles mentioned above 4,000 acres or perhaps five square miles has been pretty thoroughly prospected and two veins have been developed, each of which has already produced more than 400,000 ounces of silver. The Millerett No. 1 vein is in conglomerate. Very little prospecting has ever been done on this formation and no other silver bearing veins have yet been found, but there is every reason to assume that some good conglomerate veins yet remain to be discovered. The Miller Lake-O'Brien vein in diabase had not a remarkable surface showing, nor did the mine look particularly promising until after a year's hard work. There were several other properties which looked better, both on the surface and on the 50-foot level, than the Miller Lake-O'Brien, but the others stopped at that and no one knows anything more about them, while the O'Brien kept right on and repaid the confidence of owner and manager by earning 100 per cent. work-

which one can distinguish good veins from the others, and thorough underground work alone can determine the value of each special vein, on which the surface showings are sufficiently encouraging to warrant the expense required for their exploration.

There is not at present any reason to believe that Gowganda will provide any very big or remarkably rich mine, but there are good grounds for the opinion that several profitable mines may yet be developed, similar to the two which are steadily producing at the present time. Three other mines may become profitable producers during 1912. Their development is not yet far enough advanced to make any positive statement, but their chances look good at the present moment, and there is always the possibility of "dark horses" coming to the front.

It can at least be said that the future of Gowganda depends most of all upon the prospecting and development of the large area which is to-day absolutely idle. During 1908 and 1909, 7,000 claims were staked in the immediate vicinity of Gowganda and 2,000 more



ing profit during 1911, with prospects of doing even better in 1912. The No. 7 vein in the Millerett also in diabase showed a length of only 12 feet of silver ore on the surface, while on the 150-foot level there is an almost continuous body of concentrating ore for a length of 250 feet and close to 100,000 ounces of silver have been taken from this vein during the past ten months. Against these facts, it must be frankly admitted that some of the very best surface showings were found to peter out altogether at a depth of 30 feet to 50 feet and some properties which have been thoroughly developed, have certainly proved great disappointments. There does not seem to be any rule by

in the outlying districts, which are generally spoken of as part of Gowganda camp. The great proportion of these claims were quickly abandoned, for the most part with little or none of the assessment work completed. About 2,500 claims still remain in good standing and on most of these, leases have been secured, signifying that 240 days' assessment work has been recorded on the claim. Much of this work was done on contract, a good deal was slighted over and some of it entirely faked, so that very little is known as to the probable value of these properties, except that in several instances promising discoveries of silver were made and nothing done thereafter.

Since the discovery of the camp, approximately 100 claims (i.e., 4,000 acres) have been carefully prospected by stripping and trenching and only a small fraction of this area has been the subject of underground work and operations to-day are confined to twenty-five claims.

The area on which mineral rights are still held is therefore considerably larger than the likely prospecting area which is practically all blanketed. Prospectors who do not own claims have no incentive to try their luck at Gowganda and owners who will not prospect or develop their claims are only a detriment to

this or any other district. To-day Gowganda furnishes a splendid illustration of the "Paralysis of Mining District by the Holding of Idle Claims," a common enough condition, most ably written up by Mr. E. B. Kirby in 1909.

The hope of Gowganda is that as transportation facilities and other conditions improve, the great idle area will be gradually but thoroughly explored and the result of this exploration, judging by the record of the camp to date, should be the development of several small or medium sized mines whose aggregate silver production would make a very respectable total.

DECREASE OF VALUES IN ORE SHOOTS WITH DEPTH

*By Reginald E. Hore.

The paper read by Mr. F. L. Garrison at the March meeting of the Canadian Mining Institute, being on a subject of vital importance and containing comments on a large number of well-known deposits, invites discussion. All will doubtless agree with his statement that payable deposits do not usually persist in great depth. The history of mining operations is quite clear on this point. Most of the known deposits which were rich enough near the surface to be mined profitably are at a depth of a few hundred or a few thousand feet, unprofitable, either on account of decrease in values or increase in cost of mining. In the great majority of cases it is decrease in values rather than increase in cost that results in abandonment. That there are deposits containing rich ore at depth and little or none at or near surface is quite probable; but they are not likely to be discovered. They who have explored deposits in the belief that increased values would be found at depth have good reason to conclude that such is not a common occurrence.

The term "deep mining" has a significance varying according to the district under consideration, and a general discussion of the subject presents many difficulties. I will not attempt to deal with the larger subject, but will simply add some notes on deposits in Michigan and Ontario recently studied. The copper mines here in Houghton County, Michigan, include some of the deepest mines in the world. The Porcupine and Cobalt deposits are of particular importance to Canadians. Some observations on these three districts may, therefore, be of interest to members of this Institute.

The deposits in the districts mentioned are very different; but they have some features in common. The ore in each case is the native metal—Michigan copper, Porcupine gold and Cobalt silver. All are of about the same age, being in rocks generally called Pre-Cambrian. The Michigan copper deposits are in the series of volcanic and sedimentary rocks which is known as the Keweenawan. The Cobalt silver deposits are in Keewatin, Huronian and Keweenawan rocks, and were probably also formed in Keweenawan time. The Porcupine gold deposits are in Keewatin and Huronian rocks and were probably formed during the Huronian period. All three districts are in glaciated areas and except for changes coincident with change in character of enclosing rock the ore at depth,

so far as shown by development, is composed of the same minerals and is in all respects very similar to the ore found in the same deposits near the surface.

In several respects, however, the deposits differ. The Michigan copper deposits are in bedded rocks. The richest ore is a coarse conglomerate averaging 15 feet in thickness. All the others being worked are the amygdaloidal upper parts of bedded volcanic rocks. The copper in both types of rock is partially in the form of a filling and partially as a replacement of rock constituents. The Cobalt silver deposits are chiefly in the form of very small vertical veins of rich ore on either side of which there is some silver in minor fractures in the wall rock. The enclosing rocks are seldom schistose and comparatively few of the fissures which have been filled with ore show signs of extensive differential movements. The rocks have been much fractured, but the individual fractures are not extensive. The Porcupine gold quartz deposits are in rocks that have been much crushed and altered. The region has evidently been very extensively fissured and some of the individual fissures were long and probably deep.

The deposits in the three districts are therefore of very different types. The origin of the spaces which were filled with ore was entirely different, and it is probable that there was little in common between the ways in which the ore was deposited in the three districts. The Michigan copper deposits persist to depths of thousands of feet. The Cobalt silver ore shoots are commonly but a few hundred feet deep. The Porcupine gold deposits have not yet been extensively developed. From their character it is likely that the gold mines will be deeper than the silver mines, but the extent of individual ore shoots is yet unknown.

‡Michigan Copper Mines.

There are at present in Michigan 19 mines, which are producing large quantities of copper, and a few others which are producing small quantities. Many of the mines are over 2,000 feet deep on the inclination of the lodes, which varies from 37 to 73 degrees, and three mines have workings which are over one mile down on the dip. The deep mines are the Tamarack and the Calumet & Hecla, which are on the Calumet conglomerate lode, and the Quincy, which is on the Pewabic amygdaloid lode. The Calumet lode dips at 38 degrees near surface and at 37 degrees 30

*Mining Geologist, Houghton, Mich.

‡A description of these mines will be found in volume on Mineral Resources of Michigan, 1812, Michigan Geological Survey.

minutes at depth. The Pewabic lode dips at 54 degrees at surface and flattens more or less gradually to 38 degrees at a depth of one mile.

The Tamarack mine has five vertical shafts which have respectively the following depths: 3,409 feet, 4,355 feet, 5,253 feet, 4,450 feet, and 5,308.5 feet. No. 5 is the deepest vertical shaft in the world. From No. 3 shaft workings a winze started at a vertical depth of 5,223.5 feet has a further depth of 335 feet on the dip of the lode. The bottom of this winze is therefore 5,430 feet vertically from surface. The ore in the deep workings averages about 19 pounds copper per ton. To mine this without making new openings costs about 12 cents per pound. To continue openings further brings the cost up to 15 cents. At present the price of copper is 14 $\frac{5}{8}$ cents, and whether the mine will be in the future worked to greater depth depends upon conditions which cannot be safely predicted. The severe pressure at great depth results in crushing, and adds materially to the cost of mining. The ore at the lower levels is below the average grade, and we have here therefore a deposit which has decreased in value with depth, but has been profitably worked to a vertical depth of one mile, and which at greater depth contains ore which if near the surface could be profitably mined. Further development work has been discontinued because the openings recently made do not point to an improvement in values. Whether or not there is richer ore at still greater depth will remain unknown, unless it is found that the low grade ore can be profitably mined.

The Calumet and Hecla Mining Company is mining the Calumet conglomerate lode from nine shafts, one vertical, seven following down on the dip of the lode from surface, and one inclined shaft or winze starting below the 57th and running 1,588 feet parallel to the lode, but at an inclination of only 22 degrees. The vertical shaft is 4,900 feet deep. The seven incline shafts have respectively the following depths—6,155 feet, 7,995 feet, 6,186 feet, 7,465 feet, 7,570 feet, 6,102 feet and 7,529 feet measured on the incline starting at 38 degrees and changing to 37 degrees 30 minutes. Some of these shafts are being deepened. The others have been bottomed at the boundary between this property and the Tamarack. The ore now being mined is lower grade than that found nearer the surface. The company did not in the early days publish statements of the values contained in the ore mined. It was much richer than that now being taken from the deep workings. In 1900 the ore mined averaged 3 per cent. copper, but the workings below the 57th level in the northern part of the mine yielded ore of much lower grade. The average yield for ore mined in 1910 was 30.12 pounds per ton. The decrease has not been by any means a gradual one, and there are parts of the mine where payable ore was not encountered until great depth was reached. On the whole the Calumet lode shows a falling off in values with depth; but is still being very profitably worked at a depth of over 7,000 feet on the dip of the lode. Actual figures showing values in all parts of the mine are not available; but according to Dr. A. C. Lane and others the lode was at its best at a depth of 2,000 to 3,000 feet. We have, therefore, an increase with depth for 2,000 feet, maximum values to 3,000 feet, and then decline to greater depth. Neither increase nor decrease were very regular, and the figures given there are only approximates.

The Quincy is mining the Pewabic lodes by four inclined shafts, three of which, No. 2, No. 6 and No. 7, are over one mile deep on the dip of the lode. No. 8 is nearly one mile deep. Excluding virgin territory north of No. 8 shaft the bottom of the mine has reached an average depth on the dip of the lode of about 5,200 feet. If the copper contents continue to be as good as at the deepest present workings, the lode will, without doubt, be profitably mined to much greater depth. The ore now being mined yields 16 pounds per ton. In some of the workings near surface there was mined in the early days ore which contained a much higher percentage of copper. As in the case of the Calumet lode the general statement can be made that there has been a decrease in values with depth. The ore being mined at a depth of one mile is not as rich as the ore which was taken from the upper workings. It must not be inferred, however, that the decrease is a gradual one. There are levels at which the ore is not as good as that at the deepest workings, and there are splendid ore bodies at a depth of 4,000 to 6,000 feet, which in the upper levels show comparatively low values.

Instead of a single lode there is, at the Quincy mine a zone about 300 feet thick, in which there are several lodes. These vary considerably in different parts of the mine. For the most part they run parallel to one another and are separated by trap. In places they come together. There is commonly one lode that is better than the others and is known as the "main" lode. As the workings are continued this "main" lode becomes lower in values than one of the "east" or "west" lodes. What is known as the "main" lode in workings from one shaft is not called the main lode in another part of the mine. In places there are four parallel lodes being worked at once.

At the Quincy, therefore, the conditions are such that there is a greater chance than usual of finding ore shoots which are rich at depth; but not at surface high enough in values to tempt investigation. In mining one lode cross-cuts are frequently made and diamond drill holes bored into foot and hanging walls. This practice has resulted in the discovery of numerous ore shoots at great depth. Such lodes, richer at depth than at the surface might forever have remained undiscovered if they had not been situated within a short distance of a lode which was rich enough near surface to be profitably mined.

Cobalt Silver Mines.

At Cobalt there are no very deep mines. The ore shoots which outcrop at surface have failed suddenly in values at a depth of a few hundred feet. Similar ore shoots have been found which do not outcrop, and it is probable that others will be found by underground exploration. The ore is very rich and the veins are remarkably numerous. On either side of the rich veins there is usually a few feet of profitable low grade ore. Naturally, therefore, there is very good reason to expect that lateral exploration will result in the discovery of very large quantities of ore. Whether or not there are ore shoots at great depth is unknown and not likely to be determined in the near future. It will take many years to develop and mine the ore that is within 500 feet of the surface. Very important changes take place in the ore shoots before this depth is reached, and it is to these changes that the following notes refer.

At Cobalt it has been found that the silver veins show remarkable dependence on the rock which encloses them. Most of the ore shoots are in Huronian sediments and do not continue without marked change of values down into the underlying Keewatin. Many ore shoots lose their values suddenly before the contact is reached. Along the so-called "west ridge," where are located the Hudson Bay, Trethewey, Buffalo, Coniagas and some of the Nipissing workings, the ore that has been mined has come almost entirely from shoots near the base of the Huronian sediments. The deposits showed rich ore outcropping where the conglomerate is thin just east of outcrops of Keewatin rocks. Exploration by vertical shafts proved that the ore shoots do not usually continue down into the Keewatin rocks; but that they pitch to the east parallel to the contact between the Huronian and Keewatin. In the Huronian series itself the shoots often lose values suddenly with depth; but quite similar variation in silver content is found laterally. The ore from the deeper workings is quite like that at the outcrops, and there is little to suggest that the ore shoots are genetically related to the present surface. There has been apparently no important migration of silver since the surface was swept clean of decomposed rock by the glaciers. It is not unlikely, therefore, that where the Huronian series is thick there are silver veins similar to those which outcrop where the conglomerate is thin. It is probable that the Huronian is in places 500 feet thick and rich silver veins are not unlikely to be found in the lower half of the sediments where this thickness is found. It seems that the Keewatin rocks have determined the localization of the ore shoots in the overlying sediments, and the ore thus far mined has practically all come from within 200 feet of the Keewatin. It is not to be concluded from the above that ore is being mined only from the Huronian. Ore is also being mined from the Keewatin, and it is quite probable that many more deposits will be found in these older rocks. The point which I wish to emphasize is that the ore shoots in the Huronian are mostly within 200 feet of the Keewatin and pitch with the contact and generally fail at or near the contact.

Of deposits in the diabase it is characteristic that the ores are similar to one another and differ from those in the other rocks by containing a comparatively small amount of the arsenides of nickel and cobalt. The deep parts of an ore shoot as in the other rocks are of quite similar character to the surface ore. The values fail suddenly vertically and laterally. There is no apparent dependence on the present surface. Some veins have been followed down from Keewatin rocks into the Keweenawan diabase. At the Nova Scotia the character of the ore was different in the two formations. In the Keewatin greenstones it contained much smaltite, while in the underlying diabase there was little. The ore shoots in the diabase at this mine are richer; but have not been found to hold with depth.

At the Temiskaming mine below the fifth level Keweenawan diabase has been encountered, and two of the veins which were productive in the Keewatin have failed at the contact. The diabase below the workings on the other productive veins has not yet been explored. The workings at the Temiskaming mine are the deepest at Cobalt, and it is interesting to note that the ore shoots in the deepest workings in the Keewatin are at least as rich as those near the

surface.

There are cases where rich veins in Keewatin rocks have failed suddenly at a depth of a very few feet, and most of them have failed at less than 200 feet. The changes vertically are, however, not more marked than the changes laterally. One rich vein in Keweenawan diabase at the Kerr Lake mine, described by S. F. Emmons† failed very suddenly at a depth of 350 feet and further exploration did not show any change in formation. Another rich vein in diabase failed when the contact with the Keewatin was reached.

While there are some exceptions it can be stated as characteristic of the silver veins at Cobalt that the decrease in values with depth is coincident with change of formation. For ore shoots in any one formation it may be stated that values change very markedly vertically; but just as markedly laterally. The changes in value with depth have apparently not been dependent in any way on the present topography. Some shoots fail a few feet from surface and some continue for 100 or 200 feet. Many ore shoots do not outcrop.

Porcupine Gold Mines.

The deposits at Porcupine have not yet been developed to any considerable depth; but it may be of interest to call attention to some of the characteristics of the deposits which have a bearing on the question. The veins exposed have all been glaciated and there has been apparently practically no alteration since. The ore looks remarkably fresh at the surface and samples taken a few inches from the surface show very little more alteration than those from a depth of 200 feet. There is no good reason to believe that the character of the ore has been determined by the present topography, and glaciation was quite as likely to leave exposed a poor part of an ore shoot as a rich part.

At the Hollinger Mine a remarkable deposit has been partially developed, and the results of sampling reported* by Mr. P. A. Robbins. At the surface for 900 feet it averages 9.4 feet wide with an average gold content of \$32.96 per ton. At the 100 foot level it shows a continuous ore body for 1,000 feet, averaging 8 feet wide with an average gold content of \$31.54 per ton. At the 200 feet level for the 350 feet of drifting done the ore body averaged 9.3 wide and contains \$49.30 gold per ton.

At the Vipond mine there are two rich veins about 100 feet apart. According to H. P. Davis** one of these veins showing 4 to 6 feet of quartz, mineralized schist and ferrodolomite averages at surface \$30 per ton for a length of 600 feet. At the 100-foot level the values for a stoping width of 42 inches and a length of 320 feet average \$23.10 per ton.

At the Rea mine, the main vein stripped for 205 feet, shows, according to Mr. Rea,*** an average at surface of \$23.05 for a thickness of 6 feet. At the 200-foot level for a length of 200 feet the shoot averages \$18 per ton. Where cut at the 300-foot level the vein is 38 feet wide and the values low. The ore shoot has therefore at the shaft a vertical extent of less than 300 feet. Whether it extends deeper in other parts of the vein, and whether there are other ore shoots in the vein are not yet known. It is not unreasonable to expect that similar ore will be developed at greater depth.

There are at Porcupine no deep mines; but development has shown that the rich ore is not a superficial phenomenon. The gold in all the deposits is in

†Mining and Scientific Press March 18 th, 1911

*Annual Report Hollinger Gold Mine, 1910.

**Canadian Mining Journal, Jan. 1st, 1912, pp. 16-8.

***Canadian Mining Journal, Nov. 1st, 1911, pp. 697-699.

the form of the native metal, partially in coarse grains, but chiefly in very minute particles intimately associated with pyrite. There is at depths of 100 and 200 feet ore that is quite as rich and of the same character. The information concerning values at greater depth is slight and for the most part confined to drill cores. These give no very reliable estimate of the extent of ore bodies; but they show that the ore at depth is of quite similar character to that near the surface. At one property it has been found by drilling across the strike of the ore shoots that they are in places at least as rich at a depth of several hundred feet as at the surface. How large the several shoots may be, and what their average values, can only be guessed at. It would be re-

markable if glacial action had exposed the best part of each ore shoot. In some mines it has already been found that it did not. There is no safe ground for assuming that any one ore shoot will persist to great depth. It is quite possible that the values will be found to fail within a few feet of the present workings, for such is not an uncommon occurrence. It is quite as likely, however, that the shoots have a vertical dimension as great as the lateral, for the distribution of values shows nothing to indicate the contrary. Where it is found that there are no exceptional features such as faulting, etc., it is reasonable to count on a depth equal to one-half the lateral dimension.

OPENING OF THE DOME MINE, PORCUPINE

(By Our Special Correspondent.)

To commemorate the starting up of the Dome mill a demonstration was organized in the Porcupine camp. On Friday night a special train of Pullmans arrived in South Porcupine, consisting of the T. & N. O. Commission, the Dome directors, newspapermen, and a very large representation of mining men and brokers from Toronto, in addition to operators from all over Northern Ontario.

On Saturday morning a special train ran out to the Dome mine, where mill and mine were thrown open to the public. The forty stamps in the mill were dropping all the time the visitors were passing through the mill and everything but the cyanide end of the plant was in operation. As there has been an absolute edict against allowing anyone underground at the Dome before this, the privilege of walking through the drifts was much appreciated.

A raise has been put through to the surface from the 45-foot level, and ore is trammed to the rock house where it is crushed, thence it passes in a conveyor belt to the head of the mill. Underground there are now eleven raises to the surface, and from the shoots ore can be taken out into the cars at any time. A block of ground, 200 by 600 feet, has been divided into 100 feet sections, and the whole of this will be open-cut, yielding ore enough to supply the mill for at least two years, while further ore is blocked out at lower levels. There are to-day 1,800 feet of drifts and cross-cuts at the 45-foot level alone.

After the inspection at the Dome, the visitors drove out to the Hollinger, the McIntyre, and the Vipond, where all plants and mines were thrown wide open for inspection. It was very opportune for the good success of the celebration that Mr. Albert Freeman, president of the McIntyre mill, brought the first gold brick from the camp to South Porcupine the day before, so that the first fruits of the camp could be seen and felt. It weighed 160 ounces of gold, the result of 174 hours run at the McIntyre ten-stamp mill. At night several speeches of importance were made at the banquet in the Majestic Theatre.

Mr. Ambrose Monell, president of the International Nickel and of the Dome Mines, gave a brief sketch of the conditions at the Dome up to the present time. He told how the option came to be taken up and of the heavy expenses in transportation which caused them to spend \$80,000 for teaming from the steel alone.

He continued: "In July, 1911, we had done a certain amount of underground work and practically completed a mill, when the awful cyclone of fire swept the country and left not a vestige of any work above ground. I arrived here two days afterwards, and I may say to you that the insurance companies willingly co-operated in the quick adjustment of accounts, thus enabling us to proceed rapidly with reconstruction. Plans for the new brick buildings, hospital, storehouse, power house, crusher, etc., were out, and orders for material placed within ten days. The mill was erected under the supervision and untiring co-operation of a staff, which for team play I have never seen surpassed. We had the advantage of the presence of Mr. Merrill, the president of the Merrill Metallurgical Company; of Mr. Mein, the well-known mining engineer, with his wide and varied experience in South Africa and in America; of Mr. Meek, our general superintendent, and of Mr. Hanson, in charge of the erection of the plant. Even with the observation which you have had to-day you will perhaps not appreciate all that was necessary to do in such a short time, in order to make the conditions of life not only bearable, but comfortable for such an isolated and self-contained community. Much, of course, remains to be done in the way of underground development, before any real judgment can be formed as to the ultimate extent and character of the deposit. It would be idle for me to say more than that we have great belief in the future of the property, which will not be run with one eye on the hoist, and the other on stock ticker.

"Now, as to the outlook of the camp, and for the belief of myself and associates in the mineral future of this country; there is no reason to believe that the ore bodies are contained in only a few properties. The development which has already taken place puts the camp farther ahead, in the same space of time, in the way of probabilities for its future than any other gold camp I have ever known. Do not be too hopeful or despondent. Such a gold camp requires time for careful development, requires a large expenditure of money for the development, and after the development a knowledge that you have orebodies sufficient to justify the erection of a mill. It requires a large expenditure of money for the installation of individual mills, or the erection of a customs mill. This is es-

essentially what is known as a rich man's camp. That is to say, it requires large sums of money to be put into the ground before you can expect to get a dollar out. I would like to utter a note of warning against the embarkation in the enterprise of creating a producing property until those embarking in the enterprise are well assured by conservative engineering advice, as to the amount of money that will be required before they can hope to get any return. If care is exercised in this, much loss and heart-burning will be avoided, because if an enterprise is started with too little money in the treasury first to develop, and (even if they have the ore) to follow up that development with a mill to produce the gold from the ore, the inevitable result must follow; of bankruptcy and re-organization.

"There is no more useful calling in the world than that of mining. The farmer, the fisher, and the miner are the only three natural producers. For the up-building of your country the farmer, of course, takes the first rank. That occupation creates more independent, self-reliant individual citizens than any other. The fisherman produces a hardy race, the natural defenders of your country by sea. The miner takes rank with either as producer not only of a great labouring class, making most useful citizens, but he produces the raw material from which the manufacturer creates the tools, the foundation of modern machinery and wealth.

"How, then, does the case stand as to Canada in relation to her mineral future? In 1910 you produced ninety million dollars of mineral wealth, metallic, and non-metallic; forty-five millions in non-metallic, such as coal, cement, etc., and forty-five millions, metallic. In my belief you are scarcely on the threshold of mineral development. It behooves such men as yourselves, therefore, to see that the mineral development

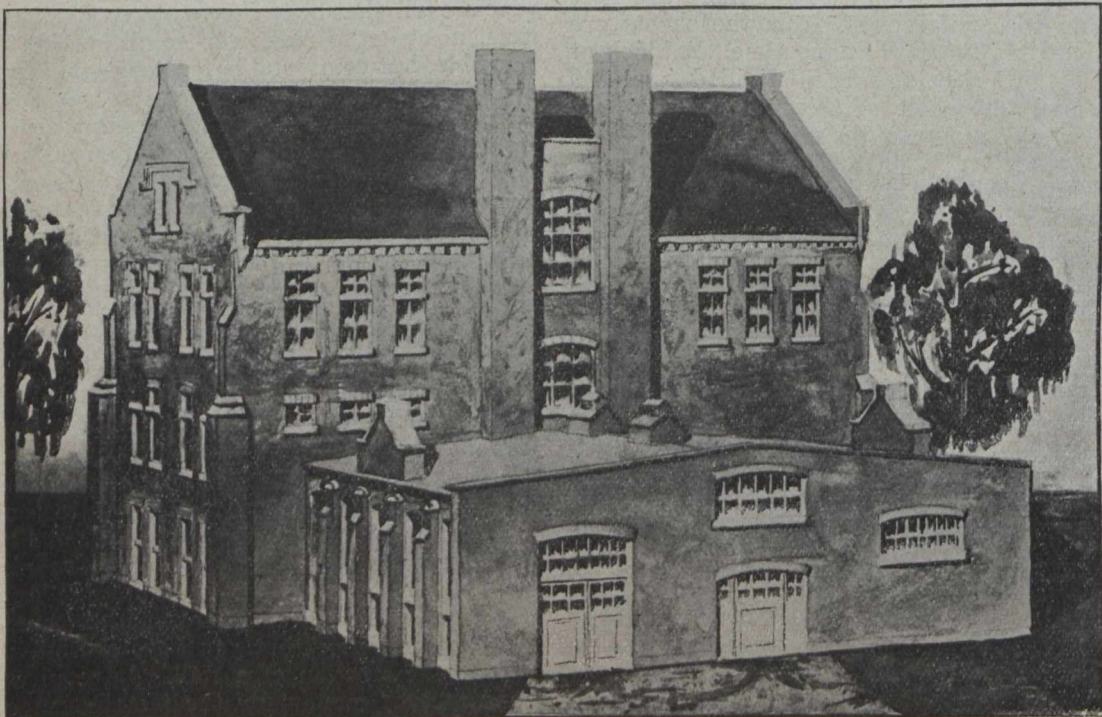
is conducted on business lines. Again may an outsider offer his meed of tribute to the advantage which you possess in the administration of British justice, and British fair play. Capital is timid, but while you maintain your reputation for even-handed justice administered promptly, you may rest assured that capital will be bold, so long as it feels that the standard of Canadian public life, whether in Parliament or on the bench, is maintained on its present high plane.

"I am happy to offer this tribute after years of mining experience in this country. May I suggest that he is the best friend to the cause of Anglo-Saxon liberty, who fosters and maintains the present friendly relations between the people of the flag under which I have the honour to live and the Union Jack under which you live. United they may front the world. My greatest wish is that they may so rest united and further the cause of Anglo-Saxon supremacy."

Mr. C. W. Merrill, head of the Merrill Metallurgical Company, of San Francisco, who designed the mill, stated that after a study of conditions at Porecupine he had come to the conclusion that there were few superior in facilities and local conditions from the economical extraction of gold from its ores. Porecupine has an abundance of water, its labour was of high class in comparison with many other camps, and it had, he believed, great possibilities in regard to the development of large quantities of ore. He would not say that the Dome would have a thousand stamps, but he would say that no one could say how many stamps they might have. Not only were conditions favourable for cheap extraction, but the ore itself was one of the best that it had ever been his experience to meet with. As to results at the Dome mill, they had not gone far enough to make a positive prediction, but they were perfectly safe in saying that they would be able to make a recovery of no less than 95 per cent.

NICOL HALL, SCHOOL OF MINING, KINGSTON

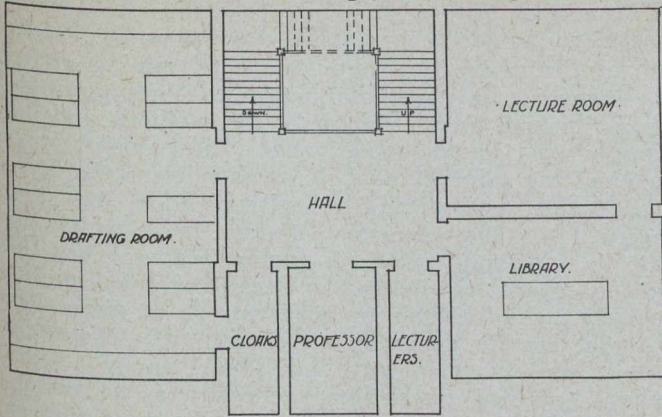
By J. C. Gwillim.*



*Professor of Mining, School of Mining, Kingston

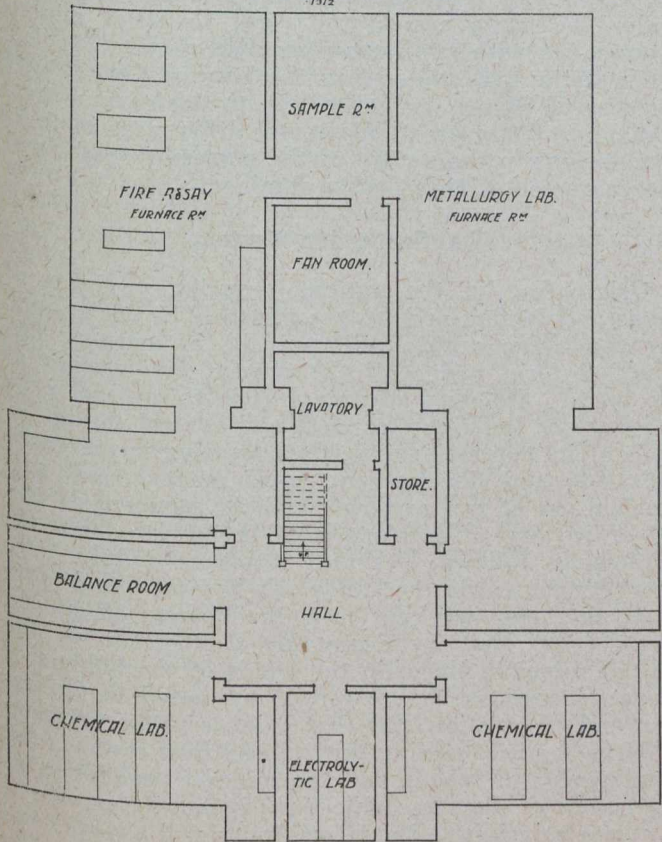
Nicol Hall is the latest addition to the group of grey limestone buildings on the grounds of Queen's University. Beside it is the newly built and equipped Gordon Hall, devoted entirely to chemistry, a gift of the Ontario Government, to the School of Mining.

Nicol Hall is to be given over entirely to mining and metallurgical engineering, as may be seen by the accompanying floor plans, which are the inner outlines of the architects' more complicated designs.



-FIRST FLOOR PLAN-

- NICOL MINING & METALLURGY BUILDING -
- SCHOOL OF MINING -
- KINGSTON, ONT. -
1312

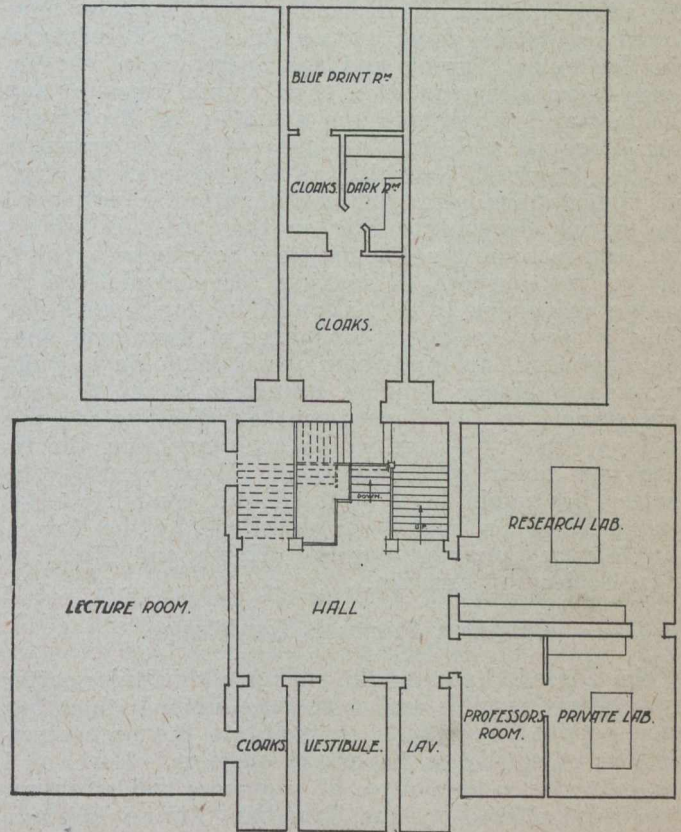


- SEMI-BASEMENT FLOOR PLAN -

The building is composed of two parts: the main building of three floors and an attic, 80 feet x 48 feet; and the furnace building, a single floor, high story, stone structure, 64 feet by 48 feet, with a few small rooms over its central portion.

This combined building will, it is expected, accommodate the Department of Mining and Metallurgy in a way suitable to its merits and its long patience with make-shifts in the other buildings. The milling of ores and concentration work will still be carried on in the old wooden building, which has served so well, until the happy day when a solid stone structure is attached to these new laboratories.

Besides supplying laboratories, library, and lecture rooms for the students, there will be carried on for the Federal Government Mines Branch some extensive metallurgical research work. This building merits more than passing notice for it is the gift of a professor, William Nicol, and of graduates and alumni of the School of Mining.



-GROUND FLOOR PLAN-

At the time of its inception, May, 1910, there were 254 graduates, all young. Eighty-eight of these were graduates in mining and metallurgy, but one hundred and twelve subscribers contributed about \$10,000. Another \$10,000 was subscribed by an older graduate of Queen's and present Governor of the School of Mining, whose name is much honoured in the mining world.

The principal gift, and the original idea, came from Professor Nicol, whose devotion to mineralogy and his Alma Mater, Queen's University, inspired him to build a suitable home for mining and metallurgy, partners of the earlier history of the School of Mining, in old Carruthers Hall.

Over its front entrance is graven "Nicol Hall," and upon the corner stone is this inscription: "The corner stone of this building erected with money given by Professor William Nicol and Graduates in Science was laid by James Douglas, Esq., LL.D., October 18th, 1911."

The floor plans are from the office of Power & Son, the architects; the perspective view from O. G. Wellton, and the photos from Dr. Clark, of the School of Mining.

THE MINING LAW—ITS FAULTS AND SUGGESTED CHANGES

By Horace V. Winchell.*

The question of national mining laws is of special interest just now in both Canada and the United States. Attention has been widely called to the many defects and general insufficiency of existing statutes, and wherever the matter has been discussed, the need for revision has been admitted. In the United States during the past decade there has been frequent agitation of the subject. Public officials connected with the administration of our land and mining laws have urged legislation along certain lines; the Director of the Geological Survey and the Secretary of the Interior have discussed it in their annual reports; and the matter has engaged the attention of Presidents, Mr. Roosevelt and Mr. Taft discussing it in messages to the Congress. Associations and societies of various descriptions, after due consideration, have passed resolutions demanding this or that measure of relief, and in some cases committees have been appointed for the purpose of making recommendations as to the principles to be followed in new legislation. Thus, a few years ago a committee of prominent mining engineers, among whom were John Hays Hammond, and James Douglas, united in a report upon this subject to the Government at Washington; but nothing came of it, and so far as I can learn, the report was never even published. More recently the matter has again been agitated and committees for its consideration have been appointed by the American Mining Congress and the Mining and Metallurgical Society of America.

Canadian Proposals for Change.

The United States might well profit in this matter by the very sensible and systematic method which has been adopted in Canada to facilitate the proper settlement of this most important question. Here, as I am informed, a committee of engineers and attorneys has been selected by the Canadian Mining Institute to draft a bill for a Canada Mines Act, and to present the same for consideration and adoption by the Dominion Parliament. In other words, you Canadians are proceeding in the best way to procure laws framed by experts; and none can doubt that statutes thus prepared are in every way superior to enactments whose subject matter is prepared by theoretical political economists on the one hand or by agitators and professional politicians on the other. I wish, therefore, at the outset to commend the Canadian Mining Institute for its very wise procedure in this matter and admonish you not to weary in well-doing, not to be disheartened at slow progress. When you have accomplished what you have set out to do, you will not only have that pleasant sense of satisfaction which succeeds the consciousness of duty worthily performed, but you will have made an investment of time and labour which will return a thousand-fold in actual wealth and prosperity. For that country which is willing to be guided as to the handling and development of its mineral resources by the crystallized policies of its mining engineers is the country whose mining industry will be at once best managed and the most productive of material blessings for all the people.

*Presented to the Canadian Mining Institute at the Toronto meeting, March the 6th.

Systems of Mining Law.

The mining laws of a country are those legislative enactments or customs established by precedent which control the acquisition and tenure of mining rights and property, in contradistinction to "mining regulations" which have to do with the methods and appliances used in operating mines. The principles underlying the mining laws of various countries have been found susceptible of classification into two groups: "(1) The concession system under which the state or a private owner of mining property has the right to grant concessions or leases of such mining property to individuals or corporations at discretion, or under certain general restrictions. (2) The claim system, under which any individual, under certain general specified restrictions, generally as to nationality and colour, has the right to locate on discovery or otherwise certain limited areas of ground, and under certain conditions to hold, work, and dispose of the same."

Under the concession system the right to grant lies with the owner, and it is said that five-sixths of all the mining areas of the world are held under it; under the claim system the right to claim mining ground lies with the locator or discoverer. The latter is the system underlying the laws of Canada and the United States, as well as South Africa and Australia; but there are fundamental differences in these countries as to the nature of the possessory right and the character of title finally obtained.

The Concession System.

Originating in the ancient proprietary rights of kings and feudal lords to the minerals in the ground, the concession system still prevails in more or less modified form under all the ancient civilizations of the world. Its chief advantage is in the retention by the state of the right to select and control the operations of its concessionaires, thus assuring proper capitalization and development, good management, economical use of raw material, and the payment of rental or royalty. To this system there have been objections as follows: (1) that it places unduly large property control in the hands of a few men, and takes from the poor working man the chance of sudden wealth; (2) that by destroying competition in the sale of mines it places in the hands of the holders of large concessions the power of unlimited capitalization and speculation; (3) that it leads to the tying up of large areas of mining ground and thus restricts the employment of labour and the mineral production of the country. To these objections it may be answered that a relatively small number of men will always have control of the money with which to buy and develop mining property, no matter how it be granted; that the Government may easily regulate the capitalization of its lessees; and that a large, strong corporation is usually better prepared to thoroughly prospect its territory than the unaided though far more numerous prospector. If diligent prospecting is required as a condition in the concession, the system of

preference rights to explore large areas with the further right to take out leases of limited area would seem to present many practical advantages for new and unexplored countries.

The Claim System.

The claim system grew out of conditions in early mining days in the United States and Australia. The Argonaut horde who invaded California in 1849 and a few years later rushed to Australia were in many cases allowed to make their own local rules as to size of claim, method of discovery, staking, recording, and obtaining title. In the United States the usages thus established were later sanctioned by Congressional enactment which grew into our present system of mining law, and also served to greater or less extent as a model for Australia and other nations. This system, "however necessary in the peculiar circumstances of its inception, should have been altered as soon as changing circumstances permitted," but instead it has been patched and interpreted by judicial decision until the United States has to-day the most wretchedly inadequate and antiquated law with which a great country is anywhere afflicted. Instead of fostering the mining industry the law as it stands to-day and as interpreted by the judicial and executive branches of the Government creates confusion, entails unnecessary expense, causes waste, and retards development.

Common Principles.

Two fundamental principles are common to the mining laws of all countries: (1) The right of the mineholder to a perfectly secure and indefeasible title to his property so long as he fulfils certain specified conditions entirely within his own control, and (2) the right of the state or other landlord to certain rents, royalties, or taxes on the property or its output, and to the reasonably constant operation of the mine.

In the power of the Government to fix the rate of royalty or taxes lies also the ability to promote or to discourage prospecting and mining. If the chief aim of the Government is the development of national resources and the increase of general prosperity and business, its policy for the disposition and holding of its mineral lands will be most liberal. If there is a desire to enrich the public treasury directly by means of revenues from taxes upon mines, the result may be a rapid decline of the mining business, and a shifting of the population to more favoured communities. It is frequently stated, and truly, as I believe, that the principal factor in the growth and development of the United States and Canada has been the liberality of their policy for the distribution of their public domain. Freely, or at a nominal consideration, homesteads and mines have been offered to all who chose to come and settle, to develop and use. If during the past fifty or seventy-five years the policy of conservation as now advocated by its most ardent proponents had been expressed in our statutes North America would be for the most part as little developed as Alaska. There would be a line of settlements along the Atlantic and a few fishing hamlets on the Pacific. The interior of the country would still be to a very large extent bottled up and conserved; and the country would perhaps be still importing the bulk of its copper and iron as it is its supply of tin, platinum, potash, and nitre.

Mineral Wealth of the United States.

To speak to an audience of mining men of the importance of a liberal mining law is like carrying silver to Cobalt or copper to Butte, but since these remarks may find a wider audience a few words upon the extent of our mining industry may not be out of place. First, with reference to the United States. The annual products of the mines of the United States now exceed \$2,000,000,000 in value. They contribute 65 per cent. of the freight traffic of the country. The industry employs over a million men at the mines and twice that number in handling, transporting, and manufacturing the products. The total value of our metallic products during 1907 was \$900,000,000; of mineral fuels, \$788,000,000; and of non-metallic mineral products, other than fuels, more than \$378,000,000. During the year we imported mineral products to the value of \$255,000,000, and exported mineral products to the value of \$340,000,000. From the beginning of coal mining in this country in 1814 to the close of 1907, there were mined nearly seven billion (6,865,000,000) tons. Adding to this the one-half additional supposed to have been wasted in mining, gives a total of more than ten billion tons taken from the supplies originally available. The amount of easily accessible and available coal in the United States, exclusive of Alaska, is estimated as 1,400,000,000,000, while the total, including Alaskan reserves of 150,000,000,000 tons and the coal not easily accessible, is perhaps double this amount, and the country is as yet but partly explored. It may be remarked in passing that since the United States is now mining about 500,000,000 tons of coal annually we would appear to have a coal supply sufficient for about 6,000 years at the present rate of consumption, even without borrowing or buying from the enormous coal bins of Canada. Can anyone doubt that the provisions of the laws governing the disposition of the fifty million acres of coal land still remaining in the hands of the Government is a matter of importance to a nation with an annual coal consumption of five tons per capita?

Area of Public Lands.

Figures are wanting as to the quantity and value of other mineral products estimated to remain within the unappropriated public domain. The land area of the United States, excluding Alaska and the insular possessions, is about 3,000,000 square miles, or 1,920,000,000 acres. Of this area over half is arable, and a little less than half is occupied as farm land. About two-thirds of the land has passed into private holdings. Of the original acreage there remained on July 1, 1908, 387,000,000 acres, or about one-fifth open to entry. Nearly all of this is arid or otherwise unsuitable for settlement by families. There are also about 235,000,000 acres in national forests, national parks, and other lands reserved for public use. Of the entire area of 1,920,000,000 acres there remain unalienated about 622,000,000 acres, or nearly one-third within which valuable minerals may still be discovered. Is it not a matter of vast importance to provide most carefully for the exploration, disposition, and development of this vast empire? In what direction can the fostering care of government be more profitably and properly extended? And when Alaska, with its undeveloped area of about 360,000,000 acres and the island possessions with 90,000,000 more acres, are taken into account, is it not clearly one of the largest questions before the public to-day?

Canadian Conditions.

In Canada the percentage of unappropriated public domain is larger than in the older country lying along its southern border, and there is yet ample time to avoid the mistakes of omission and commission of the United States. With a total area of 2,118,814,000 acres, you have still in the hands of your Provincial and Dominion Governments the larger part of your acreage. Your annual production of minerals is valued at about one hundred million dollars. At its present rate of increase it may easily amount to \$500,000,000 by 1950. Can your engineers find any more truly national work than to aid in the framing and adoption of the best possible laws for the protection and encouragement of the mining industry? Is it not apparent that there is a very close connection between mining laws and that conservation idea so dear to the imagination of the majority of our people to-day? If the true aim of conservation be "maximum use with minimum waste," is it not evident that to be consistent with this theory, mining laws must be liberal as to opportunity and inducement for the individual or corporation, and at the same time as scrupulous and exact in supervision and scientific regulation as the conditions of industry and the laws of political economy will permit? If the terms and conditions for acquiring mining property be so difficult as to materially restrict the number of prospectors or development companies there will be far less than "maximum use"; and if no right of supervisory control is retained by the Government there will seldom be "minimum waste." The best code of mining laws will inevitably aid in the development of natural mineral resources, and at the same time have a tendency toward the right species of conservation, as contradistinguished from that variety of it which seems to aim at disuse, stagnation, and paralysis.

Failure of American Mining Law.

In many particulars the present mining law of the United States is admittedly a failure, and in other respects it has both its critics and defenders. I propose to mention briefly some of its defects, and some possible amendments, not because there seems to be any danger that our worst faults will be copied by others, but in the way of general illumination of a question which is not always clearly understood even by our own people.

Briefly stated, the United States mining law, known as the Act of 1872, provides for location by discovery; possession perpetuated by annual assessment work; and title in fee simple to the surface and minerals obtained after the expenditure of a certain amount of money by the payment of \$5 per acre, and the observance of certain formalities as to survey, etc. The metal-mining laws do not apply to all of the states. They are made applicable to the western states and territories with the exception of Michigan, Wisconsin, Minnesota, Missouri, Kansas, and Texas. Mining locations are not recognized in the states east of the Mississippi River, nor is there in any state legal authority permitting one man to prospect or mine beneath the surface of ground owned by another without consent of the latter. To this statement there is one important exception, and that lies in what is called the "apex law" under which the owner of the outcrop of a vein in mining claims has the right to follow and mine the vein on its downward course be-

neath the surface of a claim owned by another. This law has proved more productive of expensive litigation than of economical mining, and in many of the more recently established and more progressive mining districts has been made inoperative either by common agreement or by compromise between adjoining owners. Placer mines are likewise located by discovery and held by annual work and acquired by purchase in fee-simple forever. Known veins within placer locations must be declared and paid for separately or else they are excepted from the placer patent and can be located by others in "lode claims." All veins on placer ground not known to exist at the time of application for patent belong to the grantee, but without extra-lateral or apex rights. If an applicant for a placer patent can be shown to have had knowledge of a valuable lode within his lines prior to the making of his patent application, his title as to that vein may be cancelled for fraud at any time upon application of a contesting locator. There is no limit to the time for such contests and they are still being brought in some cases twenty years after placer patent. The law is very defective on this point; for it frequently happens that veins discovered to-day have a value by reason of improved transportation facilities or metallurgical processes, although these same veins were of no value whatever when the placer claim was located and patented. The owner of such a claim is sometimes put to the expense and annoyance of defending such contests repeatedly, since there is no limit to the number of contestants. The law should be amended so as to make it impossible to attack a placer patent on such charges after a reasonable term of years. Another absurd feature of the placer act is that providing for the location of oil, gas, iron ore, and other deposits in the same manner as auriferous gravel. Coal lands are sold by the Government upon an appraised valuation, and the amount of land that may be legally acquired is limited for an individual to 160 acres and for an association to 640 acres. Tracts of such limited area do not often justify the installation of the most efficient equipment, and economical operation is therefore impossible under the terms of the very law which was expressly designed to promote economy and prevent monopoly.

Absence of Leasing.

Under the present United States law there is no general system of separation of surface from mineral rights, no leasing of mines from the Government, no payment of rental or royalty, and no Federal supervision or control after location and patent. Taxes are paid to the state and county, and mining regulation is attempted by many states. Unfortunately there is no uniformity of principle and practice as to these matters, nor any stability, nor assurance of permanence in any state either as to methods of operation required or basis of taxation.

Although it has been successful elsewhere and has much to recommend it, the Government leasing system has never met with much favour in the United States. There is not at present strong opposition to grants in perpetuity by the Government, although the leasing system has been recommended by some organizations and public officials. There is a hesitancy to create more bureaus; for bureaucratic administration is not popular with those who have tried to transact business with many of them.

Requirement of Discovery.

Aside from the generally condemned apex law, there are two or three features of our present system which should be speedily remedied. The first is that provision of the law requiring a discovery of valuable mineral before location. There is really no sense in such a requirement. What seems valuable to one man is often worthless to another; and what is of no value to-day may be worth a million in a year or two. Moreover, it sometimes requires a year's work and a shaft several hundred feet deep before the actual discovery of ore, even though the surface indications give ample promise of its existence below. Every mining engineer and geologist knows that many ore deposits have no value whatever immediately upon the surface of the ground. Why not allow a prospector to stake out his mining claim wherever he chooses on the public domain, and hold it so long as he performs the required amount of development work?

Limit the Number of Locations.

Another defect in our present law is that permitting a prospector to locate an indefinite number of mining claims and to hold them without doing his assessment work. Many promising districts are kept from becoming hives of industry and producers of mineral wealth by the tying up of their territory in this way. The prospector should be restricted in the number of his locations, and real development work should be exacted.

Right of Appeal.

The last important defect in the United States and Alaskan mining and land law to which I wish to call attention is the lack of any provision for appeal to the courts from the decisions of administrative officers. It is contrary to the general spirit of our institutions and an anomaly in constitutional government to take away from any citizen property rights to which he considers himself justly entitled under the law, by the mere fiat of an appointed government official who is here to-day and gone to-morrow. To place in the hands of such officials the final dicta in matters involving property valued at hundreds of thousands of dollars, and to provide no method of appeal to any duly constituted non-political judicial tribunal is not only to subject the said officials to great and unnecessary tests of moral courage and fidelity, but to require in them the qualifications of superior judges and experience in the interpretation of the law which many of them cannot be expected to possess. Serious injustice may be done without any remedy at law to the defeated applicant. In the interests of justice, provision should be made for appeals in important cases, and perhaps in all cases, from decisions of the Commissioner of the General Land Office or the Secretary of the Interior to some court of competent standing and jurisdiction, whose decisions could and would be accepted by the public and the interested parties as justified by the law and evidence. I am gratified to notice that this point has been carefully covered in the recommendations of the Canadian committee on this subject.

Comparison of English and American Systems.

A comparison of the mining laws of the United States with those of other English speaking countries will disclose a fundamental difference in the under-

lying theory of the proprietorship of minerals, and hence in the attitude of the courts upon the subject as reflected in their decisions. Recent publication of a report upon the "Mining Laws of Australia and New Zealand," has caused considerable discussion because of the fact that its recommendations have been to a certain extent adopted by other government officials in their annual reports and public addresses. This report apparently assumes a similarity between British laws and those of the United States in certain respects where actually a wide difference exists.

Absence of Regalian Right.

"Neither regalian right, nor anything similar, has ever existed in or been asserted by the United States. While it has sovereign authority, and the power to enact such statutes as Congress in its wisdom sees fit, within the limits of the Constitution, its right is dependent upon and controlled entirely by statute." Furthermore: "A distinction exists, and should be observed between ultimate ownership and right to govern on the one hand, and the exercise of regalian right, after possession and title is parted with, on the other. The former exists in the United States, the latter does not. The ownership, as well as the manner of exercising control, of mineral lands is regulated in the United States by statute."

"The fundamental principles of the common law of England were to a certain extent ingrafted into our legal system when we separated from the mother country and were and still are the rule of action in the absence of legislation. As a general rule, under the common law minerals were the property of the owner of the land, the property in the surface carrying with it the ownership of everything beneath it. Wherefore the ownership of the surface was the best prima facie title to the ownership also of the mines. This prima facie ownership continued until rebutted by showing either: (1) that the land contained 'royal mines'; or (2) that it was subject to some particular custom that defeated the prima facie ownership, as in the case of the tin mines of Cornwall and Devon and the lead mines of Derbyshire; or (3) that the ownership of the mines and minerals had become in fact, from divers causes several and distinct from the ownership of the soil and surface."

By the term "royal mines" was meant mines of gold and silver. These belonged exclusively to the Crown, by prerogative, although in lands of subjects. In this respect the rule was the same as under civil law. It was at one time contended that mines or mineral deposits containing the baser metals in combination with either gold or silver were royal mines. This contention, however, was set at rest by statutes enacted during the reign of William and Mary, wherein it was declared that no mine should be deemed royal by reason of its containing tin, copper, iron, or lead in association with gold or silver. Thus, those mines only came to be classed as royal in which were found the precious metals in the pure state. Briefly stated, the regalian right to mines, as recognized in England, was confined to those of the precious metals, gold and silver. The base substances belonged to the owner of the soil, except in certain localities where immemorial custom had modified the rule.

At the present time "England has no general mining laws. Legal questions governing the ownership of mines and minerals have been determined on the general principles of the common law."

As distinguished from the common law the theory of the civil law is thus clearly stated by H. W. Halleck:

"All continental publicists who have written upon the subject lay down the fundamental rule, that mines, from their very nature, are not a dependence of the ownership of the soil; that they ought not to become private property in the same sense as the soil is private property; but that they should be held and worked with the understanding that they are by nature public and that they are to be used and regulated in such a way as to conduce most to the general interest of society."

C. H. Lindley has presented concisely the theory of our leading mining lawyers as to governmental control after patent, as follows:

"The Government of the United States does not concern itself with mining lands or the mining industry after it parts with the title. This title vests in the patentee absolutely to the extent of the property granted. No royalties are reserved; nor is any governmental supervision (except perhaps in the isolated case of hydraulic mines in California) attempted. Upon the issuance of the deed of the Government the mineral land becomes private property, subject to the same rules as other property in the state with reference to the transfer, devolution by descent, and all other incidents of private ownership prescribed by the laws of the state. Briefly stated, property in mines, once vested absolutely in the individual, becomes subject to the same rules of law as other real property within the state."

Did the United States Waive Its Right?

But lately we are told that the United States "has never waived its right to the precious metals," and that "in all states where the Federal Government has never owned the land, and there are 19 such states, the ownership of the precious metals lies with the state government," and "that in states where the ownership of the land has been vested in the Federal Government the ownership of the precious metals in like manner, lies with the nation, and that as against the Government no person has a right to gold and silver in any lands in the United States unless this right has been specifically granted to him in the deed of conveyance."

Here is a most radical difference of theory. Mr. Veatch would have the Government resume dominion and control of gold and silver and by implication of other metals beneath the surface of all lands except those in which minerals were specifically conveyed. He thinks the Government has the right to grant prospecting permits beneath private property and the power to collect royalties on minerals produced as a result of such explorations. In other words he insists upon it that the United States is in possession of a regalian right, but does not know it or has forgotten it. He would have the people wake up and seize what is theirs from all mine operators who are thus wrongfully removing from the ground valuable minerals never specifically granted to them by the Government. It can readily be seen that it is a matter of no small moment to ascertain whether such a thing is possible. Here is proposed mining law revision with a vengeance. I have not at hand the figures to show the relative proportion of lands patented as mineral lands and in all other classes; but have no doubt that

the lands granted under the homestead, pre-emption, desert land act, private entry, townsite, timber and stone, railroad grants, and all other laws exceed in the aggregate the lands under the mining laws four to one. Now, if the minerals under three-fourths of the privately owned land west of the Mississippi, and practically all the lands east of it, really belong to the Government, it is high time for the Government to assert its right and to exercise some sort of control over its vast possessions. This is either a nebulous and iridescent dream or a very important discovery. If the former the bubbles should be punctured, and the mist dispelled, before arousing too many false hopes; if the latter the work of mining law revision at once assumes paramount importance. Fortunately, we have some illuminating opinions of the United States Supreme Court, as a guide and cloud dispeller.

Opinions of the Supreme Court.

In the case of *Deffeback v. Hawke*, 115 U.S., p. 400, Mr. Justice Field, after reviewing at length the various acts of Congress relating to the public lands of the United States, concludes as follows:—

It is plain, from this brief statement of the legislation of Congress, that no title from the United States to land known at the time of sale to be valuable for its minerals of gold, silver, cinnabar, or copper, can be obtained under the pre-emption or homestead laws or the townsite laws, or in any other way than as prescribed by the laws specially authorizing the sale of such lands, except in the states of Michigan, Wisconsin, Minnesota, Missouri, Kansas. We say "land known at the time to be valuable for its minerals," as there are vast tracts of public land in which minerals of various kinds are found, but not in such quantity as to justify expenditures in the effort to extract them. It is not to such lands that the term "mineral" in the sense of the statute is applicable. In the first section of the act of 1866 no designation is given the character of mineral lands which are free and open to exploration. But in the act of 1872, which repealed that section and re-enacted one of broader import, it is "valuable mineral deposits" which are declared to be free and open to exploration and purchase. The same term is carried into the Revised Statutes. It is there enacted that "lands valuable for minerals" shall be reserved from the sale except as otherwise expressly directed, and that "valuable mineral deposits" in lands belonging to the United States shall be free and open to exploration and purchase. We may also say lands known at the time of their sale to be thus valuable, in order to avoid any possible conclusion against the validity of title which may be issued for other kinds of land, in which years afterward, rich deposits of mineral may be discovered. It is quite possible that lands settled upon as suitable only for agricultural purposes, entered by the settler and patented by the Government under the pre-emption laws, may be found, years after patent has been issued, to contain valuable minerals. Indeed this has often happened. We, therefore, use the term known to be valuable at the time of sale, to prevent any doubt being cast upon titles to lands afterward found to be different in their mineral character from what was supposed when the entry of them was made and the patent issued.

And in the case of the *Colorado Coal Company v. the United States*, 123, U. S., p. 528, Mr. Justice Matthews uses the following language:

"A change in the conditions occurring subsequently to the sale, whereby new discoveries are made or by means whereof it may be profitable to work the veins as mines, cannot affect the title as it passed at the time of the sale. The question must be determined according to the facts in existence at the time of the sale. If upon the premises at the time there were not actual 'known' mines capable of being profitably worked for their profit, so as to make the land more valuable for mining than for agriculture, a title to them acquired under the pre-emption act cannot be successfully assailed.

Since these are the opinions of the highest court in our land it is probable that although the advocates of radical revision of our mining law may be able to change the form of its superstructure they will hardly be able to mine deep enough to disrupt its solid rock foundations. It will continue to present fundamental differences from the mining law of Canada on the north, and from that of Mexico on the south, but rights already granted will not easily be set aside.

General Conclusions.

Summarizing these somewhat disjointed remarks, it appears in general that:

1. The development and prosperity of all countries is vitally affected by the provisions of their laws relating to mines.
2. Greater inducements and more liberal rewards should be offered in unsettled countries than in districts of denser population.
3. Continuous development work should be required and rigidly enforced, but
4. No narrow limit should be placed on the amount of property held by an individual or corporation so long as the aggregate amount of work equals the pro-

duct of the net units of area held multiplied by the amount of development required for each unit area.

5. In case of any contest either between rival claimants or between a locator and the Government full privilege should be given of appeal to the courts as in other matters wherein the title to property is involved.

In addition to the above, and with particular reference to the United States, taking into account the system of mining law there already established by long years of precedent and custom, the following recommendations are tentatively presented:

- (a) The apex law should be abolished.
- (b) Mining claims should be locatable regardless of a "discovery" and held only so long as the specified development work is performed in good faith.
- (c) Placer locations should be limited to deposits of loose materials above solid bedrock.
- (d) A statute of limitations should establish a reasonable term of years beyond which placer patents shall be immune from attack on the ground of misrepresentation in the patent application.
- (e) Special statutes should be enacted providing for the location and working of oil, phosphates, rare earths, haloids, and other mineral substances not specifically mentioned in the present laws.
- (f) Existing titles should be fully recognized and confirmed and no effort should be made to create retroactive legislation.

I have purposely avoided any discussion of the relative advantages or disadvantages of permanent alienation of title as opposed to the government leasing system. For Canada, I am confident the latter system is to be preferred, and am pleased to find myself upon this point in accord with the majority of Canadian mining men.

OIL SIGNS AND PROSPECTS IN COLORADO AND ALBERTA

By Arthur Lakes.*

The account as given by the Government geological survey of the favourable oil signs of Alberta is of much interest to those familiar with oil signs and occurrences in Colorado along the eastern side of the Rocky Mountains, and in Wyoming. The general geology of the Rocky Mountain region in Alberta seems similar to that along their east flank in Colorado and in parts of Wyoming. The rocks are the same from the granite up with the exception of the Devonian which is not represented in this portion of Colorado, the geological series there, as in Alberta being mainly of Mesozoic character with the cretaceous as a prominent member, and the principal oil carrier. The sedimentary strata appear in both regions to be tilted near the axis of the granitic range and to become flatter as they pass beneath the plains. The Dakota sandstones in which seepages appear in both regions are covered by a heavy overburden of great thickness of marine cretaceous shale which is generally too deep for wells to exploit them. No productive wells have so far been found in Colorado or the Dakota sandstone despite abortive

efforts at prospecting its attractive looking seepages and tar exudations. The productive wells in this state, viz. those at Boulder and Florence are within and confined to the marine cretaceous shales. In Wyoming the Dakota cretaceous sandstones are the favourites for the exhibitions of oil seepages, the apparent reservoir of oil is however often traceable to much lower sources in the palaeozoic rocks.

A marked feature of the surface geology of Wyoming is the numerous anticlines and corresponding synclines into which the sedimentary strata including the oil bearing ones are thrown, folded or crushed together.

These anticlines are sometimes in the form of quaquaversal domes, the summits of which are favourable for gas whilst the slopes may carry oil and the corresponding synclines water. A powerful gas spring was tapped in one of these lower cretaceous domes near Basin City in the Bighorn Basin which after it caught fire illumined the country around for many miles around for some months.

*Superintendent The Ymir-Wilcox Development Co., Limited, Ymir, B.C.

Although the marine cretaceous series lying above the Dakota is the present seat of the productive wells in Colorado, oil signs have been observed at various other horizons from the Precambrian below to the upper Tertiary above, but no productive wells have so far been found outside of the cretaceous shale zone. In this both at Boulder and Florence, the wells appear to occur in independent fissures with no connection with any under or overlying formations, and the oil seems indigenous where found. Deep testing wells put down nearly to the Dakota have not found any appreciable amount of oil below the zone in the shales where it is usually found i.e., within 3,000 feet of the surface.

Oil seepages are not uncommon at various points along the foot hills of Colorado in the outcrops of the uptilted Dakota sandstones. Wells put down directly on these seepages and on the uptilted portion of the sandstones of course failed to find oil in quantity whilst those bored at a greater distance from the outcrops were precluded from reaching the Dakota by the thick overburden of shale. For this reason the Dakota sandstones in Colorado have never been proven as to whether or not they are an oil reservoir as their surface seepages might imply both in this region and in Alberta. The porous character of the rock and its being well packed between impervious shales would make it an excellent reservoir for either oil, gas or artesian water. In Southern Colorado and South Eastern Kansas where it favourably underlies, it is the principal source of artesian water in those acid districts, the same is the case in parts of Dakota, but in none of these instances do we hear of it as a productive source of oil. The Dakota would seem by its origin and structure and position in the geological series to act more the part of a catchment or recipient of oil from other sources than a generator of the same.

At Florence, Colorado, although the outcrops of Niobrara limestone as well as the Dakota sandstones, show no signs of oil the Jurassic marls and shales below them have prominent oil seepages flowing into Oil Creek. These have only been tested by shallow wells, but would also seem to be independent and indigenous to the rocks where found because no traces of oil have been found by boring or seepages in the underlying Palaeozoic rocks down to the Pre-Cambrian or granitic series now in any rocks intervening between them and the overlying reservoir fissures on the cretaceous shales at the Florence horizon.

The seepages observed so abundantly in Colorado and Wyoming and especially in Alberta in the Dakota sandstones would certainly suggest more regions to be underlaid by a considerable oil field whose resources we have no reason to believe exhausted by such seepages and leaking or the outcrops as observed. Seepages unless erosion is in rapid progress alongside of them are apt by hardening to form a protecting cap over the exuding points and prevent further leakage. If the money that has been wasted in putting down wells close to the seepages had been expended in more judiciously located wells, we should know more of these fields. The desirable point in such fields is to find some locality where by erosion or other causes the thickness of the overlying shales is sufficiently demonstrated to admit of reaching and testing the underlying cretaceous sandstones with a reasonable depth.

Making Use of Hydraulic Power.

The introduction of a small tap into a main water-pipe line does not appreciably reduce the pressure, but by this means power can be obtained for various purposes. In a case known to the writer water to operate a movable motor is taken from the main pipe line through a fire hose, and for any work around the mine the necessary power can be obtained from this movable motor.

Over two hundred thousand tons of coal are now in the coal heap at Dominion No. 2 Colliery. The heap is still growing and will likely reach the 300,000 ton mark before the shipping season commences.

At the Talisman mine, in New Zealand, a water jet is used during drilling. The supply is taken from the main pump column and the pressure ranges up to 140 pounds per square inch. At blasting time a three-sixteenth inch nozzle is screwed to the end of the compressed air pipe and air is allowed to blow through as soon as the fuses are lighted. This air rapidly dissipates the fumes from the powder.

Covered Coal.—Late Westphalian experiments seem to indicate that little is gained in attempts to preserve coal by excluding air under water or in special atmospheres. The tests were made with lumps about $\frac{3}{4}$ of an inch in diameter, a portion being placed in half gallon jars under water, carbon dioxide, flue gases or sulphurous acid vapours, and another portion being exposed in the open air. Though different coals gave unequal results, the loss of gas was not much influenced in any case by the protective treatment. It was recommended that, if anything is to be done, the coal piles should be provided with roofs, and thermometers should be inserted so as to obtain warning of any tendency to spontaneous combustion.

The Coal-Mine Vacuum Cleaner.—The vacuum-cleaning of coal-mines is a new idea for preventing risk from dust. A Scottish electrical firm has devised a special mine-cleaner, which includes a jet of pressure air for raising the dust from every crevice, with a bell-mouthed suction tube behind the air-nozzle, and a separator or filter that retains the dust sucked in and permits the air to escape. A single electric motor drives both the suction fan withdrawing the dust and the small pressure fan that produces the jet.

ALASKA TREADWELL CONCENTRATES.

At the Alaska Treadwell cyanide mill the concentrates are ground to pass 200 mesh, given a preliminary agitation with 2 pounds of lime solution, thickened by decantation and cyanided. The treated pulp is filtered in Kelly presses, from which the solution passes to Merrill precipitation presses. The precipitate is acid treated, melted in a specially constructed oil burning furnace, and refined in Faber du Faur testing furnaces. In the company's assay office there were 4,741 samples taken from the mine during 1911 and 3,230 from the mills assayed. In addition to this work, all the samples from the other mines and mills on Douglas Island, the cyanide plant and experimental work, also the Alaska Juneau Gold Mining Company, amounting to 18,029, as well as the retorting and assaying of all bullion collected in the mills, was done at this company's assay office. For several years past the concentrates have been locally treated instead of shipping them to the Tacoma smelter.

THE DOMES OF NOVA SCOTIA

By T. A. Rickard.

PART I.

(Continued from last issue.)

Origin of the Crenulation.

The origin of this beautiful structure is difficult to explain. The first idea, adopted by some of the early observers, is that the quartz constitutes an integral member of the sedimentary series, that is, the silica that became quartz was deposited contemporaneously with the silt and sand that became slate and quartzite. According to this theory, the quartz underwent folding and corrugation with the encasing rock, and was particularly plicated at the places where anticlinal movements crossed. This simple explanation is killed by the single fact that the crenulated veins cut across the bedding-planes between the slate and quartzite. (See photograph No. 1.)

The next theory that may be proffered is that the quartz has replaced another mineral, segregated from the original sediment and distributed along bedding-planes or other lines affording passage to underground solutions. Calcite is prevalent throughout the region, and in association with the quartz; therefore it may have occupied the fractures in which quartz is now found. Such calcite would have been crushed by the earth-movements, and thus it would be all the more easily soluble in silicious acid waters. This theory also lacks the support of evidence. It is true that although we cannot conceive a layer of quartz undergoing violent bending without becoming crushed, a condition in which quartz is not uncommonly found in lodes,* we can imagine more readily that calcite could better withstand the strain, and even if crushed it might, at a later period, be replaced by quartz. In this connection we may remind ourselves, on the testimony of natural sections, that rock deformation ensues in the deeper portion of the earth's crust. C. R. Van Hise

has estimated that at 12,000 metres "the weight of the superincumbent mass is greater than the ultimate strength of the rocks,† which then undergo "flowage" or deformation without fracture." These considerations might well apply to the case in point, for, as we have seen, the rocks encasing the gold-bearing quartz now being mined in Nova Scotia were at one time covered by eight miles, or 42,000 feet, of superincumbent strata. Moreover, the practical researches of Frank D. Adams, in the laboratory of McGill University, prove that many rocks and minerals are capable of deformation without rupture when under great pressure.‡ Thus we have evidence on this point; but it is not applicable to our problem. If it be supposed that the quartz replaced another mineral which was deposited along the bedding-planes, either by original sedimentation or by subsequent segregation, we are again faced by the fact that the crenulated veins traverse the bedding. Hence they could not so originate. If we recognize that the quartz does not lie wholly along the planes of bedding, then the problem of explaining the crenulated structure is not facilitated by imagining quartz to have replaced calcite for any explanation that would suffice for one would be adequate for the other. Therefore this second theory does not carry us any further forward. We dismiss it, with regret.

The next theory is not so easily stated, but it is based on the observation that quartz veins exhibit a step-like or zigzag course in traversing beds of diverse texture and in crossing the cleavage, joints, or other structural inequalities of a homogeneous rock. Thus, at Bendigo, I noticed that the "spurs" or cross-veins, which are mined profitably on a large scale, have a marked characteristic: they cross the sandstone almost



No. 1—The Borden Vein in the West-Lake Mine at Mount Uniacke.

A paper to be discussed at a meeting of the Institution of Mining and Metallurgy, to be held in the Rooms of the Geological Society, Burlington House Piccadilly, W., on Thursday, April 18th, 1912, at 8 O'Clock p.m., and presented at a meeting of the Canadian Mining Institute, at Toronto, on March 6th, 1912.

*I refer to the excellent maps prepared by E. R. Faribault for the Geological Survey of Canada.

†Such as the Comstock.

‡Trans. Amer. Inst. Min. Eng., Vol. xxx., page 32.

§The Journal of Geology, vol. xviii., No. 6. "An Experimental Investigation into the action of differential pressure on certain minerals and rocks,"

By Frank D. Adams.

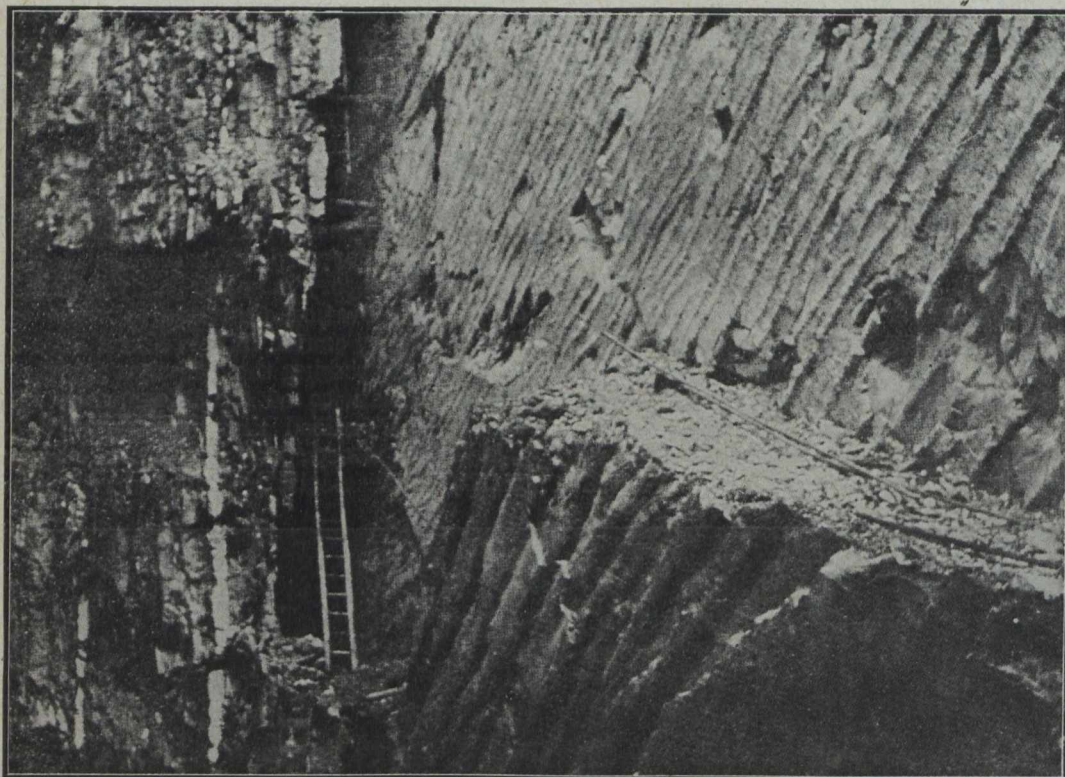
at right angles to the bedding, but they tend to follow the cleavage of the slate. Fig. K reproduces Fig. 31 of my Bendigo paper. On turning to the description, written in 1892, I find that I referred to this characteristic in the following words: "A quartz seam upon leaving a bed of sandstone and entering one of slate, invariably turns its dip in sympathy with the cleavage of the slate." To put it in another way: a fracture crossing a series of slate and sandstone (or quartzite) beds will cut right across the sandstone because it is of fairly uniform texture, so that it is as easily broken one way as another. The same fracture, when encountering a fissile rock, like slate, will find the path of least resistance along the cleavage rather than across it. Hence the fracture, in crossing an alternation of such rocks, will take a step-like or zigzag course. See Fig. L).

If, now, the beds be thin we find this structure emphasized.

If, next, we suppose the alternation to be repeated with greater frequency—if, in other words, we take a

66, illustrating this structure. Fig. O reproduces the Fig. 65 just mentioned; it is particularly interesting because it shows that the deposition of quartz has followed, not only the lines sympathetic to the bedding, but also a nearly vertical fracture along the anticlinal cleavage. We must remember that the shape of the quartz is determined by the nature of the receptacle that it occupies; even if we suppose it to have found space by replacement of portions of the country-rock, we have to ascertain the nature and shape of the fractures along which it found a way when in solution. Veins of quartz vary in dimension and direction in accordance with the diverse texture and hardness of the rocks traversed by fractures precedent to ore deposition.

These fractures are various. The lines of weakness along the bedding-planes, especially such as separate a relatively soft from a relatively hard rock, a slate from a quartzite, for example, furnish obvious facility for rupture. Along these is deposited the quartz of the ordinary saddle-vein. Other things being equal,



No. 2.—Crenulated foot wall in open cut at Mount Uniacke.

shaley sandstone marked by well-developed cleavage—we obtain conditions favourable to a crinkly line of fracture. (See Fig. N.)

This affords a clue, which appears to be confirmed by the significant fact that the crenulation, as seen in the Nova Scotian mines, has a pitch conforming to the line of intersection between the bedding and the cleavage. It appears to be dependent on a relation to the cleavage.

Crenulation is not unknown at Bendigo, although there it is not a dominant characteristic. On turning to my first paper on the Bendigo goldfield (Trans. A.I.M.E., vol. xx.) I find two sketches, Figs. 65 and

the crest of an anticline furnishes an opening or a tendency to open; the syncline does this also, but, while the principle of the arch tends to keep the anticlinal fracture open, the dead weight of a trough-like depression or syncline tends to close it. Between the two bends, on the flanks of the anticline—which are also the reversed flanks of the syncline—the strata are compressed, the bedding-planes are tight, and the least possible facility is afforded for the circulation of underground waters. Connection between the crests of the anticlines is obtained by fractures that follow the anticlinal axis, as in Nova Scotia, or by dikes that have been injected in the wake of regional dislocation, as at Bendigo.



No. 3—The Richardson Vein with cross-stringers.

In a region marked by folding the greatest intensity of fracturing is exhibited at the place of maximum plication. At Bendigo this is found at the apex of an anticline. In Nova Scotia it is found where the folds intersect, that is, where an anticline plunges in obedience to a transverse syncline: at the nose of a dome. It is there that the crenulation is most marked. Folding is accompanied by cleavage in fissile rocks and by jointing in those of granular texture. The main antichinal axes are characterized by a dominant cleavage, usually at a high and persistent angle. At the approach to the apex of the fold, and more especially at the place where the rock is twisted by cross-folds, the regional cleavage is dominated by a local radial fissility, exemplified in several of the annexed photographs. It is there that the crenulation is most marked and most continuous.

At the place of maximum flexure, where the cleavage dominates the bedding, any fracture due to regional movement will find a devious way. In part it follows the bedding, or, at least, it confines its divagation to one soft bed—of slate; in part, it responds to the invitation of the cleavage-lines. In default of such assistance it traverses both bedding and cleavage, but not for long. A vein-fracture in one mine plays many parts. That was the lesson at Bendigo; that is the teaching of Nova Scotia.

When the solutions containing both quartz and gold began to course along the fractures thus prepared, they were deposited wherever conditions were favourable, and after deposition they tended to reproduce the character of their abiding place. Thus I argue that they were precipitated along the bedding-planes, to form the simply tabular deposits that delight the writers of textbooks; they likewise were laid down along the arches that gave us the symmetrical saddle-lode; they rested in cross-fractures that became the "spurs" of Bendigo and the "angulars" of Nova Scotia; and, finally, they found a way into the intricate and rhythmically-crikkled passages prepared for them, where cleavage and bedding disputed for structural mastery.

As far as I know, only one writer has made a detailed study of the crenulation. I refer to Mr. J. Edmund Woodman, formerly Professor of Geology in

*A pelite is a rock composed of fine mud.

the Dalhousie University, at Halifax. His paper on the Moose River district, to which reference has previously been made, is a good example of careful investigation. The accompanying drawings are excellent. They afford evidence that the crenulation is usually confined to one side of a fold, that it is found on cross-veins as well as on the stratified veins, that the laminae of the enclosing slate tend to curve with the quartz, that the crenulation is most common in slate beds bounded on both sides by quartzite, that the sympathetic curves in the rock rarely reach more than 2 feet from the crenulated vein, and that the furrows are larger where not parallel to the bedding. He recognizes strain-slip cleavage, and says that "if it caused the corrugations, we should find some sign of it also in the sediments, either cleavage or acute small-scale folding; but do not." He adds that "there is not the slightest deviation in the dip of the laminae in proximity to the veins," but I cannot reconcile this with the statement that "the lamination of the slates follows the crenulations of the lead, exactly when near it, less faithfully when farther away. If the "deviation" of the laminae is not from the normal dip, from what line is the deviation? Dismissing strain-slip cleavage, Mr. Woodman says: "The only explanation remaining, therefore, is that the cross-veins lie in fissures which had their present sinuous course at the beginning of occupancy by the vein material. It is noticeable that this crenulation is not found in quartzite unmixed with slate; but is confined to slate and alternations of the two. It is best developed where no quartzite is present. It appears, then, that in the thinly laminated pelites,* at the time of intrusion of the cross-veins, the rock broke under the strain most easily across the strata squarely or diagonally in places, with the bedding in others, and in some backward or downward rather than upward. Thus I infer that Mr. Woodman and I reach the same conclusion by diverse ways. I had not read the foregoing paragraph until after arriving at my own conclusion. And I reached it by two suggestions: first, the coincidence between the pitch of the crenulation and the line of intersection between the planes of cleavage and bedding, as noted by me in 1905, and, secondly, the analogy of the cross-veins as sketched by me at Bendigo in 1890, showing the zigzag structure when the quartz-filled fracture crosses alternate beds of slate and sandstone. On turning to Mr. Woodman's paper I noted his sketches of cross-veins accompanied by crenulation, but it was not until writing the foregoing paragraphs that I ascertained how closely his conclusion tallied with my own. We express it differently, but the fundamental idea is nearly identical. He wrote in 1903.

Thus the crenulation may finally be regarded as the beautiful product of complex fracture due to cross-folds in rocks of uneven texture. The fissility induced by extreme plication has afforded a sinuous line of passage to rupture and to the quartz that subsequently healed the rupture. As originally formed the veins were crooked, that is, they zigzagged in a sharply angular line. In the course of mineral impregnation they became rounded. Nature hates an angle as she abhors a vacuum. Time softens hard lines is a poetic way of saying that chemical corrosion is most rapid where the largest surface is exposed to solvent action. The angles of the zigzag vein-fracture were filled with quartz, which, in the course of accretion from further passing solutions, replaced the crushed slate adjacent

to it and slowly gained a rounded outline. On the 700-foot level in the Gagnon mine, at Butte, I have seen boulders 5 or 6 feet in diameter, formed by the solvent action of water that has seeped along joint-planes in the granite. These were similar in origin to the boulders formed by erosion at surface, and were due to the sculpturing hand of chemical waters. Once rounded, the hard quartz bent the neighbouring soft slate to its unyielding shape. Neither movement nor solution cease underground at a given moment. Since the veins were formed, the continual shifting of loads of sediment, by transfer from mountain to river, from

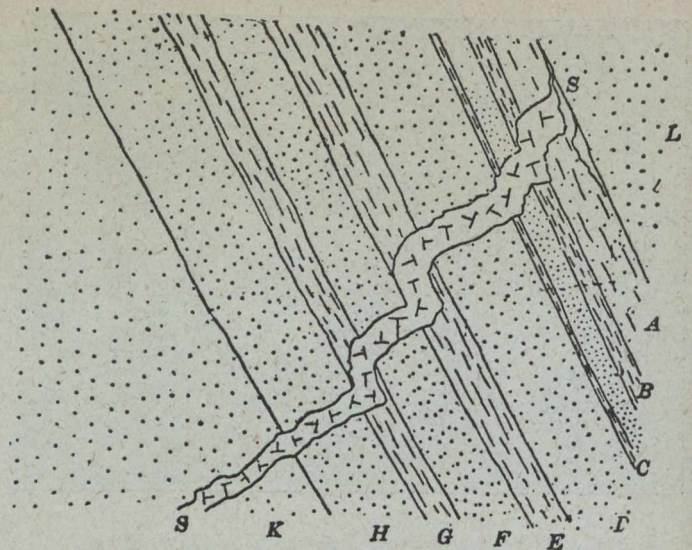
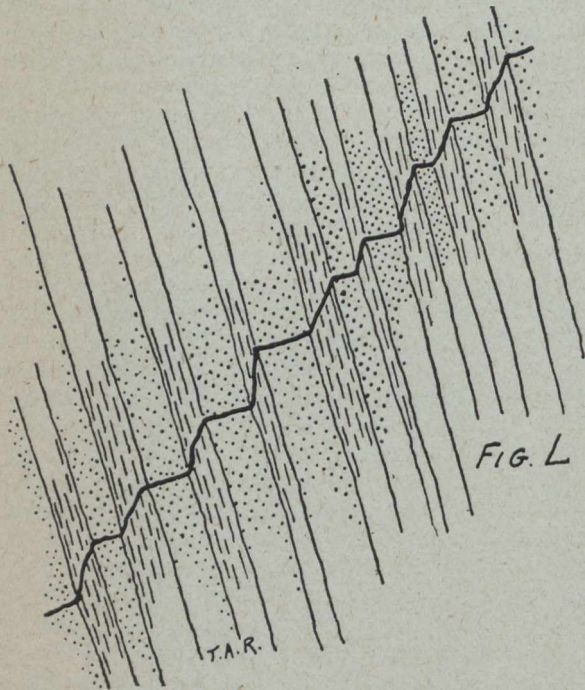


FIG. K.

punctuates the geologic record; ours is a brief phase synchronizing with a minute portion of the vast stretch of time during which the vein of ore has undergone successive change. Had we left it in the ground it would have undergone, in later eons, a further alteration. When we remove it with the pick and hammer we break the normal sequence of its development; we are for a brief moment the masters of forces that have operated since the dawn of creation.

land to sea, has caused the disturbance of equilibrium that incites geologic unrest. This has been the cause of new fractures along which later solutions have found a patient way. Photograph No. 3 shows clearly the occurrence of quartz veins differing in character and origin. We who see a vein in a mine to-day are apt to regard it as a finished product, brought to our attention at the close of a completed cycle of chemical and physical operations. We regard ourselves as full-stops in time. On the contrary, the whole of the period during which man has tenanted the earth barely

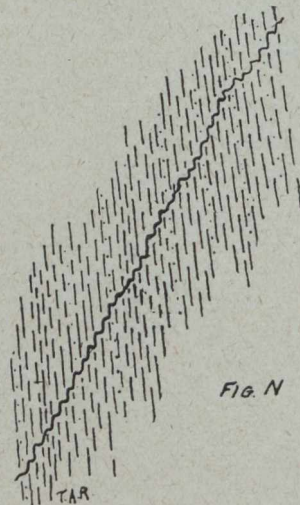


FIG. N

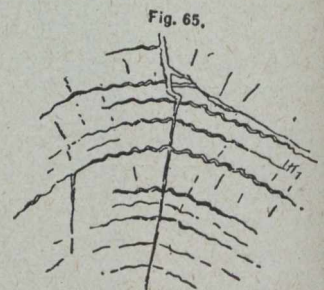


FIG. O.

THE INFLUENCE OF SMELTING, ELECTRICITY, AND THE CYANIDE PROCESS ON MEXICAN SILVER MINING

From the Bulletin of the Mexican Institute of Mining and Metallurgy.

By Victor M. Braschi, E.M., C.E.

Twenty years ago the bulk of Mexican silver ores was treated by the Patio process, but attempts were made often to introduce the American pan system with very little success owing to any of the three following causes:

- No. 1. Non-adaptability of the ore;
- No. 2. Irregular supply of ore, and

No. 3. Lack of knowledge of mechanics and of pan mill practice.

In mining the methods were still of the primitive type, the only machine which had been accepted generally being the steam hoist. Pumping was done preferably by hoists, the old horse malacate and ox hide bag in the lead, the ox hide bucket making it flexible

and easily filled vessel. Steam pumps were a nuisance, expensive to install and to run, and the lack of mechanical knowledge and the heat developed under ground made them a troublesome and very unsatisfactory contrivance. The only successful steam pump in use at that time was the good old Cornish pump which was the favourite in Pachuca in the hands of Cornish miners, but practically the methods described by our worthy President in his Centennial address were in full blast. Expensive fuel and consequently expensive power being one of the greatest drawbacks to development.

At about the same time the American Secretary of the Treasury ruled that lead ores should pay a duty when imported into the United States, and at once this gentleman laid the foundation of the smelting industry in Mexico, as you all know.

Roughly and generally speaking we may say that in the well established mining camps of those times, like Pachuca, Guanajuato, Zacatecas, etc., the expense for mining and treating a ton of ore was about \$15.00 each, so that ores assaying less than one kilogram of silver could not be treated, especially as the major portion of the gold was lost. Let us remember, also, that the general average of time required for a torta was thirty days, so we can see, therefore, that the mining interests of Mexico were well prepared for the inducements which the smelter made to them.

The smelter not only paid for the ore on delivery, but it even advanced money to the mines, and it also paid for the gold contents, until then mostly wasted, and the matter of a high charge for freight and treatment was easily lost sight of by the miner on account of his being put in funds promptly and of being paid for a larger average extraction than the Patio process yielded. It is also a matter of history that the smelters prepared their ground very carefully by getting the railroads to make long time contracts for ore haulage at low freight rates at practically cost to the railroad, with the argument that the tonnage would benefit the railroad indirectly by the long haul and by the general industrial growth of the country, but the miner did not receive the benefit of the low freight rate, either.

Gradually the Patio process began to go out of existence and no more attempts were made to develop any other different metallurgical process since all ores gravitated to the smelter, until the mining industry awoke to the fact that the profit was all going to the smelter and a period of stagnation in mining set in. The Mexican owners of mining properties sold them readily to the smelters and to foreign corporations and the old spirit of the native Mexican miner began to die out. The Mexican capitalist also devoted his wealth to speculation in banking and industrial shares, real estate, etc., so that mining began to be looked upon askance.

The railroads also complained of the non-profitable haul on ores and endeavored to have the freight rates changed in their favour.

But the smelter waxed so fat that it formed the natural monopoly under such circumstances, accumulating large reserves of cash, paying large dividends and buying and leasing and controlling large mining properties.

The smelter began by helping the Mexican mining industry, but it was ending by throttling its very life. There was no incentive to the prospector nor to the independent outside investor. The whole commercial

activity of the various mining districts was dying out and the Mexican mining industry was giving evident signs of becoming soon simply a series of large mines controlled by the smelting interests and a few independent large companies. And things went even further, since the Government of Mexico and her most influential surrounding business groups began to lean to the idea that the mining industry partook too much of a gambling proposition which tended to demoralize the good substantial business principles of the country and that it would be a very proper thing if the commercial energies of the nation and its wealth should be turned into other channels, so that the Mexican silver industry was indeed facing many dangers.

At this writing the whole country is well satisfied with the results achieved by the law of monetary reform which has given the country a stable currency and at the same time kept for the country's exports the great benefit of a high rate of exchange, which also was made stable. Results have confirmed the wisdom of this monetary law, but mining men considered then and consider now that the law did not go far enough as the taxation upon silver mining was kept still at a high figure, collected upon the gross output, an inheritance of the times of the "King's fifth."

It was most fortunate for Mexico and her chief industry, silver mining, that just as the new monetary law went into effect the price of silver went up and the Mexican silver dollar could be exported at a profit, which lucky circumstance happened at the very time that the silver miner had the opportunity to convert his wasteful and expensive antiquated methods into modern, efficient and economical processes.

The historic old mining camp of Guanajuato deserves the credit of having been the cradle of the new epoch. It is true that the cyanide process as applied to silver was first tried in the State of Sonora, but it was Guanajuato that made it generally known upon a large and suitable scale. It was Guanajuato, also, practically a dead and abandoned mining camp, which because it had produced so largely and contained such well-formed mineral veins with mines containing considerable amounts of low grade ore and valuable dumps, induced a group of American capitalists to develop electrically a water power in the State of Michoacan and graphically blazed a way to point out to the silver miner what he could accomplish with cheap power and a cheap metallurgical method. It is true that this was not the first electric transmission hydraulic plant installed in Mexico, as I believe that honour belongs to the Regla Company, but it was the epoch maker.

Cheap electrical power at once gave the miner the convenient electric hoist and electric pump, not to speak of course of the cheap power for his cyanide mill.

It is unnecessary to go into descriptions at the present time of the improvements made in electrically driven machinery, but I will say that Mexico has been the field where many of the successful machines of to-day were either developed to the fullest extent in their application or even were first tried. We are all familiar with the rapid development of the Pachuca tank; it was in Mexico where the Johnston concentrator made its first success, and it was in Mexico where the very first Aldrich electric pump manufactured was set up. Some of us remember the days of the old steam pump when no pump was satisfactory and if somebody had bought one make he wished he had bought another one,

so that the miner was easily inclined to give up the expensive and annoying steam pumping plant and have recourse again to the expensive but satisfactory and reliable hoist with its positively up and down moving bucket. The sinking of shafts in those days was a laborious and unsatisfactory job, so the miner was constantly tempted to forget the good basic principle of keeping the bottom of the shaft always below his stopes, and he went back readily to the plan of his forefathers of keeping the bottom of the shaft over his stoping head.

During the period of transition the smelter still enjoyed the troubles of the miner because the abundance of silver ore in this country is so phenomenal that if the ore did not come from one camp it was bound to come from another.

I well remember the time when every mining camp was a bee-hive of freight and commercial activity because the ore was mined and treated at each mine or at each mining camp and pay rolls of mines and mills kept commerce alive locally. But gradually the high roads ceased to see the string of freighters. Slowly the Patio mills began to shut up their gigantic doors. The arrastras stopped grinding, the mules were sold to the farmer or to the street car company, houses were abandoned, doors closed, and mining camps began to look like deserted cities, but the smelter kept on gathering the piles of ore and sending the profits all abroad.

With the cyanide process mines can not only treat the newly developed low grade ore profitably, but they can go back to the old rotting stopes and to the fills and dumps and make them yield a silver stream with a golden lining. Each mine capable of producing regularly from 50 tons of ore a day up can at once begin to treat its own ores. Every mining camp has begun

filling up and the good old buildings of the Patio mills are opening up their hospitable doors to the new machinery, the names of which I will not mention so as to avoid any feelings of jealousy. Every mining camp is again becoming a centre of commercial, metallurgical and mining life and the silver industry is coming back into its very own now that the twenty year period of the smelter tyranny has come to an end.

But more than that—the Mexican miner, always full of hope, always having a keen eye for a prospect, and the Mexican capitalist have both jumped back into the ring with both feet and we hear nothing more of the “character aleatorio” of mining, but on the contrary banks and bankers are doing their share to promote the modern business of Mexican silver mining.

A great deal has to be done yet—besides a revision of the system of taxation on silver we need here in this country a modern, up-to-date mining school and the training given to young mining engineers will be of vast use to Mexico in developing some of her other industrial needs. Copper and iron ore are being mined by steam shovels; cement rock and phosphate rock belong to the crust of the earth just as much as does silver quartz. The young engineer might just as well work in a cement mill as in a copper smelter; as well in a fertilizer plant as in a quartz mill. Modern Technical education will fit the young man as well for one as for the other. Mining in a sense is manufacturing—productive mining certainly is. Many people think that mining is simply the preliminary part or unprofitable part whilst you are looking for something until you find it, but it is not mining alone that requires the investment of capital in the stages of investigation and research. Mining has always been one of the great businesses of the world and always will be.

COAL LANDS IN NORTHERN CARIBOO, B.C.

Mr. C. F. J. Galloway, mining engineer, of Vancouver, B.C., has made the following preliminary report on coal lands in Northern Cariboo, B.C., to Mr. A. E. Hepburn, also of Vancouver:

“Your coal area on Bear River is situated about 50 miles above the mouth of the river, being about 45 miles due east from Fort George. A good trail exists from Fort George eastwards to Willow River, a distance of 26 miles; from there a trail about 22 miles long would reach the property.

“The best way to reach it with a trail or road, however, would be from a point on the upper Fraser River, above the canyon, which is only 15 or 16 miles distant, the pass separating the two valleys being low. As the Grand Trunk Pacific Railway will have steel laid to Tete Jaune Cache, and small steamers running on the upper Fraser River, next spring, it will be easy to get supplies and materials in this way.

“The area consists of 15 full sections covered by coal prospecting licenses; of these, three may profitably be dropped. The exposures of coal measures are few, and are confined to the banks of the river, following more or less the line of strike, so that the extension of the measures to the dip can only be assumed from the configuration of the ground, the limits being fixed by exposures of igneous rock. There is every reason to be-

lieve that the coal measures underlie the whole of the flat area between the hills of igneous and other rock, but allowing a large margin for disturbed and unproductive areas, a very conservative preliminary estimate of the area underlain by coal measures would be 4,000 acres. The recent survey of the area has shown that some of the sections extend on to the hills of igneous rock. My estimate of the productive area is, therefore, considerably less than that given on previous occasions, being, moreover, intended as a rough estimate of the minimum probable productive area included in 12 sections only.

“Three workable seams of excellent bituminous coal have so far been proved, with an aggregate thickness of rather more than 21 feet, plus an unknown amount up to 4 feet, for the top of the upper seam, which was not visible above drainage level at the time of our visit. Numerous smaller seams are visible, and some of these will very likely prove workable under portions of the area. It is also quite likely that other seams occur, which are not seen at all in the few exposures.

“Taking a thickness of 21 feet over an area of 4,000 acres, at the rate of 1,200 tons per foot per acre, which allows amply for all losses in working, faulty ground, etc., there would be 100,800,000 tons of coal included. This figure is not given so much as an actual estimate of the quantity available, as to show that even taking

the minimum probable conditions as to area of measures and thickness of coal, the property is of enormous value.

"Where the coal is seen, the measures are standing at an angle varying from 20 to 45 degrees, but the indications point to a flattening toward the dip, so that the coal may be expected to underlie the greater part of the area at a comparatively small depth.

"The depth and extent of the coal should be proved by diamond drill holes at several points before any permanent opening is done, but, if it be desired to work a small output without further delay, a temporary shaft could be sunk on the northeast side (right bank), of the river, opposite to, and not very far from, the coal exposure which has been opened. If this be not done, I should recommend the driving of a cross-cut on the same side of the river as the present tunnel, but at a slightly higher elevation, to prove the ground below the three known workable seams.

"As we had to abandon our boats coming out, it was unfortunately necessary for me to leave all my samples behind, to be brought out later, but the analyses you already have prove the excellent quality of the coal. One of these analyses, by Mr. J. O'Sullivan, of Vancouver, B.C., of a sample of the thickest of the three seams referred to, is as follows:

	Per Cent.
Hygroscopic water	3.5
Volatile combustible matter	41.5

	Per Cent -
Fixed carbon	50.0
Ash	4.0
Sulphur	1.0
Coke, 54.5 per cent.	

Character of coke, hard and firm.

Heating power in British thermal units, 12,517.2.

Pounds of water evaporated by one pound of coal, 12.95.

"The seams are to some extent interbedded with bands of shale, but this will easily be removed by a modern washery.

"As this is the only coal, other than lignite, yet known in central British Columbia, it will find a ready market in the Grand Trunk Pacific, and other railways which will soon be built through that country, which is now attracting so much attention. Timber is scarce in many places, and the coal will have a considerable market for household and industrial purposes in Fort length, over the pass already referred to, will connect George and other places.

"A short railway or tramway, 15 or 16 miles in the coal area with the Grand Trunk Pacific Railway, or, one of 8 or 10 miles across an equally easy pass to the west, would connect it with the Willow River & Barkerville Railway, which, it is expected, will be constructed shortly, so that once railway communication is in the country, the question of shipping facilities will be very easily solved."

MINING IN BRITISH COLUMBIA IN 1911

In the course of an address to the Legislative Assembly of British Columbia, the Premier of the province, Hon. Richard McBride, who is also Minister of Mines, said:

"Perhaps as Minister of Mines, I should say something at this juncture with regard to the progress made by the mining industry of this province during the year just past. Mining generally held its own in 1911. The older properties made about the output expected of them, and a few new properties advanced to such a position as to ensure a substantial production in the future, such as the Britannia mine on Howe Sound, and the Granby Company's Hidden Creek mine on Observatory Inlet, while in the Slocan several properties have developed ore of such quality and in such quantity as to give hope that the palmy days of that district are by no means past—even the hills there have a silver lining.

"Statistics of the year's production are not yet complete, but an estimate by the Provincial Mineralogist leads us to expect a production of about \$5,187,000 in gold, \$946,000 in silver, \$1,161,000 in lead, \$4,432,000 in copper, and \$127,000 in zinc, or a total production of metalliferous minerals amounting to \$11,853,000; of coal an estimated production of \$8,523,000; of coke, \$465,000, and of miscellaneous minerals (building materials, etc.), \$2,000,000, giving a total valuation of the output for 1911 of \$22,841,000, which total is approximately \$3,500,000 less than was that of 1910.

"Each of the minerals mentioned, except miscellaneous minerals, shows a considerable decrease as compared with last year, which does not appear consistent with my previous remarks relative to the general ad-

vancement made by the province, and would not be were the position not capable of being explained. The chief reason for these decreases is to be found in the fact that labour troubles caused the shutting down of the Crow's Nest coal mines and coke-making plants for a period of about eight months out of the year. This entailed directly a loss in output of coal and coke of more than \$2,120,000, and indirectly (through cutting off the coke supply, thereby causing suspension of work at the Granby Company's mines and smeltery in the Boundary district), of a considerable proportion of the losses shown in gold and copper and part of the decrease in silver. A remaining portion of the decrease in silver, and as well that in zinc, is attributable to the destruction by forest fire in the summer of 1910, of part of the Kaslo & Slocan Railway, thereby cutting off transportation facilities, and the burning of mine and mill buildings and plant.

"With regard to the regrettable labour difficulties, I have referred to, I sincerely hope that we shall ere long find some machinery which will operate successfully and without injustice to any, by which such deplorable industrial disturbances may be avoided. I do not propose to enter into any discussion of the ethics of strikes. It is perhaps true that the right to strike constitutes the greatest protection which the working man enjoys; but when one goes through a district in which a strike is taking place he cannot but feel the pity of it all. It is, of course, disastrous to the interests directly concerned and to the business of the country, but how much worse for the men who are deprived of their opportunity of earning a livelihood for themselves and those dependent upon them, and how much worse still for their faithful wives and their little chil-

dren. It is too bad that the genius of man has not yet been able to devise some means by which these most deplorable crises may be averted.

Wonderful Deposits of Coal.

“The outlook for the metalliferous mines of British Columbia is encouraging, and if we shall get a year free from labour troubles, the output of the East Kootenay, Slocan, Nelson, Rossland, Boundary, and Similkameen mines should show an increase in gold, silver and lead, while the Coast mines should increase the production of copper.

“At present our coal mines produce about half of our total mineral output in value. And it would seem from the development of the past year as though we had only touched the margin of our wonderful coal deposits. The year’s developments include new and great coal fields in East Kootenay, other new and important deposits in the Similkameen, and last, but probably the greatest, is the determination of what promises to be the greatest anthracite or semi-anthracite field west of Pennsylvania, at the head waters of the Skeena River. This last-mentioned field is as yet but little developed, but if only a fraction of present promise shall be fulfilled, it will be bound to have a wonderfully stimulative effect upon the future of the province. The coal mines of Great Britain gave it its position as the manufacturing centre of the world, and our coal fields unquestionably will serve as a strong magnet to draw the manufacturing interests of the Pacific to our shores. Coal is a breeder of industries and its value to the country does not by any means end with its having been disposed of by the companies engaged in mining it.

“Before I conclude my remarks, it will not be uninteresting to have mentioned to you that the coal mines legislation enacted during the last two years (this including the provision for mine-rescue work in 1910), has been working well. And, before sitting down, I might announce to the House that the office of Chief Inspector of Mines, vacated by Mr. F. H. Shepherd, now representing Nanaimo District in the House of Commons, was filled at the first of this year by the appointment of Mr. Thomas Graham, of Nanaimo, an appointment which I am sure will prove of distinct advantage to the mining industry and to the province.”

As supplementary to the foregoing, our correspondent, Mr. E. J. Jacobs, Victoria, B. C., has supplied the following approximate estimate of the mineral production of British Columbia for the calendar year 1911. In this connection he observes: “The accompanying estimate differs somewhat from other estimates I have recently sent out for publication, but as the latter were necessarily based upon returns in which production in November and December months was estimated, while now the actual production in a number of instances is known, it follows that changes have had to be made accordingly.

Approximate Estimate of Mineral Production.

Gold, placer	\$ 470,000
Gold, lode, 230,000 oz.	4,754,100
.....	...
Total gold	\$ 5,224,100

Silver, 1,900,000 oz.	962,077
Lead, 29,000,000 lbs.	1,153,620
Copper, 35,500,000 lbs.	4,393,480
Zinc, 2,600,000 lbs.	127,270

Total metallic minerals	\$11,860,547
Coal, 2,450,000 long tons	\$8,575,000
Coke, 66,000 tons	396,000

Other materials (stone, brick, lime, cement, etc.)	2,000,000
Total non-metallic minerals ...	\$10,971,000

Total value of mineral production\$22,831,547

As compared with the production of 1910, the foregoing shows a gross decrease in metallic minerals and coal and coke, of \$4,045,519, but as there was an estimated increase in building materials of \$500,000, the net decrease in the production of the year is estimated at \$3,545,519.

JOURNAL OF THE CANADIAN MINING INSTITUTE.

The Journal of the Canadian Mining Institute for 1911, which is Vol. XIV., has been issued. It is a credit to the Institute, and compares favourably with corresponding publications of older and larger mining and metallurgical institutions, in respect of number of general standard of the papers contained, and decidedly so in the comprehensive and most useful index compiled by the secretary, Mr. H. Mortimer-Lamb, who took infinite pains to make this almost indispensable adjunct to an excellent work the more serviceable to its readers.

Of the more noteworthy of the papers included in this volume, several may be mentioned, namely, those of Dr. James Douglas, on “Earthquakes in Mines”; Mr. J. S. Diller, on “The Types and Modes of Occurrence of Asbestos in the United States”; Mr. E. B. Wilson, “Some Notes on Pyrite and Marcussite”; Dr. Heinrich Ries, on “The Clay and Shale Deposits of the Western Provinces of Canada”; Mr. J. D. Irving, on “Some Features of Replacement of Ore-bodies and the Criteria by Means of Which They May be Recognized”; Mr. W. R. Ingalls, on “The Problem of Mixed Sulphide Ores”; and—among those of the Canadian members—Mr. D. B. Dowling, on “The Undeveloped Coal Resources of Canada.”

The reports of the 1911 annual meeting, held in the city of Quebec, and of meetings of branches of the Institute, will doubtless prove of interest to members generally, who will also appreciate an improvement in quality and style of binding, the latter admitting of the book lying quite flat when open. Altogether, Vol. XIV. will be a welcome addition to many libraries.

DUTY OF GRINDING PANS.

The average duty of a 5-foot grinding pan is about 20 tons a day as a stage-grinder, or about 9 tons a day as a slimer, and the power consumption is about 6 horse-power. In the Kalgoorlie field the Wheeler pan is in general use, but not so on other fields. At the Ivanhoe mine elaborate tests were made some years ago as to the relative value of the pans and tubemills, and these tests came out in this particular case in favour of the pans.

VERTICAL VERSUS INCLINE SHAFTS IN PRECIOUS METAL MINING*

By John Malcolm Nicol.

There is still a great diversity of opinion as to the relative merits of inclined and vertical shafts; hence, the excuse for these notes is not so much to give an account of my experience, or to state my own opinion regarding the matter, as to sum up and analyze some of the generally accepted ideas, so as to obtain a generous discussion of the whole subject from other members of the profession, thus enabling us to hear the most recent experience and advanced opinions of engineers in Mexico.

A three or four compartment inclined shaft sunk on the vein was almost universal practice in California for a great number of years, and we may still find some notable examples of four compartment inclined shafts with only two hoisting compartments through which from three to five hundred tons of ore is handled with self dumping skips every 24 hours, from depths of 2,000 to 3,000 feet, on the incline and even over. In South Africa I understand the tendency has been to change from vertical to inclined shafts, and also to the use of combination shafts; while here in Mexico the inclined shaft has been almost exclusively used for exploration purposes and ladderways, the main hoisting and unwatering shafts being nearly all vertical.

This subject may be considered from various points of view: first, as to the primary purpose of the shaft and the relationship of the surface topography to the dip of the vein and other local conditions; secondly, as to the cost of sinking, and subsequent cost of extraction per ton; and, thirdly, as to the intrinsic advantages or disadvantages of either type of shaft, per se, in relation to any of the factors coming under the above heads.

No final rule can be laid down inasmuch as numerous local conditions, such as an excess of water in either wall of the vein as against comparatively dry ground on the other side, the stability of the different walls, and such factors, often finally control the location and type of shaft. I have, therefore, dealt with the subject from a broad standpoint, and rather from a consideration of the merits or demerits of the vertical or inclined shaft "per se."

I find that in Mexico there is a very general prejudice against the inclined shaft, and the idea seems to prevail that it cannot be sunk as rapidly and economically as a vertical shaft, and that ore extraction and other mining operations in the course of the development of a mine cannot be carried on as conveniently and economically through an inclined as through a vertical shaft.

The purpose for which shafts are sunk in precious metal mining may conveniently be considered under four heads.

1. Those sunk to locate a body of ore in an unexplored vein: that is "prospecting shafts."
2. Those sunk for the express purpose of draining a given zone, either virgin or comprising old workings.
3. Those sunk for the economic development and extraction of a known or assumed body of ore.

4. Those sunk exclusively for ventilation, or for providing additional means of egress from the workings for purposes of safety, etc.

It frequently occurs that nearly all the above requirements are covered by one shaft, yet the classification will be found I think, convenient for purposes of reference.

Dealing with the first division, "exploration shafts," and assuming that the topography and the dip of the vein are such that either an inclined or a vertical shaft could be sunk, I believe it is generally considered that the inclined shaft is preferable, especially for exploring an undeveloped zone in a district that has not been proved at depth by other mines in the neighbourhood.

The advantages generally claimed by sinking on the vein with an incline are the following:

(1) That the vein can be followed however much it changes, and no long cross-cuts are needed to reach the ore for extraction purposes.

(2) That, when the first exploration shaft that is sunk on an out-cropping rich ore shoot is inclined and follows the ore, the ore extracted will often pay expenses; hence, the maximum of exploration is accomplished with the minimum of expenditure.

(3) That, owing to the fact that quartz forming a vein is often softer and more uniform than the wall rock, sinking operations can be accomplished more rapidly and economically by an inclined shaft on the vein than by either a vertical or inclined shaft in the country rock.

While it is true that the last advantage claimed may often exist near the surface in dry ground, the advantages are generally more than offset by other disadvantages.

The disadvantages of sinking on the vein may be enumerated as follows.

(1) Nearly all veins carry more water than the walls, hence, if sinking is carried on in the vein in a wet zone, all the water of the region has to be drained while actually sinking, and this with pumps of the sinking type. It is well known that a large volume of water is always more difficult to handle with sinking pumps than with station pumps.

(2) There is yet to be found on the market an ideal sinking pump which will successfully handle gritty water without ceaseless delay from the cutting of packing and plungers. In nearly every case this difficulty is found to be greater with the sharp quartz grit from the vein matter than with the wall rock, but is often nearly negligible when sinking in a slate wall or moderately soft porphyry formation. This difficulty is always accentuated when an exceptional volume of water demands quick handling of the pump and the minimum of delay for packing and from breakdowns.

(3) If the vein varies considerably in dip, there will be great difficulty in maintaining favourable track and hoisting conditions when sinking on the vein, and the shaft is liable to be useless for the economic extraction of the ore.

*Reprinted from Bulletin of Mexican Institute of Mining and Metallurgy.

(4) If a large amount of valuable ore exists on either side of the shaft when sinking on the vein, and for commercial reasons it is desired to extract this ore at the earliest possible moment, it will be found difficult to do so without resorting to expensive timbering or else large pillars of ore will have to be left until the rest of the mine is practically worked out, otherwise the shaft will be imperilled by caves from the hanging wall.

The advantages claimed in favour of the vertical shaft are as follows:

(1) It reaches the maximum depth in the minimum time.

(2) It can be driven more rapidly, and timbered with greater ease than the inclined shaft.

(3) The difficulties with the pumping question are never as severe as in the case of the inclined shaft, owing to greater facility in suspending the pump and in the formation of the pump.

(4) It is also generally conceded that the extraction of the ore can be carried on more economically through a vertical shaft than through an inclined one.

Personally I do not think that these claims in favour of the vertical as against the inclined shaft can readily be substantiated. The choice should be controlled by other factors.

Up to a few years ago, when we were dependent upon steam or Cornish pumps for underground work, the inclined shaft also presented serious disadvantages on this score, but with the introduction of electric station pumps and air or electric sinking pumps this is no longer an obstacle. Great facilities are offered by the use of electricity underground, and with the establishment of air compressor stations close to the point of operations, provided the proper equipment is furnished and an intelligent system of work is organized, it should be possible to carry on work just as quickly and efficiently in an inclined shaft as in a vertical shaft.

It is claimed by some engineers in Mexico that ore is most successfully extracted from the mine by wheeling the cars directly on to cages and hoisting these to the surface, hence, there is a further prejudice against the inclined shaft owing to the difficulty of constructing satisfactory incline cages on which cars can be easily handled. Now as a matter of fact, in the majority of camps outside of Mexico experience has shown that greater economy is obtained with the use of self dumping skips, which can be handled just as easily and economically in an inclined as in a vertical shaft.

The factors above enumerated have all to be taken into consideration before final choice is made between an inclined or vertical shaft for the first exploration work. It is certainly as well to combine the advantage of following a vein closely by means of an inclined shaft with the facilities for the economic extraction of waste rock and any ore that may be encountered during exploration work, if this latter can be done as efficiently through an inclined as through a vertical shaft. I believe this is possible, and would, therefore, emphatically recommend an inclined shaft driven at a constant angle in the foot wall and closely following the vein for all exploration work. In this case only short cross cuts will be required to tap the vein at frequent intervals. Less water will probably be encountered in the foot-wall than in the hanging wall side of the vein, and certainly a great deal less water than in the body of the vein itself. Sinking operations, therefore can be

carried on with a minimum of difficulty with regard to water, which greatly facilitates the rapid advancement of the shaft.

Pumping stations, and ore bins can be easily located between the vein and the inclined shaft, and, if rich ore, which it is desired to remove at once, is encountered in the vein, stoping operations can be carried on almost from the first start without endangering the safety of the shaft, or preclude the final extraction of ore from the deeper levels.

We have now to consider the second division.

Shafts sunk exclusively for drainage purposes.—These are rare in the case of a virgin vein, and are more often driven to unwater old workings that are known to exist full of water, and are directly in accessible to exist full of water, and are directly inaccessible owing to caved, and bad ground that makes it impracticable to make use of the old shafts.

If the vein has a very flat dip it would seem probable at first sight that the best procedure would be a vertical shaft sunk in the hanging wall of the vein, and located so as to cut the vein just below the deepest known workings. But let us suppose a case of comparatively flat surface topography and where an old mine has been taken under option, and it is desired to reach the upper part of the old workings just below water level at the earliest possible date. In this case a vertical shaft would not be best, owing to the fact that very long cross-cuts would have to be driven before the upper workings could be reached.

If we waited until the full depth of the shaft had been sunk and a pumping station installed having a capacity sufficient to control the unwatering of the whole mine, valuable time would be lost before any real progress could be made in lowering the water level to make the upper workings accessible.

Furthermore in case of caved ore bodies in large veins, the hanging wall is liable to be badly fractured and to cause considerable trouble with the alignment and timbering of any shaft sunk near the zone. The seepage water in the hanging wall is liable to be excessive and cause trouble with sinking pumps prior to the establishment of the larger and permanent station pumps.

Another objection to the vertical shaft in cases similar to the above, is that if the ore bodies are found to be workable at levels below the point at which the vertical shaft cuts the vein, it would have to be extended into the foot wall which is typical of standard examples shown in the text books. When the upper levels of the mine are ultimately stoped out, the resulting partial settlement of the hanging wall often develops a bad fracture zone near the point where the vertical shaft intersects the vein, which in some cases has been the cause of endless trouble and expense. As already explained surface topography in relation to the dip of the vein must be a very strong controlling factor in the choice between vertical and an incline shaft. For instance, if a vein dips sharply into a steep hill, an inclined shaft in the foot wall is clearly indicated; whereas if a vein dips with the surface of a hill, a vertical shaft located in the valley below may offer features of accessibility, speed and economy that more than offset any other disadvantages as enumerated above.

Although somewhat out of place in these notes, I think it would be apropos in view of the difficulty often encountered in unwatering ground, to draw attention

to a new system of unwatering which has been recently attempted, and which really consists of a small vertical shaft excavated by means of core drills of large diameter. Where local conditions are favourable to this class of work, it would no doubt compare favourably in speed and economy with shaft, certainly up to moderate depths: particularly in the case of veins dipping with the slope of the hill where an inclined shaft would have great length as against a vertical tube-well of this nature sunk on the lowest part of the ground.

The McKiernan-Terry Drill Company, of New York, have recently put on the market core drills capable of sinking wells of this class of from 18 inches up to 40 inches in diameter, to a depth of 400 to 500 feet; and the Bryon Jackson Iron Works of San Francisco, California, have for several years successfully built a special type of centrifugal pump which can be lowered to a depth of 250 or 300 feet in a tube-well over 20 inches in diameter, and can be driven by a motor at the surface, and which has a very large capacity, up to 2,000 or 3,000 gallons per minute.

This system of unwatering by means of tube wells has been tried in Northern Mexico, using air lifts for extracting the water. I am inclined to think that there is a considerable field in the future for this system, as its great advantage consists in the fact that the well can be drilled without unwatering; the pumps being lowered after the required depth has been reached. Its greatest drawback, however, is the limited depth at which pumps suitable for these wells can operate; although I have no doubt that before long means will be found to design pumps which will overcome this difficulty. Core drills are capable of sinking shafts up to 1,000 feet while the maximum head for large capacity pumps suitable for these wells is between 200 feet and 300 feet, I believe that as much as 3,000 G. P. M. have been raised through a tube well of this type, 20 inches diameter and 200 feet deep.

We now come to the economic extraction of ores from a mine (sec. 3) and the advantages or disadvantages of vertical versus incline shafts.

If the ore is to be extracted by means of cars run on to a cage, there is no question but that the vertical shaft is the best and most convenient; but as I have already indicated, modern practice seems to be towards the elimination of the cage in Mexico and the adoption of large size self dumping skips, which are charged from the loading station of underground bins. One of the great advantages of the use of skips as against cages is that they can easily be arranged to handle both ore and water, provided they are of the self-dumping type; and for small mines, not having a great output of ore, and where the water can be controlled by occasional baling with skips, this factor is one demanding consideration.

Shafts which are sunk expressly for the extraction of ore must, of course, be located principally with relation to the main ore shoots and the lateral extent of the vein on either side of the shaft. The mouth of the shaft must also be located with regard to the proposed location of the metallurgical plant. In the case of nearly vertical veins, the vertical shaft is undoubtedly best, and the only other consideration is its location in relation to the above factors. We also have to consider those special cases where there are a number of veins, and the ore from all the various underground workings of these veins had to be delivered at a given point. If the veins are more or less parallel on strike

as well as dip and no great distance apart, a vertical shaft is probably the best. I have, however, seen some special cases, one of which has recently been brought to my attention. Here two principal veins dip in opposite directions, their croppings forming very nearly the apex of a great triangle, whose base at a considerable depth would be so long as to prohibit all thoughts of cross cutting from a central vertical shaft; and besides the two main veins, there are other veins parallel on their strike dipping towards the main veins on the hanging wall side which also, have to be worked. In this case I would consider the vertical shaft as out of the question, and think that the most simple and economical way of solving the problem would be to drive two incline shafts in the foot wall of either vein, the collars of either shafts being side by side. By this means ores from widely divergent points of depth can easily be delivered to the same starting point for metallurgical treatment. We also have to consider the case where one vein is owned by two companies; the first one of which controls the cropping of the vein and can conveniently sink inclined shafts if required, but where the second company would have to sink a vertical shaft to great depth before reaching the vein, which is known to dip at a comparatively flat angle.

This has been a common case in South Africa, and under these conditions the vertical shaft has in nearly every instance been dropped down to a point where the vein was reached. This has been subsequently followed with an incline shaft in the foot wall of the vein, driven at a constant angle and although some difficulty has been experienced with the heavy wear and strain of the cables at the point where the vertical shaft changes to the incline shaft, this has been largely overcome.

Where, however, the combination shaft can be avoided, it is unquestionably better to put in either an inclined shaft on the same constant grade, or a deep vertical shaft; but where the veins change abruptly in dip, or where the dip reverses at great depth this is almost impossible to accomplish. With the great facilities for underground hoisting stations which now exist, as a result of the perfect electrical equipment which can be installed in mines, the most satisfactory arrangement would seem to be to install a separate discharge and loading point underground, which, if properly planned and handled, should cause but little loss of time or expense per ton of ore handled.

Finally we have to consider those cases where shafts are sunk exclusively for ventilation purposes, or for providing an additional outlet to the mine.

Large diameter core drills are now being used in the States for sinking holes in the hanging wall of the vein for ventilating purposes, and I believe that the speed and facility with which air connections can be made with these drills is not generally appreciated in Mexico. As the holes drilled with these machines are generally of very large diameter up to 20 inches, and even larger, a "shot type" of core drill is generally used for this work, in which case the holes can only be sunk vertically, and must virtually therefore be classified as small diameter vertical shafts.

Where ventilation alone is to be considered, these would certainly be far quicker to put down, and cheaper to drive than any form of standard incline or vertical shaft; and in any case ventilation can be most satisfactorily obtained with a straight well driven shaft than with the greater length required for the incline shaft.

Where, however, the vein dips into the hill instead of running parallel with its face, an inclined shaft will be shorter and more economical to sink than the vertical shaft. In the case of ventilation the ideal condition is to reduce the frictional resistance to the passage of air to a minimum, and to make connections in the most rapid manner possible with the least outlay for dead work.

Other conditions being equal, the really controlling factors between the inclined and vertical shafts for ventilating purposes will be those that I have already specified; though, as a rule, by the time a shaft is required only for ventilation at depth, the ground has been drained, and there are no difficulties to be encountered due to water. Where the shaft is to be sunk, not only for the purpose of ventilation, but is also to be used provisionally to explore and extract a certain amount of ore, all the other factors besides the final one of ventilation have to be taken into consideration.

The above notes will, I think, show that there are many advantages in the case of inclined shafts which have been very generally overlooked in Mexico. It may often occur that an inclined shaft sunk in the foot-wall of the vein will in the end prove to be the most satisfactory, either for exploring, ore extraction, or unwatering. Sinking can be carried on through undisturbed ground, and the main avenue of communication in the mine is independent of caves from worked out stopes or settlement of the hanging wall. In the case of unwatering old mines the main pumping stations can be established as soon as reasonable depth below water level is attained, and the old workings tapped by means of horizontal core drills (which avoids the danger of flooding), while sinking operations are in progress to reach the lower levels.

While I realize that this paper is far from complete, I trust that it may be a stimulus for the collection of further data, and a motive for discussion from my co-workers, which will throw added light on this very interesting subject.

THE PETROLOGICAL DEPARTMENT.

[Note.—Engineers and mine managers using the diamond drill are invited to send specimens of their cores for examination at the nominal charge of 35 cents each for slicing. In diamond drilling the most must be made of every core; for it is a tedious and costly work. In this respect the microscope is always an effective aid. Those engaged in working out relations in the Porcupine from drill cores will find its use almost imperative,—for in that district rocks of different character have often much the same outward appearance.]

J. C. M., Porcupine, 1, 2, 3, 4, Graywackes.—These specimens of drill cores are essentially the same. Angular fragments of quartz, feldspars and fine-grained diabase are the chief constituents. In 4 several shreds of muscovite are present. No. 2 is the finest grained—3, 1, 4 being coarser in the order named. These rocks represent original muddy sands, which may have been partly or entirely volcanic in origin. There is no evidence of surface alteration, nor of metamorphism, beyond mere induration.

J. P., Cobalt, A. Quartz Diabase.—This rock is much decomposed, but clearly consisted chiefly of plagioclase and augite with the characteristic diabase struc-

ture. A comparatively large amount of quartz is present, intergrown with feldspar. Biotite and ilmenite now represented by chlorite and leucoxene are minor constituents. The alteration is due to weathering.

J. P., Cobalt, B. Graywacke.—This fine grained rock is probably a specimen of the graywacke slate so abundant in the Cobalt district.

G. B. S., Porcupine, 22 Diabase.—The original constituents of this rock are all completely decomposed. The alteration is plainly due to atmospheric agencies. The grain was medium.

G. B. S., Porcupine, 23 Calc Phyllite.—An indistinctly schistose aggregate of sericite, calcite, and chlorite with minute rods of rutile and several grains of quartz that are probably relics. The original character of this rock has been completely altered by metamorphism of a mild degree.

G. B. S., Porcupine, 24 Diabase.—This specimen is completely altered, but, unlike 22, contains much secondary fibrous hornblende. Pressure and heat had therefore something to do with the alteration. It was slightly finer grained than 22.

G. B. S., Porcupine, 25 Calc Phyllite.—Like 23, but contains considerable secondary albite, but not so much calcite.

O. B., Bruce Mines, 1. Diabase.—This coarse rock is still comparatively fresh, only the augite being partially decomposed to chlorite. A small amount of quartz in micrographic intergrowth with feldspar occurs.

O. B., Bruce Mines, 2, Breccia Conglomerate.—This is evidently a specimen of the "slate conglomerate." There is nothing unusual in the section. Angular fragments of quartz and feldspars with particles of various rocks are embedded in a fine cement.

O. B., Bruce Mines, 3, Limestone.—This specimen is from the limestone and chert bands in the "slate conglomerate." Strictly it is a fine grained marble and contains secondary quartz, muscovite, and albite, the latter as large irregular grains filled with inclusions.

INDUSTRIAL NOTES.

Allis-Chalmers Reorganization.

The recent re-organization of the Allis-Chalmers Company is of interest to Canadian machinery users. Through its close connection with the parent company, the Allis-Chalmers-Bullock, Limited, of Montreal, will reap considerable benefit by the strengthening of the position of the Allis-Chalmers by the addition of new capital.

Receivers for the company were appointed in Milwaukee on April 6th, and the names show that the receivership is of a friendly character. The plan of re-organization has been under way for the last three months, and proved satisfactory to all interested. Under it bondholders and the preferred and common stockholders agreed to give up their securities and accept instead preferred and common stock in a new company. The elimination of bonds amounting to \$11,148,000, and the addition of new capital amounting to \$5,192,000 will place the company in a strong position and enable it to take full advantage of its new shops at West Allis, Milwaukee.

SPECIAL CORRESPONDENCE

NOVA SCOTIA.

Dominion Coal Outputs.

The output of the Glace Bay mines for March was 353,720 tons, the largest output ever obtained from these collieries in this month. The best previous March output was 346,529 tons, in 1908. For the first quarter of the year the aggregate outputs total 965,000 tons, comparing with 885,885 tons in the first quarter of 1911, and with 946,286 tons in the first three months of 1908.

The weather during the month was favourable to operations, and although the drift ice around the coast is very heavy, the prevailing winds have been such that the movements of the ice-pack have not interfered with navigation to any marked extent.

The production of the new mines is beginning to tell on the daily outputs of the Coal Company. The outputs for the 27th, 28th, and 29th of the month were respectively 15,868 tons, 16,035 tons, and 16,762 tons. On the 27th and 28th No. 6 Colliery was idle, so that, counting in this colliery's production at the usual figure of 1,000 tons, the output for the 28th was equivalent to 17,000 tons. These three days gave the largest output ever obtained by the company in a similar period. It may be predicted that with ordinary favourable circumstances the daily outputs during the summer will occasionally exceed 18,000 tons.

The Springhill mines produced during the quarter 107,000 tons, an increase of 78,000 tons on the year 1911. The March output was 33,470 tons.

The combined increase from the Springhill and Glace Bay mines will, therefore, amount to 158,000 tons over the first three months of the year.

Port Hood Colliery.

There have been some interesting discussions in the Nova Scotia House of Assembly during the present session on matters connected with the coal mines of the province, and the Mines Department has been vigorously assailed by the members of the Opposition, with the usual admixture of truth and error that characterizes the tactics of the politician.

A good deal has been said about Port Hood Colliery and the inundation of last June, and an impression seems to be abroad that something might have been done that was not done to save the mine after the water broke in. As a matter of fact, all that could be done was done, and no criticism can be justly made of the action of either the management of the colliery or the Mines Department, immediately after the water burst in. The time for action had then passed. There was absolutely no hope of damming the flood, and although the management made a brave attempt to control the water, they might just as usefully have done nothing. The situation was beyond human endeavours. The possibility of recovering the mine was one to be decided by mature consideration, and a careful estimate of the financial responsibility involved.

If the Government is open to criticism, it is that it did not itself appoint a commission to report on these and other points, without allowing their opponents the kudos of suggesting a most obvious procedure. It is to be heartily regretted that a matter of such importance to the coal mining industry of the province should have been given a political aspect, thus obscuring the real issue.

The cause of the Port Hood inundation is to be found in what was done, or left undone, before the water broke in. Whether the water came directly from the sea, or indirectly, is not a point of very much importance, but what would be useful is to know what caused the fracture of the superincumbent measures. The point of technical enquiry should be directed more to the cause of the failure of the cover, rather than to what happened after the roof broke, and the water had entered the mine.

The personnel of the Commission which the Government has appointed is in itself an assurance that the antecedents of the flood will be thoroughly investigated.

Unworked Coal Areas in Nova Scotia.

The statement is often made that large areas of coal bearing lands in Nova Scotia held under leases from the Provincial Government are being held by speculators, thus preventing their development, to the general detriment of the province. It was stated in the course of debate in the Nova Scotia Parliament that out of 108 leases only 20 covered properties that were being worked. It was further stated that out of 1,010 square miles of coal areas, about 10 per cent. were being operated, or only 146 square miles out of 1,010 square miles. It is certainly open to grave doubt whether there are 1,010 miles of coal lands in Nova Scotia. There are a good many leases issued in Nova Scotia covering tracts of land under which no coal will ever be found, because it is not there. Furthermore, much of the coal lands under lease is territory underlying the sea, distant many miles from the shore. These areas may or may not be worked. Their existence is presumed on good geological evidence, but not as yet proved. Again, they are in some instances so far out to sea that their operation need not trouble this generation nor that which will follow it. If a careful estimate were made of the coal seams in Nova Scotia which it would be feasible and profitable to work at the present time, for comparison with areas actually in operation, the discrepancy would not be so great as some people appear to imagine. Economic conditions decide whether or not coal areas shall be worked, and while thick seams of coal remain unexhausted which can be cheaply mined, less favourable areas with thin seams will be left untouched. There are many thin seams of coal in the Sydney coalfield, which to-day are neglected and thought but little of. Some day, however, they will become valuable. But it is not fair to assume that because an area is held and not worked that some more or less hypothetical speculator is to blame for its non-development.

The C. M. I. and the Mining Societies of Nova Scotia.

At the recent annual meeting of the Nova Scotia Mining Society, Dr. Barlow, of the Canadian Mining Institute, brought before the meeting the advantages which would follow from affiliation with the C. M. I. At the same meeting the advisability of affiliation with the South Cape Breton Mining Society was discussed, and this Society was requested to send a delegation to confer with the Council of the Nova Scotia Mining Society and a delegation from the C. M. Institute. This is a move in the right direction. The benefits to be obtained from affiliation of technical societies has been proved conclusively by the experience of the Canadian Society of Civil Engineers, the Federated Mining Institute of England, and the American Institute of Mining Engineers. Men actively engaged in the technical direction of large mining enterprises cannot spare the time to attend meetings at a distance. Neither can a large number of papers be read and adequately discussed at an annual meeting. After all the great benefit of any mining society to its members is from the papers which its members contribute, and these are better digested in the leisure which comes between working hours. The chief aim of a mining society should, therefore, be to publish full and well printed transactions, arranged to be bound annually for permanent reference. This, of course, costs money, and is almost impossible for a small society.

Again, the remark is often heard, particularly in Cape Breton, that the proceedings of the Canadian Mining Institute deal too exclusively with metalliferous mining, with the Cobalt and Porcupine regions, and contain very little that interests the coal miner. Exception is sometimes taken also to the prepon-

derance of papers on gold mining and kindred subjects read before the Nova Scotia Mining Society, although it must be admitted that no such objection can be urged against the papers read at Halifax this year. Affiliation, however, would provide a remedy for all this, and would enable each society—while retaining its own identity completely and all the social advantages this carries with it—to participate in the advantages of a set of transactions covering every field of mining. In a country so vast as Canada, with such a varied range of mining branches, there is a unique opportunity for a mining institute which shall embrace and federate all the existing societies, and adequately represent the mining industry of the nation. But this can not be done by an Institute which meets in Montreal, Toronto, or Ottawa, unless that Institute is affiliated with the east as well as with the west.

It will surely be to the mutual benefit of the Canadian Mining Institute, the Nova Scotia Mining Society, and the South Cape Breton Society to join hands, and it is to be hoped that the rapprochement will be carried to its logical conclusion.

ONTARIO.

Porcupine, Swastika, and Larder Lake.

So far developments at the Hollinger mine have more than justified the estimates Mr. P. A. Robbins made in his annual report. To date the most favourable developments have been on No. 2 vein and No. 4. In the report, No. 4 vein was estimated to contain 35,000 tons for the first 200 feet, although the 200-foot level had not then been reached. The vein at the 200-foot level has just been cut at the time of writing, and while it has not yet been sampled, it bears a strong resemblance to the vein at the 100-foot level where it was good payable ore. The cross-cut from No. 1 vein was pushed 200 feet and had passed under a point directly below where the vein should have appeared. The walls of the cross-cut were then washed down and on the north could be seen some pyrite which gave a low assay. A round of holes was then driven and when fired a four-foot vein of quartz was opened up. On the 100-foot level the No. 4 vein is so much better in grade and so many breaks in the vein have been filled in that it is estimated that there is now about twice as much ore in sight on this vein as was estimated in the report. Development work on No. 2 vein has been so much better than expected that it is computed that \$1,800,000 is estimated rather than \$1,200,000. These estimates are not of ore actually blocked out, but of what may reasonably be expected to be developed. The work on the main vein is proceeding more slowly. To the north the drift is now in bad ground, and it is probable that the commencement of the next ore body will not be picked up for 80 or 100 feet. At the end of this barren patch a winze has been sunk 30 feet below the 100-foot level and there shows \$32 ore, so that the probability that the ore shoot does not continue down to the 200-foot level is now very small.

The first fruits of the McIntyre ten-stamp mill have been shipped out in the form of two small gold bricks, worth about \$5,500. The management give out the report that 75 per cent. of the gold is being saved on the plates and that the tails, after concentration, only run 58 cents.

Another strike is said to have been made on the Tough claims at Swastika. During the winter and so far this spring Swastika has been the only prospecting ground that has yielded the prospector any results at all. Silver is reported to have been found in Lebel township, and several spectacular discoveries of gold are reported from claims within a few miles of Swastika.

A six-drill compressor has been installed along with two 60 horse power boilers at the property of the Hollinger Reserve mines. The shaft is now down 40 feet, and will be sunk to 200 feet without a check. The ore in the main vein is said to average \$12 to the ton.

The main shaft at the McEnaney mine of the Crown Reserve Mining Company, is being sunk to the 300-foot level, while drifting operations are still in progress on both the 100 and 200 levels.

A small prospecting plant has recently been installed on the Kenora property in the Three Nations section of Whitney Township, and sinking can now be undertaken to greater advantage. It is reported that a good body of milling ore is indicated. Native gold is also being discovered in the bottom of the shaft of the Three Nations Mining Company at a depth of 140 feet.

Two new veins have been cut on the Plenaureum property on Pearl Lake, both at the 200-foot level. One was cut on the north shore and one on the south shore.

A new six-drill compressor and a boiler have been installed at the Crown Chartered to work the Davidson lease. This will enable the company to operate to much better advantage than they have heretofore been able to do.

The power situation has now adjusted itself until the spring freshet runs on the Mattagami River. The only sufferers from insufficient head of water now are the Plenaureum, which has rented the Bewick-Moreing compressor, and the Jupiter, which is operating again with its old steam plant. There are, however, pretty general apprehensions of further trouble at the Porcupine power plant when the Mattagami River is in flood after the snow melts.

Cobalt, South Lorrain, Gowganda, and Elk Lake.

There is considerable activity at the Green-Meehan mine. Under the name of the Sata Maris, a considerable quantity of low grade ore is being despatched to a Cobalt concentrator for treatment.

The La Rose Consolidated has increased its dividend rate from 8 per cent. per annum to 10 per cent. per annum. At the old rate of 2 per cent. it amounted to \$150,000, and at two and a half per cent., \$187,000. The La Rose has now paid \$2,766,685 in dividends.

Continuations of two productive veins have been discovered on the McKinley mine under the swamp at the 150 and 200-foot levels. In a very short time an aerial tramway will be started to connect the Savage with the McKinley-Darragh, so that all the lower grade ore which is now being treated in the jigging plant at the Savage will come direct to the parent mine for treatment.

Several properties on Cart and Peterson Lakes have recently resumed operations. The Little Nipissing is being developed by the Peterson Lake Mining Company, the old Kerry lease, now the Seneca Silver Mining Company, is working again, and another attempt is being made by the Gould Consolidated to pick up one of the Nipissing veins.

Another new vein has been cut on the Silver Leaf property at the 470-foot level at 280 feet south of the shaft. The vein when first discovered was of barren calcite, but now carries low values.

The Nova Scotia Cobalt Mining Company has gone into liquidation. The company has for a long time not possessed any ore of its own to put through the large mill on Peterson Lake, but an attempt was made to raise money treating ore from the Kerr Lake, the Crown Reserve, and the Drummond. It has now been discovered that the process under the contracts signed with the various companies would not give an extraction which would yield the company any profit at all, and it has now been decided to go into liquidation. A meeting of the creditors is called for April 12th, at the King Edward Hotel, Toronto.

BRITISH COLUMBIA.

Nelson.—Two months ago the Hon. the Minister of Mines approved the recommendation of the Provincial Mineralogist to the effect that average samples of the ore or dike-matter occurring on the property of the Kootenay Gold Mines, Limited,

known as the Granite-Poorman mines, situated near Nelson, be obtained and sent to eminent analytical chemists for determination whether or not it contains, as had been alleged it does, platinum or metals of the platinum group in commercially payable quantity. Accordingly the Provincial Mineralogist took steps to carry into effect the object of his recommendation. Many statements that, (in the absence of verification by metallurgical chemists widely known to be fully competent to determine whether or not any of the platinum group of metals do occur in the ore referred to, in sufficient quantity to make their presence of commercial importance) may reasonably be regarded as open to question, have been published in Nelson and sent out from there in press despatches, until it has been deemed desirable for the Provincial Department of Mines to endeavour to ascertain whether or not there is warrent for even the less glowing of the allegations that have been made and given wide publicity. It is significant that both Dominion Government officials and assayers in the employ of companies possessing well-equipped laboratories, have stated that in their examinations and tests the claims made relative to the presence of the platinum metals in ores obtained in the vicinity of Nelson have not been sustained. The action of the Provincial Department of Mines is, therefore, the more commendable, since investigation by thoroughly impartial and independent men may be expected to show either that platinum metals really do occur in quantity sufficient to be of commercial importance, or that the statements made to the effect that they do were those of ill-informed and irresponsible persons, and consequently both unreliable and mischievous in their effects.

Hedley, Similkameen.—Recent information concerning the results of the mining and stamp-milling operations of the Hedley Gold Mining Company indicates that they continue to be profitable and that the profit earned during the first quarter of 1912 was larger than in the corresponding period of 1911. At the time of writing available information covers the months of January and February, and but three weeks of March, so that the figures for 1912 used in making a comparison between the results of the respective first quarters of the two years must be regarded, so far as those of 1912 are concerned, as, to a small extent, only approximate. The figures for 1911 were:—

Month.	Tons Milled.	Assay Value.	Profit.
1911—			
January..	4,239	\$11.29	\$17,979.85
February..	3,929	11.98	16,862.92
March	4,391	11.90	22,477.85
Total..	12,559		\$57,320.62
1912—			
January..	5,701	\$10.70	\$25,928.92
February..	5,010	9.49	17,382.09
March (21 days)	4,232	12.18	
Estimate for remaining 10 days..	2,015		33,365.22
Total	16,958		\$76,676.23

An analysis of the foregoing figures will result in showing for the first three months of 1912 an estimated increase in quantity of ore crushed of nearly 35 per cent., and in profit of about 34 per cent. It may be stated that the tonnage for the latter part of March has been estimated as similar to the average daily quantity for the immediately preceding 21 days, while the profit has been calculated on the basis of that of the average profit per ton of ore milled through the whole of 1911, namely \$5.34. This estimate should prove conservative, for the rea-

son that the exigencies of doing thoroughly good mining work required the breaking down of a quantity of rock that reduced the average assay value of the 5,010 tons of ore milled in February to \$9.49, which was \$1.06 per ton lower than the lowest monthly average during the whole of 1911. As the average assay value for one month of 1911 was \$14.36, it will be reasonable to look for a similarly high average for at least one month of 1912 to offset the unusually low value for last February. The information here given is submitted with the idea that as it bears upon the results obtained at the largest mine and mill in British Columbia at present operated for gold only, it will interest many readers of the Canadian Mining Journal. There are several other mines in the province the annual production of which includes a larger quantity of gold than that produced by the Hedley Gold Mining Company, but this is in conjunction with silver and copper as well. It is noteworthy, as indicating the efficiency of the gold-saving appliances and methods of the Hedley Gold Mining Company, that in 1911 there was made an average extraction of 94 per cent. of the gold contained in the ore milled.

Princeton, Similkameen.—The British Columbia Copper Company, which is doing development work on several of the 63 mineral claims of the Voigt group it holds under option of purchase, is obtaining distinctly encouraging results on claims Nos. 14 and 18. In a cross-cut on No. 14 claim 8 feet of ore was encountered at a depth of between 90 and 100 feet. Of this about two feet gave assay returns of \$24 in gold and copper. A good-sized lump of ore sent to the company's head office, New York, contained gold 0.55 per ton, and copper 8 per cent. Much ore of good grade has also been found on No. 18 claim. These results are considered favourable, and it is hoped they are but preliminary to more important discoveries that will justify the company in eventually purchasing and extensively working this Copper Mountain property.

Britannia, Coast.—Last year's favourable developments and results at the Britannia Mining and Smelting Company's mines on Britannia Mountain, near Howe Sound, together with the higher price now obtainable for copper, has led to the adoption by this company of even more activity than that which characterized its operations last year. Mention has already been made in the Journal that in 1911 this company mined and treated at its large concentrating mill, more than 100,000 tons of ore and produced concentrate averaging about 14 per cent. copper, its production of that metal having been between 8,000,000 and 9,000,000 pounds. Estimates of developed ore in the Britannia mines vary between totals of 450,000 and 1,000,000 tons, and average copper value contained therein up to 4 per cent. Taking the lower estimated tonnage only, and an average copper content of 3 per cent., and an average recovery of only 80 per cent. of the copper, as was made in 1911, it will be seen that at the present market price of copper there is a comparatively large realizable value available. To take fuller advantage of these favourable conditions than is practicable under existing local circumstances, it is planned to double the capacity of the hydro-electric power plant, and make provision for conveyance of a much larger quantity of ore from the mines to the concentrating mill and shipping dock at Britannia Beach. In connection with these intended necessary additions to producing facilities, Mr. Grant B. Schley, of New York, who has long financed this enterprise, recently went west, for the purpose of discussing on the spot with the company's general manager, Mr. J. W. D. Moodie, the nature and extent of the improvements and the most effective means of making them expeditiously. For several months the company has had from 500 to 700 men in all employed at its mines and concentrating mill, and it is not unlikely that the number will shortly be increased considerably.

GENERAL MINING NEWS

NOVA SCOTIA.

Glace Bay.—The screening plant for No. 15 colliery, Waterford, is now on the way from Plowright Bros., England, and should arrive here in a few weeks' time. The plant consists of two tipples, two sets picking tables, two sets perforated plate screens, one loading belt, and all other necessary accessories.

Glace Bay.—Experiments are being made with the improved Cottar mining machine, in Nos. 4 and 10 collieries. The mines in the Waterford district are equipped with this type, which are giving satisfaction.

Glace Bay.—Some of the miners have been growing somewhat careless lately in obeying the Mines Regulation Act in spragging their coal, and two hand-pick miners have been arraigned before Stipendiary John J. Smith charged with violation of the Mines Regulation Act in that regard. There are too many violations of the Act in respect to spragging in all the collieries, and as a result of a miner's carelessness or neglect to sprag his coal, accidents occur, especially in sections where there is "proud" coal.

Glace Bay.—S. S. Halvista was in port of Louisburg loading a coal car for St. Vincent, Africa, a Portuguese coaling station. She is taking 8,000 tons cargo and 900 tons bunker. This is the largest coal cargo and bunker shipped at this port up to the present.

ONTARIO.

Cobalt.—An English company has taken over the Little Nipissing shaft near the Right of Way and will cross-cut for an ore body that has already been located from this spot.

Cobalt.—An additional 20 stamps are being added to the equipment of the Townsite mill at the Northern Customs concentrator in Cobalt, this bringing the total milling capacity for Townsite ores up to 50 stamps. The additional equipment was found necessary owing to the increased output from the Townsite. When these additional stamps are dropping there will be a total of 94 stamps in operation at the Northern Customs concentrator.

Cobalt.—The additional equipment which is being added to the Casey Cobalt consists of a small experimental mill of five stamps and a three-drill compressor. The mill, which is being installed now is of a small experimental type, and if it is found that the Casey Cobalt ores can be treated satisfactorily by this the construction of a large mill will be commenced.

South Porcupine, April 5.—The new vein encountered on the north and south crosscut on the 200-foot level of the No. 1 shaft of the McIntyre is proving to be one of the most important on the property. The crosscut is into the vein 15 feet without yet picking up the wall.

Porcupine.—Two shafts are being sunk on the Miller-Middleton lots, west of the Hollinger holdings. The main shaft is down to a depth of 76 feet, while the No. 2 was started last week. Both are located along the west edge of the bluff of rock that extends across the lots from the Hollinger.

The Keora mine has started work. A small boiler and a steam hoist have been installed for future deep sinking. The main shaft is down to the 50 foot level, and with the aid of the prospecting machinery it will be deepened to the 100-foot depth.

Robert Clark, of Buffalo, former owner of the Clark claims in Northern Whitney, now turned over to the Gold Crest Min-

ing Co., is in the camp. Mr. Clark will be in charge of the field work on the property. Boilers, compressor for five drills, hoist for 500 feet, pumps, and camp electric lighting plant are being taken into the property. The Trinity-Cobalt outfit was purchased.

The management of the "big" Dome at Porcupine has planned to accomplish 10,000 feet of underground development during the summer. A shaft will be sunk to the 500-foot level, while the other levels will be opened out. In all 24 drills will be operated.

Sudbury.—The Mond Nickel Company is extending operations at Garson mine, with the view of having a steady supply of ore for the new works at Coniston, which are now under construction. It is to be hoped that an effort will be made to have the road from Sudbury benefit by the enlightened and liberal policy of both the Dominion and Provincial administrations.

The Syndicate holding option from Stobie and Tough, of the Lavaek nickel claims, has been at work for some time, stripping and trenching the surface. Three diamond drills are at work and the ore body has been traced for some distance.

The work on the new Grondal plant of Moose Mountain, Limited, is being pushed along with all possible expedition, but the plant is a large undertaking and some time yet must elapse before it is completed. Probably June 1st will see it ready for operation.

Port Arthur.—The report that a diamond drill was at work on the iron discovery just north of town, and that some recent assays indicate a remarkable rich sample of ore, has aroused considerable excitement, both in Fort Frances and International Falls.

Dryden, April 5.—Work on the Good Luck claims, sold by Mr. E. G. Rogers to Bewick, Moreing & Company, is progressing rapidly. Work is being done on two shafts, which are now down 65 and 50 feet. Cross-cutting has proven the vein to be very wide.

BRITISH COLUMBIA.

Vancouver.—Construction of a smelter with a treatment capacity of 2,000 tons daily, at Granby Bay, Portland Canal District, for the Granby Consolidated Mining & Smelting Company, will be started in May. During the present year much work will be done on the development and equipment of the Hidden Creek mine at Granby Bay. The site for the proposed reduction works, which will also treat custom ores, has already been graded. A surface tram will convey the ore from the mine to the smelter at tidewater.

Vancouver.—The recent increase in the price of copper has stimulated mining operations at the Britannia mine on Howe Sound. The company now has over 700 men engaged in development work, as well as in carrying out extensive improvements about the mill. Shipments are averaging about 5,200 tons, including concentrates, monthly.

Revelstoke, April 4.—The Pioneer Placer Mines, Limited, owned by E. A. Bradley and associates, of Revelstoke, has decided to install a Keystone placer testing drill to determine the values of their properties on French Creek, in the Big Bend district, adjacent and tributary to this city.

Phoenix.—In the Voight property, which the B. C. Copper Company took under option last year, some important development work has been done. At a depth of a hundred feet in a cross-cut running from the shaft, a very promising vein has been found, which was eight feet wide. Drifting on this vein has been continued for a distance of 105 feet, and it is believed the ore will run to depth.

GENERAL.

Washington.—A valuable discovery of soluble potash salts has been made in the Mojave Desert, Southern California, by field representatives of the Bureau of Soils and Geological Survey. The potash was found in a partly dried-up lake. There are indications of millions of tons of potash.

San Francisco, Cal.—California mining men are quietly preparing for a systematic invasion of High Grade in Madoc County as soon as weather conditions permit. Several prominent

San Francisco capitalists are outfitting prospectors and arranging to be at Fort Bidwell to take advantage of the first rush. The present warm weather prevailing throughout the state is expected to melt the snow at High Grade more rapidly than first anticipated, and the Golden State miners do not intend to be distanced by their brothers of Nevada, Colorado, and other states.

Spokane, Wash.—Dates for the American Mining Congress, to be held in Spokane this year, have been fixed for Nov. 25-30.

COMPANY NOTES

LA ROSE DIVIDEND RECORD.

The dividend record of the La Rose Mines Company, including the forthcoming payment, is as follows:

	P.C.	Bonus.	Amount.
1908—October 20	3	.	\$171,505
1909—January 20	3	1	228,480
1909—April 20	3	1	228,840
1909—July 20	3	1	300,000
1909—October 20	3	1	300,000
1910—January 20	2	.	150,000
1910—April 20	2	.	150,000
1910—July 20	2	.	150,000
1911—October 20	2	.	150,000
1911—January 16	2	.	150,000
1911—April 16	2	.	150,000
1911—July 16	2	.	150,000
1911—October 16	2	.	150,000
1912—January 16	2	.	150,000
1912—April 16	2½	.	187,000
Totals	35½	4	\$2,766,685

Dividends amounting to \$1,204,862 were also paid by the La Rose when privately owned.

THE INTERNATIONAL NICKEL CO.

The International Nickel Company has recently declared a 7 per cent. dividend on the common stock, which calls for \$810,784, and brings the total of dividends for the fiscal year, which ends on March 31st, to 18½ per cent., which makes \$1,841,786 distributed to stockholders in the last twelve months.

Last year the company increased the common stock issued from \$8,872,662 to \$11,582,629. The year ended March 31st, 1910, showed 17.27 per cent. earned on the \$8,872,662 common stock, and last year showed approximately 28 per cent. on the increased common issue.

NIPISSING FOR 1911.

The Nipissing Mines Company enjoyed the best year in its history in 1911, with earnings running better than \$2,000,000. From this amount there was paid in dividends \$1,800,000.

The company's yield approximated 5,200,000 ounces, which was produced at an average cost of less than 14 cents per ounce, comparing with 14.72 cents per ounce in the previous year.

A very significant result of the past year's operations was the saving of 74 per cent. of the total gross production for net profits.

Although a smaller amount of development work than usual was accomplished high-grade ore reserves were increased by about \$250,000, while total reserves of all grades were swelled by almost \$1,000,000 to \$4,500,000, the greatest in Nipissing's history.

Prospecting was cut down materially last year owing in part to the delay in delivering the hydraulic plant. In fact, it did not amount to more than 33 per cent. of the previous twelve months' efforts in this direction. Of its 846 acres Nipissing has a virgin territory remaining of about 270 acres.

BRITISH COLUMBIA COPPER CO.

The balance sheet of the company for the year ended Nov 30, 1911, shows assets as follows: Properties at cost, \$3,426,901; metals and smelter product, supplies, etc., \$245,172; copper on hand and in transit, \$132,343; prepaid insurance and taxes, \$2,506; accounts receivable, \$4,666; cash, \$3,826,029.

The liabilities of the company at the close of the year were: Capital stock, \$2,958,545; sundry creditors, \$146,473; reserve for employees' liabilities, \$3,749; profit and loss surplus, \$717,262; total, \$3,826,029.

The company has secured options to purchase the Copper and Riverside claims in Franklin camp, the Greyhound claim in Deadwood camp, the L. H. claim, near Silverton, and the Voight claims near Princeton.

Shipments of ore for the year amounted to 384,588 tons, of which \$340,029 tons were from the Mother Lode mine. The company's smelter handled 608,945 tons of ore and blister copper production amounted to 10,044,093 pounds, containing 9,944,987 pounds of fine copper, 31,144 ounces of gold, and 134,266 ounces of silver.

DOMINION STEEL CORPORATION.

The Dominion Steel Corporation statement for March, just issued, shows that this big concern is doing a tremendous heavy business, and that the closing months of the company's fiscal year are adding largely to the success of the whole enterprise.

The steel plant is running full time in order to meet the demand for manufactured goods supplied by the company, while at the Dominion collieries the output of coal is creating new records practically every day.

The output from the steel plant for March is as follows:

	Tons.
Coke	42,160
Iron	25,425
Steel Ingots	27,710
Blooms	21,230
Rails	11,095
Rods	778
Total shipments	19,305
Coal output	353,170

KERR LAKE DIVIDENDS.

The directors of the mine have declared their regular quarterly dividend of 25 cents a share on the capital stock of the company. This dividend is No. 26, and is payable on June 15 to

stockholders of record June 1. This is the third of the 5 per cent. dividends to be paid by Kerr Lake, and will bring the total percentage of dividends paid by this mine to 134 per cent. The following shows the payments made to shareholders since the mine first entered the dividend-paying class:

	P.C.	Amount.
1905	½	\$ 15,000
1906	4½	135,000
1907	8	240,000
1908	15	450,000

	P.C.	Amount
1909	23	690,000
1910	40	1,200,000
1911	10	300,000
1911	10	300,000
1911	8	240,000
1911	5	150,000
1912	10	300,000
	<hr/>	<hr/>
	134	\$4,020,000

STATISTICS AND RETURNS

COBALT ORE SHIPMENTS.

The following table shows the Cobalt ore shipments for the week ending March 30th, and for the year to date:

	Week.	Year to date
Beaver		123,988
Buffalo	58,936	653,897
Can. Gowganda		15,967
Casey Cobalt		549,000
Chambers-Ferland	64,000	192,000
City of Cobalt	57,620	226,298
Cobalt Lake		206,530
Cobalt Townsite		457,744
Colonial		40,000
Coniagas		814,057
Crown Reserve		256,139
Drummond		604,000
Hudson Bay	64,332	376,744
Kerr Lake	60,905	384,913
La Rose	130,313	1,683,114
Mann (Gowganda)		40,000
McKinley	84,965	1,368,617
Millerett		126,000
Miller Lake-O'Brien		96,500
Nipissing		1,043,710
O'Brien	64,017	398,970
Provincial		44,440
Right-of-Way		220,296
Temiskaming		432,805
Trethewey	55,311	241,134
Wetlaufer	40,383	160,470
Totals	674,812	10,767,363

The bullion shipments for the week were as follows:—

	Ounces.	Value.
Nipissing	98,366.02	\$57,296.02
Crown Reserve	13,000.00	7,572.50
Totals	112,366.02	\$64,868.52

COBALT ORE SHIPMENTS.

The following table shows the Cobalt ore shipments for the week ending April 6th, and for the year to date:—

	Week.	Year to date
Beaver		123,988
Buffalo	56,635	710,582
Can. Gowganda		15,967
Casey Cobalt		549,000
Chambers-Ferland		192,000
City of Cobalt		226,293

	Weeks	Year to date
Cobalt Lake	64,150	270,680
Cobalt Townsite	78,000	535,744
Colonial		40,000
Coniagas	184,400	998,467
Crown Reserve	42,430	298,563
Drummond		604,000
Hudson Bay		376,744
Kerr Lake		384,913
La Rose	77,338	1,760,482
Mann (Gowganda)		40,000
McKinley	137,981	1,506,598
Millerett		126,000
Miller Lake-O'Brien		96,500
Nipissing	65,112	1,108,822
O'Brien		398,970
Provincial		44,440
Right-of-Way		220,296
Temiskaming	54,934	487,739
Trethewey	53,000	294,134
Wetlaufer	56,000	216,470
Totals	869,980	11,637,343

The bullion shipments for the week were as follows:—

	Ounces.	Value.
Nipissing	24,875.00	\$14,645.22
Crown Reserve	22,234.00	12,212.20

BRITISH COLUMBIA ORE SHIPMENTS.

Consolidated Company's Receipts.

Ore production and shipments to Consolidated for week ending March 24th:—

	Week.	Year to date.
Rossland—		
Centre Star	3,770	36,560
Le Roi	954	10,401
Le Roi No. 2	363	508
Bluebird .....	...	57
East Kootenay—		
Sullivan	851	5,566
St. Eugene .....	...	401
Society Girl .....	...	21
Ainsworth—		
Utica .....	...	132
No. 1	24	286
Slocan—		
Standard	202	2,234
Van Roi	125	1,079
Hewitt .....	...	59

	Weeks	Year to date
Ottawa	28	28
Eastmont	51	51
Fidelity	61	61
Richmond-Eureka	31	415
Rambler-Cariboo	65	411
Reco	24	24
Lone Bachelor	31	31
Ruth	44	259
Middleton	24	24
Other mines	228	228
Nelson—		
Canadian King	54	54
Arlington	670	670
Nugget	22	44
Granite-Poorman	70	70
Queen	70	70
Emerald	833	833
Vancouver	17	17
Molly Gibson	131	131
Monarch	25	86
Silver Cup	86	86
Devlin	11	11
Foreign—		
Knob Hill	86	1,037
Hope	20	20
Northport	34	34
Bonanza	80	80
Totals	6,695	65,231

B. C. ORE SHIPMENTS.

Consolidated Company's Receipts.

The production and shipments to the Consolidated for the week ending March 30th were:—

	Week.	Year to date.
Rossland—		
Centre Star	2,457	39,017
Le Roi	858	11,259
Le Roi No. 2	376	5,457
Bluebird	57	57
East Kootenay—		
Sullivan	872	6,438
St. Eugene	401	401
Society Girl	21	21
Ainsworth—		
Utica	132	132
No. 1	25	311
Slocan—		
Standard	163	2,397
Van Roi	31	1,110
Hewitt	59	59
Ottawa	28	28
Eastmont	57	57
Fidelity	61	61
Apex	36	36
Richmond-Eureka	28	443
Rambler-Cariboo	411	411
Reco	24	24
Lone Bachelor	31	31
Ruth	259	259
Middleton	24	24
Other mines	228	228
Nelson—		
Canadian King	54	54
Arlington	670	670
Nuggett	44	44
Granite-Poorman	70	70
Queen	40	110

	Weeks	Year to date
Emerald	833	833
Vancouver	17	17
Devlin	11	11
Molly Gibson	113	244
Silver Cup (Lardo)	86	86
Monarch (Field)	28	114
Foreign—		
Knob Hill	29	1,066
Hope	20	20
Northport	34	34
Bonanza	80	80
Totals	5,020	70,251

BRITISH COLUMBIA ORE SHIPMENTS.

Boundary Ore Tonnages.

Following are the returns of the output of the mines and smelters of the Boundary district for the week ending March 24, and year to date:—

Granby	23,437	266,440
Mother Lode	7,512	93,297
Rawhide	5,248	27,952
Jack Pot	587	7,256
Athelstan	340	340
Emma	4,901	4,901
Others	232	2,865

Smelter Tonnages.

Granby	24,595	313,267
B. C. Copper Co.	13,324	133,318

For the week ending March 30, and year to date:—

Granby	24,224	290,664
Mother Lode	7,836	101,133
Rawhide	5,050	33,002
Jack Pot	554	7,810

Smelter Tonnages.

Granby	23,720	336,987
B. C. Copper Co.	12,175	145,493

DOMINION COAL COMPANY'S OUTPUT.

The March output of coal from the collieries of the Dominion Coal Company totalled 353,401 tons. This is the largest March output on record, and beats the best previous production for that month, made in 1908, by 6,872 tons. Last month's tonnage was 23,000 tons in excess of February, and 72,000 tons head of January. The total output for the first three months of the present year is 964,734 tons. The output for March by collieries is as follows:—

No. 1, 52,117; No. 2, 69,787; No. 3, 9,995; No. 4, 32,659; No. 5, 24,974; No. 6, 16,762; No. 7, 14,542; No. 8, 12,252; No. 9, 37,432; No. 10, 17,039; No. 12, 26,927; No. 14, 22,978; No. 15, 7,499; No. 16, 5,767; No. 21, 1,477; No. 22, 1,194.

SHARE MARKET.

(Courtesy of A. E. Bryant & Co.)

New York Curb.

	Bid.	Ask.
Braden	5 $\frac{3}{8}$	5 $\frac{3}{8}$
B. C. Copper	5 $\frac{3}{8}$	5 $\frac{1}{2}$
Giroux	6 $\frac{1}{4}$	6 $\frac{3}{8}$
Green-Cananea	9	9 $\frac{3}{8}$
Inspiration	20 $\frac{1}{4}$	20 $\frac{1}{2}$
Yukon Gold	3 $\frac{5}{8}$	3 $\frac{3}{4}$

	Bid.	Ask.
Goldfields Cons.	4 1/8	4 1/4
Nevada Cons.	20 1/4	20 3/8
Miami	26 1/8	26 1/4
Ray Cons.	19 3/4	20
Chino	28 1/2	29 1/4

Cobalt Stocks.

	Sales	
	Low.	High.
Bailey	2 3/8	..
Beaver Consolidated	43 1/2	44
Buffalo	*125	..
Chambers-Ferland	13 1/2	..
City of Cobalt	13	..
Cobalt Lake	*25 3/4	..
Coniagas	780	785
Crown Reserve	310	..
Great Northern	12 1/2	..
Gould	3 1/8	..
Gifford	3	..
Green-Meehan	1 7/8	1 7/8
Hargraves . . . . .	..	9
Kerr Lake	290	..
La Rose . . . . .	..	**375
McKinley-Darragh	165	167
Nipissing . . . . .	..	**825
Nova Scotia . . . . .	.3 1/2	..
Ophir	10 3/4	11
Otisse	1 3/8	..
Peterson Lake	9 3/4	10
Rochester	3	..
Right of Way	8 3/4	9
Silver Leaf	*5	..
Temiskaming	40	41 3/4
Trethewey	65	..
Wettlaufer	65	..

*Bid. **Offered.

Porcupine Stocks.

	Sales	
	Low.	High.
Apex . . . . .	.05 1/4	..
Crown Charter . . . . .	.33	.34 1/2
Dome Extension . . . . .	.68	.70
Foley-O'Brien . . . . .	..	*.33
Hollinger	12.00	12.05
Jupiter . . . . .	.43	.44
Moneta	*.15	..
Pearl Lake . . . . .	.19 1/2	.20
Porcupine Central	5.30	5.35
Porcupine Imperial . . . . .	.06	.06 1/4
Porcupine Northern	1.62	1.68
Porcupine Tisdale . . . . .	.04 1/2	..
Porcupine Southern	2.09	2.13
Preston East Dome . . . . .	.11 1/2	.12
Rea . . . . .	.50	.54
Standard . . . . .	.06 3/4	.10
Swastika . . . . .	.23 1/2	..
Vipond . . . . .	.43	..
United . . . . .	.03	.04
West Dome	*.36	..

Sundry.

Island Smelters . . . . .	.12 1/2	.13
Canadian Mareconi	7.85	7.90

TORONTO MARKETS.

April 10—(Quotations from Canada Metal Co., Toronto):

- Spelter, 6.85 cents per lb.
- Lead, 4.50 cents per lb.
- Antimony, 8 to 9 cents per lb.
- Tin, 45 cents per lb.
- Copper, casting, 16.50 cents per lb.
- Electrolytic, 16.50 cents per lb.
- Ingot, brass, 7 to 12 cents per lb.

April 10—Pig Iron—(Quotations from Drummond, McCall & Co., Toronto):

- Summerlee No. 1, \$23.00 (f.o.b. Toronto).
- Summerlee No. 2, \$22.50 (f.o.b. Toronto).
- Midland No. 1, \$19.00 (f.o.b. Toronto).
- Midland No. 2, \$18.50 (f.o.b. Toronto).

GENERAL MARKETS.

- Coal, anthracite, \$5.50 to \$6.75.
- Coal, bituminous, \$3.50 to \$4.50 for 1 1/4 inch lump.

Coke.

April 8.—Connellsville coke (f.o.b. ovens).

- Furnace coke, prompt, \$2.35 to \$2.40 per ton.
- Foundry coke, prompt, \$2.75 to \$3.00 per ton.

April 8—Tin, straits, 43.35 cents.

- Copper, Prime Lake, 15.95 cents.
- Electrolytic copper, 15.80 cents.
- Copper wire, 17.00 cents.
- Lead, 4.25 cents.
- Spelter, 6.85 cents.
- Sheet zinc (f.o.b. smelter), 8.65 cents.
- Antimony, Cookson's, 8.00 cents.
- Aluminum, 19.00 to 19.50 cents.
- Nickel, 39.00 to 40.00 cents.
- Platinum, ordinary, \$46.00 per ounce.
- Platinum, hard, \$48.50 per ounce.
- Bismuth, \$1.80 to \$2.00 per lb.
- Quicksilver, \$43.50 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
March 20	58 1/2	26 1/8
March 21	58 1/4	26 1/8
March 22	58 1/2	26 1/8
March 23	58 1/4	26 1/8
March 25	58 1/4	26 1/8
March 26	58 1/4	26 1/8
March 27	58 1/8	26 3/4
March 28	58 1/4	26 1/8
March 29	58 1/8	26 3/4
March 30	58	26 1/8
April 1	58 1/8	26 3/4
April 2	58 1/4	26 1/8
April 3	58 3/4	27 1/8
April 4	58 7/8	27 1/8
April 5	58 7/8	27 1/8
April 6	58 3/4	27 1/8
April 8	58 3/4	Holiday

*Bid. **Asked.