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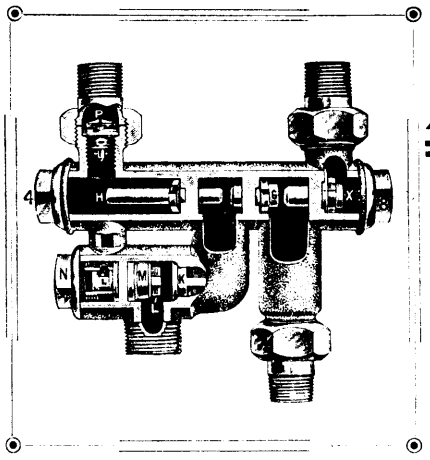
The Canadian Mining Review

Established 1882

Vol. XVI.—No. 7. MONTREAL—OTTAWA—HALIFAX. JULY, 1897.



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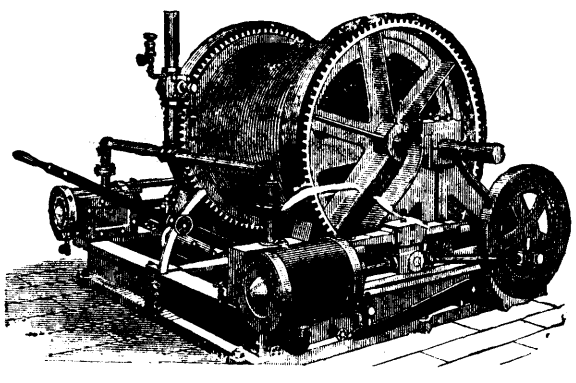

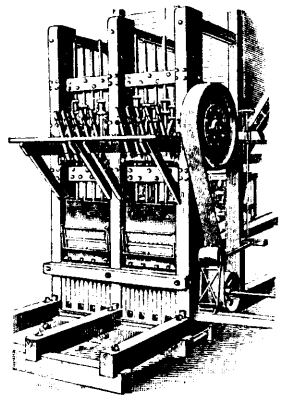

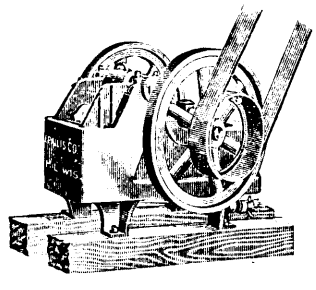

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GOLD AND SILVER.

Under the provisions of chap. 1, Acts of 1892, of Mines and Minerals, Licenses are issued for prospecting Gold and Silver for a term of twelve months. Mines of Gold and Silver are laid off in areas of 150 by 250 feet, any number of which up to one hundred can be included in one License, provided that the length of the block does not exceed twice its width. The cost is 50 cents per area. Leases of any number of areas are granted for a term of 40 years at $2.00 per area. These leases are forfeitable if not worked, but advantage can be taken of a recent Act by which on payment of 50 cents annually for each area contained in the lease it becomes non-forfeitable if the labor be not performed.

Licenses are issued to owners of quartz crushing mills who are required to pay Royalty on all the Gold they extract at the rate of two per cent. on smelted Gold valued at $19 an ounce, and on smelted gold valued at $18 an ounce.

Applications for Licenses or Leases are receivable at the office of the Commissioner of Public Works and Mines each week day from 10 a.m. to 4 p.m., except Saturday, when the hours are from 10 to 1. Licenses are issued in the order of application according to priority. If a person discovers Gold in any part of the Province, he may stake out the boundaries of the areas he desires to obtain, and this gives him one week and twenty-four hours for every 15 miles from Halifax in which to make application at the Department for his ground.

MINES OTHER THAN GOLD AND SILVER.

Licenses to search for eighteen months are issued, at a cost of thirty dollars, for minerals other than Gold and Silver, out of which areas can be selected for mining under lease. These leases are for four renewable terms of twenty years each. The cost for the first year is fifty dollars, and an annual rental of thirty dollars secures each lease from liability to forfeiture for non-working.

All rentals are refunded if afterwards the areas are worked and pay royalties. All titles, transfers, etc., of minerals are registered by the Mines Department for a nominal fee, and provision is made for lessees and licensees whereby they can acquire promptly either by arrangement with the owner or by arbitration all land required for their mining works.

The Government as a security for the payment of royalties, makes the royalties first lien on the plant and fixtures of the mine.

The unusually generous conditions under which the Government of Nova Scotia grants its minerals have introduced many outside capitalists, who have always stated that the Mining laws of the Province were the best they had had experience of.

The royalties on the remaining minerals are: Copper, four cents on every unit; Lead, two cents upon every unit; Iron, five cents on every ton; Tin and Precious Stones; five per cent.; Coal, 10 cents on every ton sold.

The Gold district of the Province extends along its entire Atlantic coast, and varies in width from 10 to 40 miles, and embraces an area of over three thousand miles, and is traversed by good roads and accessible at all points by water. Coal is known in the Counties of Cumberland, Colchester, Pictou and Antigonish, and at numerous points in the Island of Cape Breton. The ores of Iron, Copper, etc., are met at numerous points, and are being rapidly secured by miners and investors.

Copies of the Mining Law and any information can be had on application to

THE HON. C. E. CHURCH,

Commissioner Public Works and Mines,

HALIFAX, NOVA SCOTIA.

15th YEAR OF PUBLICATION.

The Canadian Mining Review

Established 1882

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

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

VOL. XVI., No. 7. JULY, 1897. VOL. XVI., No. 7.

Alluvial Gold in Nova Scotia.

"Distance lends enchantment to the view," is a proverb, the truth of which is abundantly illustrated in these days of the Westralian and African gold mining malady, under which the British mining investor has latterly been suffering, and the simultaneous total neglect, notwithstanding all that has been said and written about it during the past thirty years, of the, in many respects, more promising fields, still waiting at our own doors for that active, intelligent and energetic action indispensable to the success of all mining enterprise. In the past there may have been, and probably was, some excuse for the apathy and neglect with which gold mining prospects and possibilities in Nova Scotia have been treated. Now, however, these no longer exist, and while advantage is being taken of the greatly improved mechanical inventions and appliances in connection with quartz mining, and the treatment of gold-bearing quartz, the matter of alluvial mining is just where it was in 1870. No one since then has taken it up, nor are there any facts or observations since the recorded respecting it.

Under these circumstances it may be in the interests of the industry to call attention to, and reproduce some of the opinions and facts then made known and expressed, but which have apparently been entirely lost sight of or forgotten.

In 1867 Professor Phillips wrote: "The attention of the Nova Scotia gold miner has, contrary to the usual practice, been almost entirely directed to the exploration of veins of gold quartz, and alluvial digging has consequently been almost entirely neglected. There is, however, reason to believe that a careful examination of the alluvial deposits would lead to the discovery of gold." There appears no reason for believing that gold mining will not become one of the profitable and lasting industries of Nova Scotia. The beach diggings near Lunenberg—which are of course alluvial—were at one time most productive. In 1870 Selwyn, then recently from Victoria, Australia, wrote: "Surface leads have been found, and have been followed for limited distances into gradually deepening ground, with highly promising indications, when the influx of water being too great to be overcome by manual labor with bucket and windlass, the ground was at once abandoned." Under such circumstances it is not surprising that no alluvial leads have been developed in Nova Scotia.

At Tangier, at Oldham, at Sherbrooke, at Waverley, and at Renfrew, we have observed places that present all the conditions required for the occurrence of rich alluvial diggings; but so far as could be learned no attempts had been made to test them, although they are in close proximity to quartz veins which have afforded large returns, and the abrasion of which in past times must have contributed to the detritus in the adjacent depressions.

The quantity of water which would be encountered in all the deep and low lying drift deposits in Nova Scotia doubtless constitutes a serious hindrance to their being explored, inasmuch as it almost precludes the success of individual effort, to which in Australia the original discovery of nearly all the principal alluvial gold fields is due. They however offer, we consider, a legitimate and exceedingly promising field for combined capital and labor skillfully applied. And it is certainly remarkable that so little attention has hitherto been bestowed upon them.

The late Mr. Michel insisted strongly on the importance of searching for alluvial gold beneath the glacial drift or boulder clay, where, as Dr. Hunt remarked, the gold alluvions "may reasonably be expected to be of great richness."

Wherever valleys or flats filled with detritus are found crossing the strike of the veins, as is the case at Waverley, at Oldham, and doubtless at many other places, explorations should be made immediately below such lines of intersection, as being most likely to afford satisfactory results. In the few cases where alluvial gold has been detected the discovery has been accidental. The search has never been conducted on any defined system or principle, and was therefore not likely to effect more than it has done, viz., prove the presence of particles of gold in almost all the superficial sands and detritus that has been examined, and occasionally to such an extent as to be capable of being profitably extracted.

During a recent visit to the Waverley mine in Nova Scotia, where a considerable bank of side hill detritus overlies the Barrel quartz lead, we were informed by the manager that it all contained gold, but not enough to pay unless worked on a large scale. Close alongside this are extensive flats and depressions, the depth and character of which have never even yet been ascertained. From Yarmouth and Lunenberg in the south-west, to Halifax and Guysboro counties on the north-east, there are many similar depressions traversed by, or in close proximity to, the richest of quartz veins, the detritus from which, in the past, must have contributed largely to the infilling of these, and in the deepest parts of which the heaviest gold must be looked for.

Many of these depressions are now occupied by lakes, but the nature, depth and thickness of the deposits which underlie the water might perhaps be determined at small cost by a series of boreholes on the ice in winter.

Besides the free gold reasonably to be expected in the old detrital deposits, there must also be a large quantity of arsenical and other

sulphides, which if collected and properly treated would add as largely to the total yield of gold as these minerals are now shown to be capable of doing in the case of the quartz leads and belts.

During the past twenty-five years of gold mining in Nova Scotia nothing new has arisen, and the remarks and opinions expressed in 1870 respecting alluvial mining and its prospects in Nova Scotia can be repeated in 1897 without alteration for the due consideration of the British capitalists, who are now paying attention to, and spending many thousands of dollars on, the far less accessible, and certainly not more promising, prospects in British Columbia.

In conclusion, we would strongly urge the owners of mineral properties in Nova Scotia to carefully consider and act upon the advice given in our leading article of last month.

The Stamp Milling of Gold Ores.

At the moment when gold mining is attracting so much attention in Canada, Mr. T. A. Rickard's excellent volume on the subject of gold milling should meet with a ready sale among readers of the REVIEW. The work is a concise and handily arranged record of milling practice by one who has had a large experience in the United States and other countries, and affords valuable details regarding devices employed to overcome the difficulties which daily confront the millman in the handling of refractory gold ores. The comparisons instituted between the methods of widely separated regions give an insight into the fundamental principles of ore reduction and render the book invaluable to the student, the mine manager and the metallurgist. Even those who are not actually engaged in stamp milling will find the book very interesting because it is written in a simple and clear style, avoiding the unnecessary use of technical terms unfamiliar to laymen. The chapters dealing with the erection and management of mills are full of suggestions very helpful to capitalists, investors and others who derive profit by the economical extraction of gold from its ores. The following excerpt from Mr. Rickard's chapter on the 'Future of the Stamp Mill' will give our readers an idea of the quality of the work:—

"The stamp mill has suffered much in repute from the frequent failure to adapt the design of the mill to the capacity of the mine or the character of the ore. Some men order a reduction plant like others order a dinner. They go to the representative of a well-known machinery firm and tell him about the mine and the nature of the ore, and then leave the choice of the arrangement of the mill to him just as a man might enter a first-class restaurant and tell the head waiter to serve a good dinner, leaving the menu to his judgment. Mine-owners often hate to expend a thousand dollars in advice or experiment previous to the erection of an ore-reduction establishment, but really enjoy ordering a hundred-thousand dollar mill, which may no sooner be completed and at work before they find that the process is unsuitable or the ore supply inadequate. Hence the frequent monuments to folly which dot our western hillsides. *Hinc illae lacrimae* when shareholders inveigh against processes which prove a delusion and mills that fail to yield dividends. The causes underlying the miscarriage of milling plants are not obscure. If they are hidden from the unwise and imprudent, they are daily revealed to mere babes in metallurgical experience.

Only recently a typical instance came across my way. A mine-owner, who is ordinarily a real estate broker, went to the manager of a machinery manufacturing concern, and, exhibiting a piece of ore, told him that he wanted a mill to treat material of which that is a sample. The ore carried a large percentage of pyrites, but the gold associated with it, so said the real estate broker, was entirely amalgamable. The machinery man advised him to put up a long-drop, slow speed stamp mill, supplemented by concentrating tables. It was so ordered. The mill was shipped in due time, and was erected in the wilds of Idaho. From the very start everything went wrong. The mill did bad work, and the mine-owner anathematized the machinery fellow; the latter excommunicated the former. Not long afterward I happened to be on the ground and found the facts to be simple. When the mill was ready to start it was fed not with the hard pyritic quartz such as the original sample shown, but with very soft surface gossan. The feeding was low. The stamps with their long slow drop came crashing through the thin cover of soft material. Cams began to break, shoes went into splinters and screens were destroyed in a day. The mill was overhauled, the drop was shortened, and the cams replaced by others. The arrangement of the mill was gradually so modified that it became a hybrid between a short-drop, quick-speed form of battery and its original design. Better results were obtained Then a new superintendent came upon the scene. Work at the mine was transferred from the surface open cuts to deeper levels. Hard pyrite ore was sent to the mill. The crushing capacity of the stamps was diminished, and the amalgamating tables, their slope remaining unchanged, were unable to clear themselves. Extraction declined out of sight. The machinery firm was again pilloried. About this time the undertaking got into financial trouble and the plant was hired by a neighboring company, which was able to treat its (similar) surface ores in this mill with marked success. It all sounds foolish enough, but pity 'tis 'tis true, and not once only, but many times.

The machinery man, however, often deserves censure also. There are establishments which have what they call a "standard" type of mill which they highly recommend for the reduction of ore running through a whole gamut of differing composition. Like the iron bed Procrustes, to which the wayfarer had to suit his length at the risk of summary abbreviation or painful elongation, so the manufacturer expects the ore to adapt itself to his mill or choose between being labelled unprofitable or refactory. These are difficulties which could be readily overcome. The failure of a plant hurts the reputation of the firm that supplied it in no less than it decreases the value of the mine. It would be a profitable thing for both parties in the transaction if, it being agreed that the order will be placed, they could agree upon an investigation of the ore by a competent authority with a view to determining the best treatment, the expense of such investigation to be divided between them.

More than once, in the course of the investigations upon which these studies of milling have been based, there has come the question, Is the stamp mill likely to survive amid the inventions daily heralded from the Patent Office? Will it continue to compete successfully with the multitudinous pulverizers and amalgamators, together with the unending array of new processes which the restless brain of man brings forth from day to day? To the writer, looking over the field of metallurgical competition and cognizant of the fearful slaughter that befalls the army of ill-conceived and half-completed machines which their investors fondly imagine competent to revolutionize ore reduction, there comes a strong belief that the stamp mill is destined to survive amid much competition and to enjoy a career of further long-continued usefulness. Often enough some other process or some different pulverizing mechanism is claimed to do better work than the stamp mill. Occasionally this is true for particular ores under particular conditions, but just as frequently it is due to the fact that in making the test the stamp mill has been of unsuitable design or has been unintelligently handled, so that the comparison has been unfairly made. There is, believe me, just as much difference between a model

stamp mill properly directed and an imperfect one badly managed as there is between the latter and some one or other of the newer processes of ore reduction. I have known a leaching process put in rivalry with an imperfectly equipped or improperly managed stamp mill, and the former has given a percentage of extraction greater than the latter, but in the sequel it has become evident that the stamp mill, when it has been subsequently provided with the needed appliances and superintended by the necessary man, has surpassed the leaching process as much as the last previously surpassed the stamp mill.

One feature of the stamp mill stands out clearly when instituting a comparison between it and other pulverizers, namely, it is a crushing and an amalgamating, a reducing and an extracting machine combined. This distinctive feature has enabled it to hold its own against other newer inventions for pulverizing ore and to meet the fierce competition of so many more complete and more complicated amalgamating machines. In the two extreme types of the stamp mill, so often referred to, we have seen on the one hand* how an increased degree of amalgamation has been assured at a sacrifice to rapidity of pulverization, and, on the other hand†, how fast crushing has been aimed at and battery amalgamation made subservient to the desire for the expeditious treatment of large quantities of low-grade mill-stuff. In the one case the mortar has been enabled to do work otherwise beyond its scope; in the other, ore has been handled with commercial success which otherwise could not be profitably reduced. It is interesting to note, however, that even in California and South Dakota, where the stamp mill is so designed as to be essentially a rapid pulverizer, the amount of gold arrested inside the mortar forms about one half of the total extraction.

This feature of the stamp mill is one overlooked by many who daily direct their inventive genius to the discovery of a mechanism which shall surpass the clumsy contrivance whose reverberations echo from Coolgardie to Colorado. The steam stamp, for instance, eminently successful as it has shown itself in the quick reduction of the copper ores of the Lake Superior region, has not proved satisfactory in its application to gold ores. Why? Its crushing capacity per horse-power consumed is much ahead of the ordinary stamps. True, but it does not permit of amalgamation going hand in hand with pulverization, the force and rapidity of the discharge are unfavorable to fine crushing, the extreme violence of the agitation inside the mortar prevents the introduction of amalgamating plates, and, as a whole, it notably fails in giving the conditions required for successful milling.

The same question crops up in the discussion of the use of heavy stamps. The Alaska Treadwell Company made numerous experiments, and found 1,000 pounds the practicable limit. Heavier stamps might crush faster, and indeed did so, but this very fact resulted in the rushing of the ore through the battery so rapidly that opportunities for that contact between the gold and the mercury which is the essential requirement for amalgamation, were lessened to such an extent as to seriously diminish the percentage of extraction. The mill became a good pulverizer but a bad amalgamator.

Nine-tenths of the patent pulverizers and new amalgamators thrust before the public through the medium of bombastic advertisements are crippled by a similar defect. Where rapid pulverization is secured an ineffectual effort is often made to secure concomitant amalgamation, but in most cases the cutting up of the mercury introduced into the machine causes so much "flouring" as to render a heavy loss of both mercury and gold unavoidable. I have before me, as I write, a typical description of a machine of this kind. The author of the description who possesses merely a bowing acquaintance with his subject, emphasises the statement that it is an "evolutionary machine" which for the first time utilizes a new principle, r.mely, the "atomic pulverization" of the quartz and the complete liberation of the gold. I happen to know that that "evolutionary machine" lies resting in many a mill where it can now be purchased on the basis of scrap iron. Let me mention another example. Lately, while going up one of our picturesque Colorado canons, I visited a plant which has been re-arranged. The man in charge informed me, with unnecessary emphasis, that mercury was a "robber of gold," and that his (the speaker's) "new system," which was to utilize "hot water and air," would plainly demonstrate such to be the fact. I enjoyed the subsequent conversation. That man was as deliciously ignorant of what the stamp mill can do and how it does it as the dog that bays at the moon is of astronomy. He had persuaded a few stockbrokers to introduce his "new system," of which what was useful was as old as the hills, and what was essentially absurd and impracticable was his, entirely his. Such instances are not uncommon. They happen weekly in spite of frequent doses of bitter experience. They explain why so many mills are rotting in the sun and rusting in the rain—object lessons whose teaching is as unheeded as the whistling of the wind through the neighboring pines.

Not that one would suggest that mechanical ingenuity and metallurgical experience will fail to better our present methods. No; but that betterment will be brought about by men who are cognizant of what is being done already and of how the present practice was evolved rather than by those who are contemptuous of a process whose principles and application they have scarcely tried to comprehend.

Therefore, in conclusion, to millmen and metallurgists, fellow-students in a field of endless interest, I would say: Let us endeavor to use the stamp mill intelligently, to understand the why and wherefore of every one of its successive operations, and to lose no opportunity of applying any contrivance or modification which experience sanctions and experiment corroborates. That done, we shall have done our little best as best we can. In the meantime the inventive genius of this great mechanical age ruminates apart in an earnest effort destined in due time to evolve something better wherewith to catch the yellow gold whose want is the pain of some, whose excess is the curse of others."

* In Gilpin County, Colorado. † In South Dakota and California.

The North Star Silver Mine.

Our illustrated supplement this month is very largely taken up with a series of views of the celebrated North Star Mine, East Kootenay, B.C.

The North Star is in extent the greatest silver-lead property in British Columbia. It is situated near Fort Steele, in East Kootenay, and is owned principally in Montreal, Mr. D. D. Mann of that city being the original purchaser and president of the company.

The property was located by Bourgeois, the discoverer of the Le Roi, in 1892, and consisted in the first place of four claims grouped about the discovery. Mr. Mann became interested in it the same year, and after examination purchased the property. Five years ago the wonderful developments of West Kootenay were not yet begun; very little metal mining was going on anywhere in British Columbia; Fort Steele, or Wild Horse Creek rather, was remembered only as a placer camp, it was 170 miles from the railway and had a bi-monthly mail, so it required no little courage to invest in East Kootenay to the extent that Mr. Mann did. The result has abundantly shown his wisdom.

While the North Star remains the only shipping mine in East Kootenay, there are several properties in the Fort Steele Mining Division, notably the St. Eugene at Moyie Lake, that only await better transportation facilities to become large shippers also.

The property of the North Star Mining Co., comprising about 830 acres, is situate at an elevation of 4,300 feet above the sea, and 1,500 above the Kootenay River. Huckleberry Hill, where the mine is, is a low rounded mountain, well timbered for the most part, and an outlier of the Purcell Range. The Hill is at the junction of Mark Creek and St. Mary's River, twenty-two miles west of Fort Steele.

Two years ago the company built a wagon road from the mine to the Kootenay river, where they had acquired some ground for ore sheds and a boat landing.

The work previously done on the property had shown the presence of a large body of lead ore, but for lack of transportation very little development had been done. In the winter of 1895-96 a large force was put on and considerable work done. About 7,000 tons of ore have been mined and raised so far, 3,000 tons of this "carbonates," the rest galena.

Development consists of 1,600 feet of shafts and drifts, and more than 1,200 feet of this in solid ore, showing an immense body of galena lying nearly flat on a diorite footwall, and extends nearly to the surface. The photograph at the cross-cut on the 20-ft. level gives some idea of size. Here the ore is 60 feet wide. There are over 20,000 tons of galena in sight between the 1st level floor and the surface. This galena carries from 40 to 60 ounces of silver and runs on the average 60 p. c. lead, zinc is less than (one) 1 p. c., the rest being chiefly iron.

There is one drift 200 feet long joining No. 1 shaft and No. 3, all in decomposed ore ("carbonates,") which yielded 64 oz. silver and 50 p. c. lead to the ton. Shaft No. 4 is in similar ore; it is not connected yet, but so far as the drift has gone these carbonates are unchanged. Handsome specimens of native silver occur throughout the carbonates in a form resembling moss. The hanging wall, where exposed, is a soft porphyritic rock of the same nature chemically as the foot. The richest ore is found next the hanging. Gold in small quantities is found in the carbonates.

At the 60-ft. level is a tunnel to the bottom of No. 1 shaft, which effectively drains the mine. The tunnel goes through two feet of ore, and has been continued for 130 ft. past the shaft.

The ore is taken from the mine to ore houses where it is sorted and sacked. It requires very little picking. These sacks hold about 100 lbs. of carbonates. The ore is hauled in winter on sleighs, the 4-horse teams taking from 6 to 10 tons to the load from the mine to the landing on Kootenay River, at cost last winter of $3.50 a ton. Then during the season of navigation the ore is taken by boat to Jennings, Montana, down the Kootenay river, a distance of 169 miles, where it is loaded in cars of the Great Northern Ry. for the smelter at Great Falls, Montana, 480 miles farther.

This long transportation is a very heavy burden for a low grade lead ore to bear, especially when it is subject to the further charge of a customs duty on the lead content. Before the ore gives any return the company has spent nearly $40 a ton on it in transportation and duty. Mining and hauling to the landing is done for less than $6. Thus more than $,0 a ton is spent by the company in the United States, amounting to over $200,000 on the output to date, which is a dead loss to the company and to Canada.

The production of smelting ores from numerous other mines in the district, and the development of many of the promising properties now lying idle which the building of the Crow's Nest railway will assure all demand a smelter. But until the completion of the Crow's Nest Ry. shall have made it possible to work the rich coking coals of the Elk River fields, the construction of a smelting plant in the neighborhood is out of the question.

Although the North Star mine has produced 7,000 tons of ore it is to be borne in mind that this seemingly large tonnage is merely incidental to a consistent plan of development of the mine, and that no attempt has been made to produce large shipments; but when cheaper transportation and cheaper treatment demand it, it is estimated that the mine can produce twenty thousand tons a year, for probably twenty years or more.

In order to ship the 5,000 tons taken out this year, contained in 52,000 sacks as shown in the photograph, nearly three car loads of empty sacks were required. These jute sacks came from Montreal. Most of them will stand two trips to the smelter.

It is a striking evidence of the wealth of the mines of British Columbia to have presented in one photograph, sacked ore of the gross value of nearly $400,000, the product of the first mine developed in East Kootenay without a railway or smelter of our own. What we may expect when we have both, is a startling proposition even to the most experienced mining men from all parts of the world, who have examined the Kootenays.

The Central Rawdon Mine.

There is a general stir in Nova Scotia just now for improved methods of treating gold ores, and the new plant at the Central Rawdon Mine, illustrated in this issue, will rank amongst the first in the province. The mine has a curious history. It was sold some years ago by its present owner to an American company, who failed to make the property pay, and after prolonged litigation the present owner, Mr. Clarence H. Dimock, repurchased the mine. He has since added a considerable number of areas to the property, and it now forms one of the largest in the province, having the mining rights of between three and four hundred acres, and the timber rights for a considerably larger quantity.

There are four known leads on the property, namely, the East, the West, the Ridge, and the Cope lead.

The East vein has been opened up on the surface for a length of 400 feet, and to a maximum depth of 100 feet; these workings have produced 1,555 ounces of gold from 1,095 tons of ore. The Ridge vein has been proved over a distance of 700 feet, and has a maximum depth 40 feet only; it has produced 382 ounces of gold from 590 tons of ore.

Surface workings on these two veins have been stopped, and a tunnel is being driven which will cut the East vein at a depth of 160 feet. The tunnel is now in 400 feet, and it is estimated that it will cut the vein at a distance of 900 feet. This tunnel, besides forming a cheap and effective way by which to mine the ore, will also effectively drain that part of the property. On the West vein very little work has been done on the surface.

A very considerable amount of work has been done on the Cope vein, which has been the main producer; it has been opened up for a total length of over 900 feet, the deepest shaft being 430 feet.

These two veins (the West and the Cope) dipping at different angles, meet each other, and from present development appear to form one vein below the junction which has a width of from 4 to 6 feet, showing a good proportion of gold.

The vein matter from all the veins is heavily charged with both iron pyrites and arsenical pyrites, and the returns from the tailings in the past have been very high, running at times to over half an ounce. These tailings up till now have been allowed to go down the stream,

but in the new plant they will be saved and treated. The new plant will consist of a ten stamp mill with three Frue vanners (one Morse belt and two plain belts), a Brown's hydrometric sizer, and it is probable that a plant will be added for the subsequent treatment of the concentrates.

There are three boilers giving a total of 160 h. p., a Worthington steam pump of 3-in. discharge, and a Northey pump of 2 in. discharge, and all necessary hoisting gear.

The concentrates from this plant have assayed from $30 to over $500 per ton of concentrates, and the tailings from the present dump near the mill give an average of 11 dwt., 16 grains.

A recent run in the mill of 25 tons of slate show that this matter, which has in the past either been dumped or stored underground, is well worth milling, and in future both slate and quartz will be milled.

From the present indications we have every reason to believe that this property will in the future take a prominent position among the gold producers of Nova Scotia.

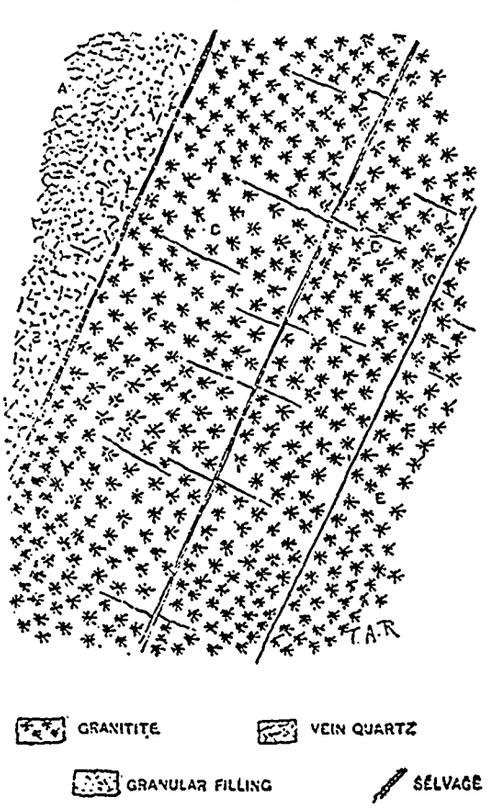
Vein-Walls.

By T. A. Rickard, Denver, Colorado.

(Continued from June issue.)

Fig. 16 affords an example of "walls beyond walls." It represents a section obtained at the station on the 500-foot level in the Mammoth mine, Pinal county, Ariz. The Mammoth lode traverses hornblende-granititite, porphyrite and a porphyry agglomerate. The lode-filling consists of altered country, and therefore changes as the lode in its strike penetrates first one kind of rock and then another. When standing in the stopes it is not difficult to recognize in the the ore the reproduction of the habit of either the granite or the porphyrite by whose alteration the lode was produced. The country near the lode is much altered and often visibly gradates into the ore, while, as the lode is receded from, these effects diminish until they become confined to the faces of the rock lining the fractures. The granitite carries two feldspars, of which the pink orthoclase is evidently more stable and succumbs to decomposition less quickly than the green plagioclase. The ore is both gold and silver-bearing, but chiefly valuable for gold. The great variety of associated minerals includes some uncommon species, such as wulfenite (usually colored by vanadic acid), vanadinite, descloizite, ecdemite, dechenite, linarite, besides the commoner anglesite, pyromorphite, cerussite, malachite, dioptase, azurite, and a little galena and pyrite. Referring to the drawing (made March 17, 1893), the edge of the ore is shown

Fig. 16.



Mammoth Mine, Arizona.

at A; it becomes mixed with altered granular country (along B) in approaching the "main footwall." This is followed by the granitite itself, in which there are well-defined walls (or fractures parallel to the lode-channel) and cross-joints, often lined with exquisite crystals of vanadinite and wulfenite.

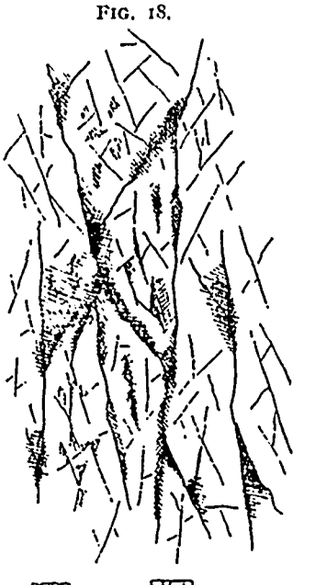
Going to the Pacific coast, Fig. 17 represents a part of the west side of the so-called "mother lode" of California. The drawing, made May 21, 1891, is the portion of the face of a large open cut at the Gold Cliff mine, Angel's Camp, Calaveras county, Cal., near the now well-known Utica mine. The ore-channel consists of a country-rock traversed by cross veins of white gold-bearing quartz. The country-rock is a greenish gray augite schist (probably at one time a diabase), carrying coarse pyrite near the gold-quartz.

There are "walls" *ad infinitum*. Each cuts off the quartz-seams, which occur again on the further side and extend to the next "wall," where they

Fig. 17.

Gold Cliff Mine, California.

Fig. 18.



Cashier Mine, Breckenridge, Col.

are terminated as before, and so on. A certain portion, 20 to 30 feet in width, of this channel of country is rich enough to work, and is sent to the mill, but the poorer material which lies beyond it has an identical geological structure. Of course, in such a case the "main walls" will depend for their determination upon commercial rather than geological conditions.

Another case in point is presented at the Cashier mine in Summit county, Colo., as illustrated in Fig. 18, which shows a part of an open cut on the lode, as seen August 22, 1895. The latter consists of altered quartz-felsite, rendered porphorytic by large crystals of feldspar. It is spoken of as a vein 45 feet wide, having a hanging-wall of porphyry and a foot-wall of lime. The ore is said to be penetrated by dikes of porphyry. The facts are really these: A certain width of quartz felsite within the neighborhood of its contact with the limestone has been acted upon by mineral solutions which probably came up along that contact. There are no walls, the porphyry of the hanging being simply the rock of the ore-channel in a less altered condition. The feldspar of the lode-rock has been leached out. In the cavities, now partially filled with crystalline quartz, iron oxide and gold, there can be distinguished the outlines of the large (½ to 1½ inches) crystals of orthoclase whose removal made the rock porous to circulating waters. The mineralization is indicated by the softening and reddening of the porphyry and is most marked along the joints, especially where they intersect. There are occasional portions of the rock comparatively unaffected by the leaching agencies, and therefore appearing as hard, unstained nuclei amid a mass of softer reddish ore. It is these that are locally termed "horses" and "dikes" of porphyry.

Lodes subdivided by partings parallel to their outer walls (as in numbers 1, 9, 10 and 12) often resemble twin veins such as are actually formed by the temporary parallelism of two distinct fissures travelling together after they have united. Such a case is shown in Fig. 19, which illustrates the union of the Old and New Castletown veins as seen in the north face of the 500-foot level of the Drumlummon mine, Marysville, Mont. The country is clay slate. A B is the Old Castletown vein, 2½ feet wide. B C is the New Castletown, 2 feet wide. There is no selvage on any one of the three walls, but each is marked by soft, crushed and foliated slate.

The generous lodes of silver-bearing copper-ore which at Butte, Mont., penetrate the granite are frequently marked by a brecciation of the encasing country and are accompanied by a mineralization of the granite far beyond the walls or limits of workable ore. In the 300-foot level of the Gagnon mine, 374 feet west of the main shaft, a cross-cut shows that the lode-channel extends 30 feet north of the supposed foot-wall, the enclosed granite being broken and mineralized. Beyond this line the country ceases to be shattered and is no longer impregnated with ore, but is comparatively fresh, hard, normal granite, with a blocky fracture. This outer foot-wall of the lode-channel is marked by the occurrence of some ore-streaks and an accompaniment of seams of clay, as is shown in Fig. 20 (drawn September 15, 1895.) The foot-wall country has a noticeable number of slips or joint-planes. It is separated from the lode-channel by a thick layer of tough black clay. Then comes a zone of kaolinized granitic filling traversed by irregular veins of zinc-blende and pyrite. Another clay-seam divides this part of the section

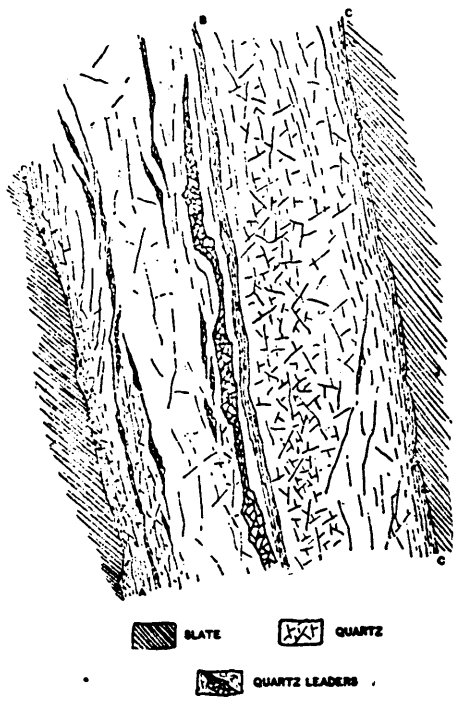
from a band of mixed white quartz and granitic filling, followed by altered mineralized granite, ribboned with veins of gray quartz, whose southern limit is a third seam of black clay. Then comes crushed, brecciated granite, diversified by quartz and occasional evidences of ore, which extends to the main pay-vein (on the hanging) which has been the workable part of the deposit. The section in the figure represents a width of six feet.

Fig. 21 came from the east breast of the 1300-foot level, in the same mine. It is a representative section of the main ore-bearing vein. Granite, visibly altered, marks the northern edge of the section, which is the foot-wall. Upon it lie a few inches of breccia, succeeded by 8 inches of blende, pyrite, and enargite, well intermingled. Then come 3 feet of friable, mineralized, light gray shattered quartz, giving place to 6 to 8 inches of harder quartz streaked with veinlets of chalcopyrite and bornite. Upon this lies a foot of altered granite traversed by streaks of quartz. Then 18 inches of low-grade ore, consisting of quartz, pyrite, blende and a little bornite, separated from the main pay-streak by 6 inches of granitic filling. The main pay-streak is from 5½ to 6 feet wide, and consists of a massive mixture of pyrite, blende, enargite and bornite, carrying about 60 per cent. of silica. Between this and the hanging-wall there is 2 or 3 feet of decomposed broken granite, showing small veins of ore which drop into the main pay-streak. Beyond is granite.

In mines of this character, the geologist may determine the existence of the lode far beyond the limits of workable ore; but the miner will rightly distinguish between what is mineralized* country too poor to exploit and the concentrated mineral which will yield a profit.

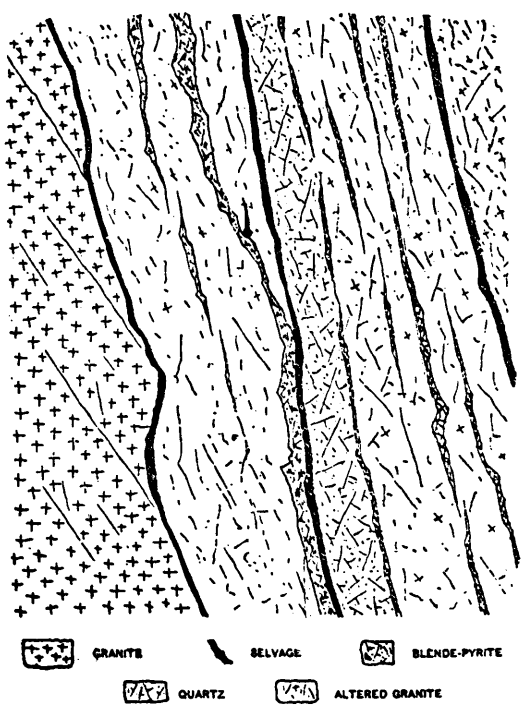
That straight walls are not the necessary adjuncts of a vein of ore is suggested in Fig. 22, which represeuts the breast (on September 26, 1895) of the hanging-wall drift on the upper level of the Double Extension mine, in Summit county, Colo. The lode-formation consists of gently sloping quartzite, cut across and broken into by porphyry, which, as a dike, forms "the main vein," and in the shape of sheets, intercalated among the beds of quarzite, makes a succession of "floors" of gold-bearing ore of widely varying hardness. In the particular section illustrated, the intrusive porphyry forms the hanging-wall, A B C, of a zone of ore which is limited on its lower side by the ragged edges of the quartzite, M M. In this instance the conventional straight walls give place to one of extreme and irregular curvature and another of a markedly broken and jagged outline; but they are nevertheless walls, as truly as would be the most perfectly straight, smooth rock faces. The porphyry, A C, a quartz-felsite, is bleached to a yellow white and softened to a granular clay, as it approaches its contact with the broken quartzite, D D. The latter is dark bluish-gray, and carries, along its joints and other fractures, minute seams of iron-stained ocherous clay, which is gold-bearing. E E and G G are veins of such gold-bearing ocher. F F is crushed quartzite, very similar to D D. The band of quartzite breccia, H H, is separated from an equally wide band of porphyry-quartzite breccia, L L, by a succession of thin parallel quartz-seams, K K. Then comes the foot-wall itself. At N, under the projecting curve of the porphyry of the hanging, there is a mass of much-shattered quartzite mixed with iron-stained quartz. This is all gold-bearing.

FIG. 19.



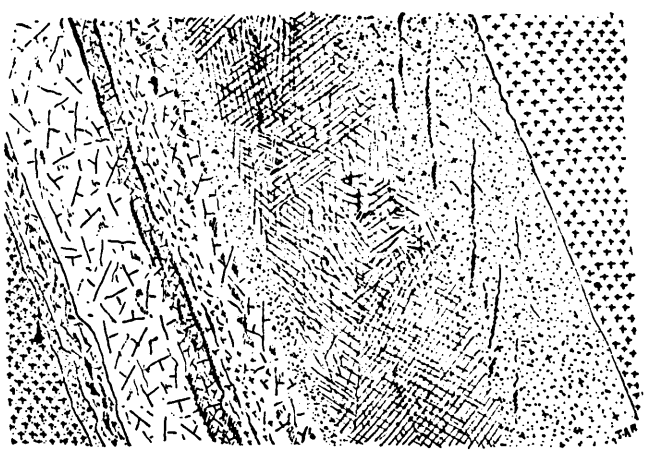
Drumlummon Mine, Montana.

FIG. 20.



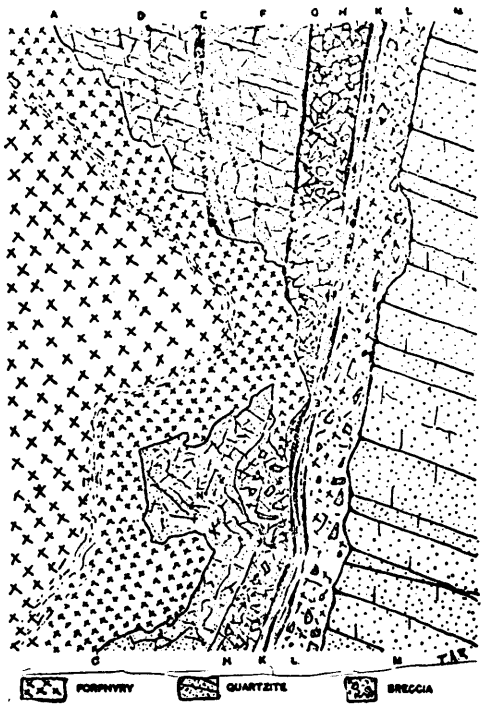
The Gagnon Mine, Butte City, Montana.

FIG. 21.



The Gagnon Mine, Butte City, Montana.

FIG. 22.



Double Extension Mine, Breckenridge, Col.

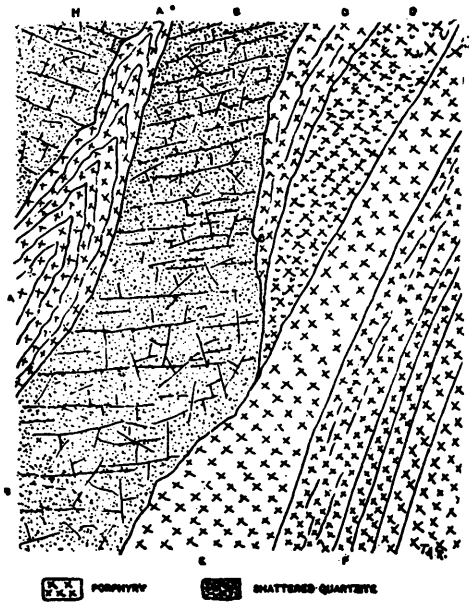
*The term "mineralized," like the word "mineral," is employed by miners in a sense not sanctioned by the ordinary dictionary, though fully entitled by its general usage to such recognition. Dr. Raymond's "Glossary of Mining and Metallurgical Terms" gives this sense as follows: "'Mineral.' In miners' parlance, ore.... 'Mineralized.' Charged or impregnated with metalliferous mineral." The French use "minerai" and "mineraliser" in this sense; and I have adopted it because no English equivalent occurs to me.

Fig. 23 representing the western edge of a "cutting-out stope," near the supposed foot-wall of the lode (as seen September 23, 1895) exhibits a somewhat similar complication and another curved "wall." To the extreme left is fractured quartzite, carrying iron-stained clay along the faces of fractures, and divided into two parts, H H and B B, by a narrow zone, A A, of soft yellow porphyry, whose curved lines of alteration are marked by streaks of gold-bearing ocher. The remainder of the section is all porphyritic material, of which C C is similar to A A; D D is a wedge of comparatively fresh rock, but slightly kaolinized and full of pyrite, and E E and F F are layers of brown and reddish soft talcose porphyry and clay, separated by numerous slips or smooth partings forming "false walls." The "main foot-wall" was supposed for some time to be the line of contact of the band of quartzite, B B, with the underlying porphyry; but assays have shown that the soft decomposed rock lying beyond it is fully as gold-bearing as the quartzite, and can be mined with as much profit for several feet beyond that line.

Not infrequently veins have irregular indistinct walls when ore-bearing, and smooth, clearly defined ones when barren. Fig. 24 illustrates the face (as seen September 15, 1895) of the west drift of the 430-foot level on the middle vein in the Nettie mine, near Butte City, Mont. The south country is a fairly hard, reddish granite, which, in approaching the hanging, becomes soft and is traversed by slips or joints. On the hanging-wall itself, A A, there is a seam of tough black clay, in which can be seen frequent films of minutely crystalline blende and galena, and small imbedded shots of ore and rock. This overlies a filling of white decomposed granitic material, full of partings and seams of black clay, such as C C. The foot-wall, B B, is also marked by a black selvage. Underneath it comes comparatively fresh "Blue-bird" granite.

A few feet further east this level carried an ore-body, A B in Fig. 24 being the zone so transformed. The brecciated quartz upon the foot-wall was the part of the vein which first became ore. The sides of the drift are now coated with a delicate efflorescence of goslarite (sulphate of zinc.) In

FIG. 23.



Double Extension Mine, Breckenridge, Col.

this connection it may be of interest to state that in the Gagnon mine, at Butte, three miles away, the apparently clean country, at some distance from the lode, was found* to carry 3 per cent. of zinc, indicating the extent to which the mineralizing action had penetrated.

Figs. 25 and 26 represent an interesting piece of evidence. Fig. 25 is an attempt to reproduce in color a block of ore giving a section of the Jumbo vein, and broken in the Enterprise mine a year ago. It is a beautiful example of ribbon-structure. The general lode arrangement is shown in Fig. 26, from a sketch made November 19, 1894. The vein follows a line of faulting, nearly at right angles across sedimentary beds of alternating sandstone and limestone. The extent of the fault is clearly marked by the dislocation of the bed of lime, B B, and its down-throw of about 2 feet on the hanging-wall. The country on the foot has its bedding-planes turned down, while on the hanging the reverse occurs.

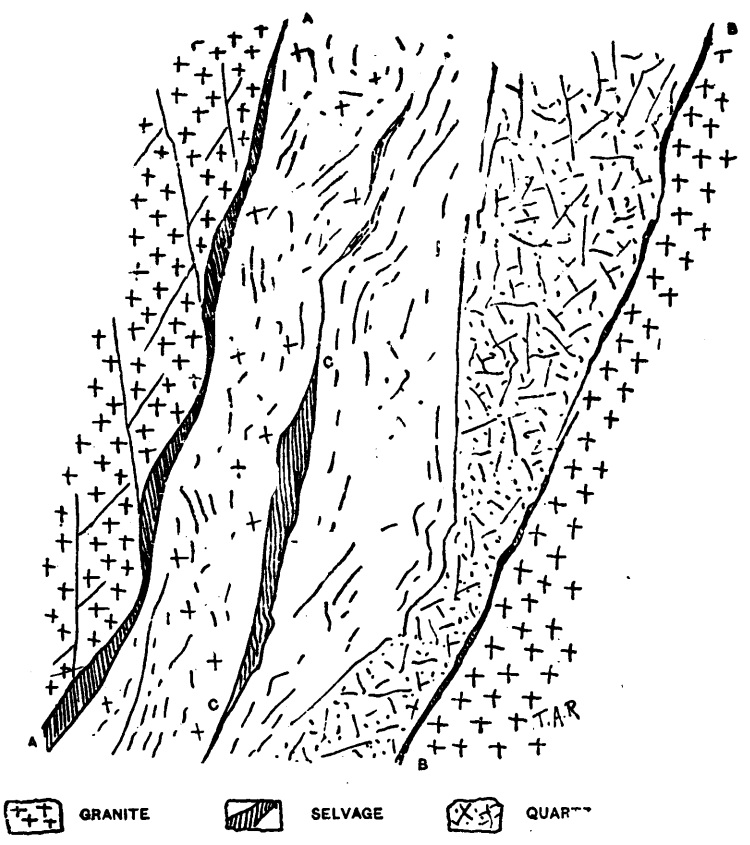
The vein is about a foot wide and is composed of a regular symmetrical arrangement of diverse minerals. The center of the ore is marked by a seam of quartz. The most remarkable feature of the section, however, is that while on the hanging the ore is frozen hard to the sandstone, on the foot there is an actual vacancy separating the ore from the country. This extends for a few feet above the place of the section, and is seen to find its downward termination as soon as the foot-wall penetrates into limestone, where the contact of the ore and the encasing rock is only marked by a slight selvage.

This description will render more intelligible the meaning of the detailed section of the vein presented in Fig. 25, which is intended to portray as accurately as possible the characteristics of the ore-occurrence at the point in the lode marked A on the out-line drawing, Fig. 26.

The main features are as follows: The western boundary of the vein is fairly straight, dipping, as the vein does, eastward. It is separated from the counrry-rock, a light-gray medium-grained sandstone, A A, by an actual vacant space, B B of about half an inch. The edge of the ore nearest the foot-wall consists of an irregular band, C C, of about ¼ of an inch of quartz, speckled with pyrite and chalcopyrite. Toward the bottom this quartz nar-

*According to Mr. C. W. Goodale, the manager.

FIG. 24.



Nettie Mine, Montana.

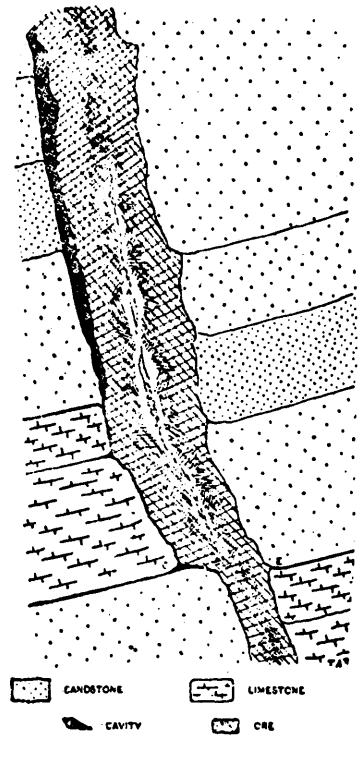
rows, but beccmes clearly defined into a crystalline comb, with teeth at right angles to the vein.

Then comes a zone, D D, averaging 1½ inches, of pink rhodochrosite. This band is broken into by veinlets of quartz, some of which are only branches from the outer seam, C C, while others traverse the rhodochrosite in bluish-gray streaks parallel to the general structure, and are peppered over with particles of pyrites.

The rhodochrosite band is broken on the right by the irregular outline of the blende and galena, E E, which is about 2 inches wide. There are blotches of yellowish "resin-blende" and patches of bluish-black galena distributed throughout a dark and intricate mixture of these minerals. They shade out into the white quartz, F F, which makes a bilaterally symmetrical division in the ore. The dark mass of the sulphides encloses shreds of rhodocrosite having distinct outlines.

Along the median line of the central quartz-seam, F F, occurs a succession of geodes, lined not only with crystals of the quartz itself but also with beautiful crystals of stephanite. The latter are seen in irregularly distributed clusters. In the outer quartz there are numerous specks of pyrite.

FIG. 26.



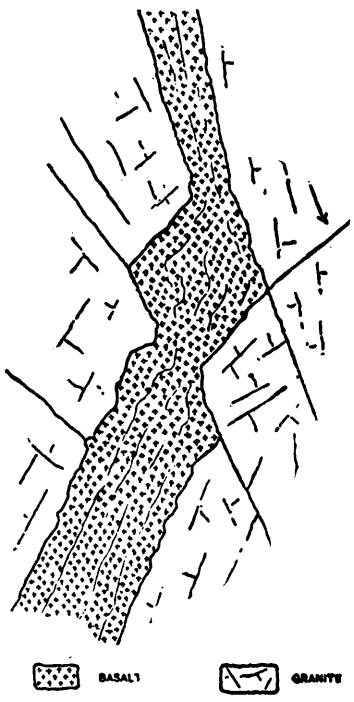
The eastern half of the vein presents, in reverse order, an exact repetition of the mineral bands just described. The separation between the rhodochrosite band and the outer quartz is more distinct. The dark sulphides also present a cleaner outline. The outer quartz has its comb-like structure strongly developed, the points of the crystals penetrating into the pink rhodochrosite and their base gradating into the dark-gray sandstone of the hanging-wall. There is not the slightest selvage or parting of any sort. The quartz is, as the miners say, "frozen" to the sandstone. The latter is marked by clouds of dark mineral hardly defined enough to be described as dendritic. This feature is traceable to the diffusion of minute particles of pyrite and stephanite. The rock is rich enough to classed as ore.

In interpreting this structure, shall we follow the explanations given for the repeating symmetry of the comb-structure of the Drei Prinzen vein,* and accept the theory of successive crystalline growth from the sides of a gaping crevasse? Or are we to conclude that the mineral aggregates, now forming the ore, were derived by the substitution, bit by bit, of rock in place by material deposited from solutions circulating along the line of fissuring?

Do we conceive of veins as formed by the filling of pre-existing cavities, whatever their shape may be, produced by the rupturing of the earth's crust, or do we believe that lodes can be formed without any previously prepared vacant space, and simply by the chemical interchange vaguely covered by the term metasomasis? or, again, do both these explanations find corroboration in the daily observations of the mine?

Walking recently along the railroad grade between Anaconda and Cripple Creek, in El Paso county, Colorado, I found in the sides of two open cuts the testimony transcribed in Figs. 27 and 28, one representing a typical dike and the other a typical ore-vein. In both cases the country is the coarse-grained, red granite of the Pike's Peak region. In both the jointing is well developed. The dark dike of basalt in Fig. 27 cuts clean through the red granite. Its boundaries are clear, there is no mistaking the line of separation. Moreover it is evident that the walls have duplicate outlines and that rupturing

FIG. 27.



A Dike.

has separated them without the destruction of their definition. The throw of the fault-fissure followed by the dike can be seen to be about 14 inches, and its direction is indicated by the arrow.

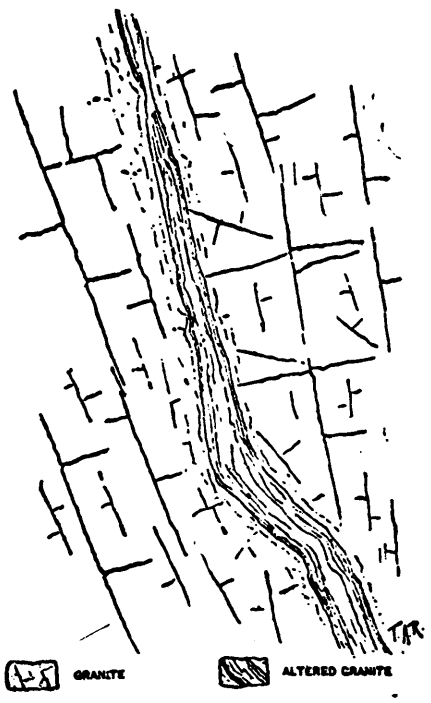
Fig. 28, sketched in the immediate neighbourhood, illustrates a gold-bearing vein in the same granite formation. Here there is no essential difference between the country and the vein-filling. The latter is altered granite, easily recognizable as such, in spite of its having become granular and soft through the kaolinization of the feldspar. The walls of the vein are ill-defined, the streakiness of the filling being dimly repeated in the encasing rock. The vein-filling assays $2.60 gold per ton at this place, but is richer, without other material change of character, a few rods distant.

The dike, Fig. 27, is composed of foreign matter filling an evident fissure; the vein, Fig. 28, is rock in place changed into ore by the removal of some of its constituents and the substitution of new ones. In the former case liquid material rose into the fissure, probably *pari passu* with its formation. On the other hand, the vein of gold-ore traversing the granite gives no evidence of the occupation of a fissure by the incoming of new material. The ore is granite in place, softened, decomposed, discolored, and impregnated with gold, but still granite, clearly enongh. Some liquid more subtle than molten lava was the vehicle which brought in the minute particles of gold and removed the alkali of the feldspar. It was water, circulating for long periods, and patiently searching out its way, which quietly changed the granite into gold-bearing ore.

As drawn by Von Weisenbach in his book published at Leipzig in 1836. Other notable examples of this structure are C. Le Neve Foster's drawing of the Huel Mary Ann lode (in the "Transactions" of the Royal Geological Society of Cornwall, vol. x'x, 1875), and that of the Carn Marth lode by J. H. Collins (in the "Proceedings" of the Institute of Mechanical Engineers, 1873). Reference may also be permitted to the writer's four colored drawings of the Eureka, Songbird, Jumbo and Kitchen veins, accompanying a paper entitled "Vein Structure in the Enterprise Mine," in the "Proceedings" of the Colorado Scientific Society for 1895.

Is it necessary in this case, as in that of the neighbouring dike, to suppose the existence of an open fault-fissure? The evidence of a fault along the course of the vein cannot be discovered with certainty; nevertheless,

FIG. 28.

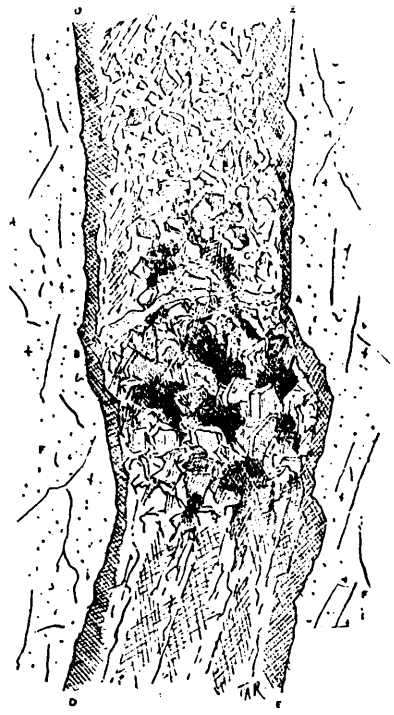


A Vein.

judging from analogy and experience, we would certainly believe that the gold has been deposited along a line of displacement. It seems difficult to conceive that any fracturing, such as marks the beginnings of vein-formation, can take place without some displacement, however slight, of the two opposing rock-faces. Without such dislocation, though it be comparatively insignificant in amount, the fracture is only latent, and can hardly be said to exist. The possibility of a simple rupture, without any shearing movement or relative displacement, cannot be denied; * but observation underground indicates that, so far as the deposition of ore is concerned, we have invariably to deal with rupturing accompanied by a relative displacement of the rock-walls. In other words, veins are generally built on fault-lines. The absence of evidence of such movement in a section on one particular plane is not conclusive, since the displacement may have been at right-angles to the section.

Where a vein cuts across sedimentary rocks, the dislocation may be looked for along the bedding-planes. Such is the case at Rico, in the Enterprise mine already referred to, where the breast of a stope will show a vein traversed by a fracture at right-angles to its walls, and apparently unaccom-

FIG. 29.



Indiana Vein, Gilpin County, Colorado.

* In this connection I would refer the reader to the suggestive paper of Mr. William Glenn on "The Form of Fissure Walls, as Affected by Sub-fissuring, and by the Flow of Rocks," read at the Atlanta Meeting of the Institute, October, 1895, and printed in "Trans.," xxv., 499.

NOBLE FIVE CON. MINING AND MILLING CO., CODY, B.C.

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YUM YUM GOLD MINE—No. 6 Lode.

MR. J. B. SMITH.

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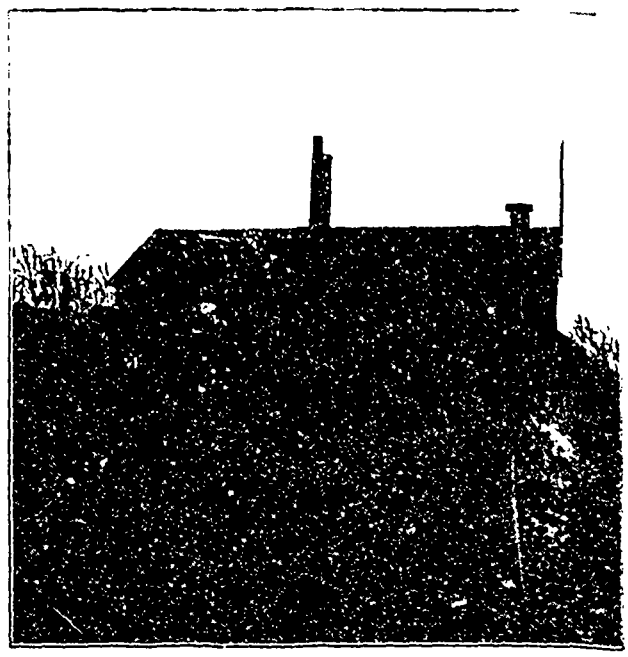
Province of Ontario.

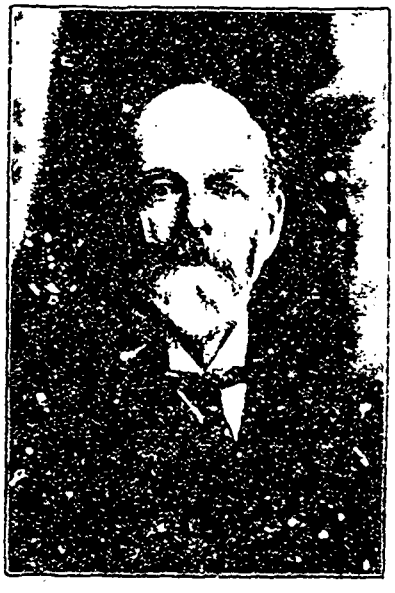
YUM YUM GOLD MINE, LAKE OF THE WOODS, ONT.—No. 6 Lode.

YUM YUM GOLD MINE, LAKE OF THE WOODS, ONT.—Open Drift, No. III. Lode.



New Mill and Shaft House at Central Rawdon, Hants Co., N.S.

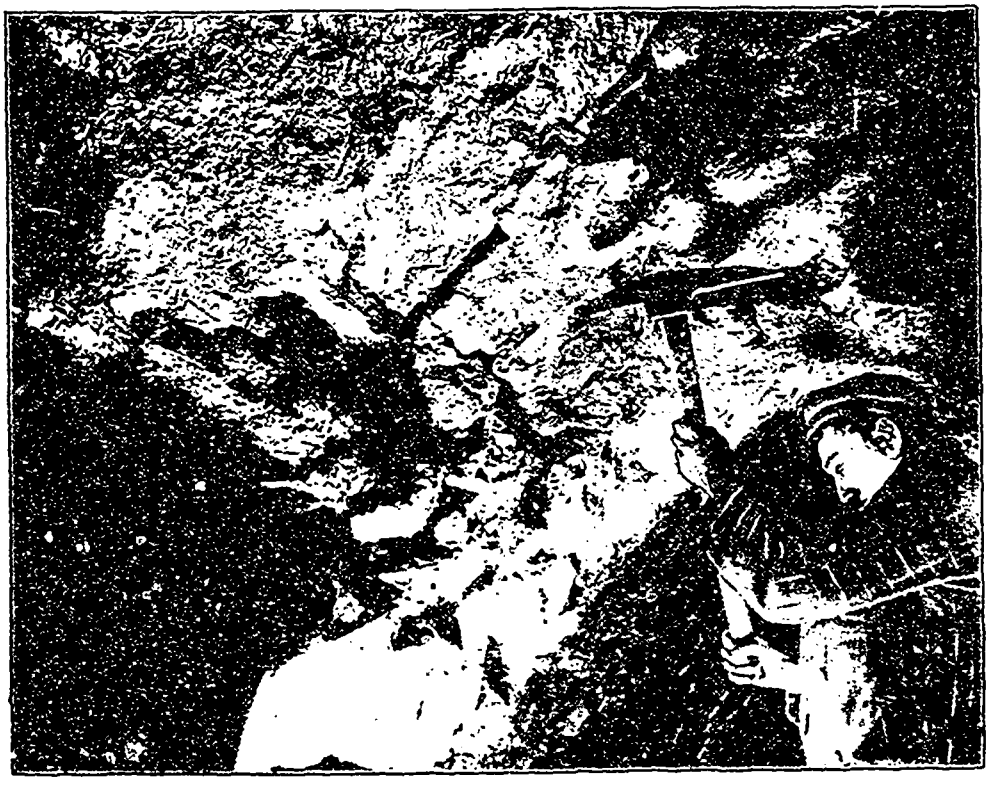
Mr. D. D. Mann,
North Star Silver Mine,
Fort Steele, B.C.



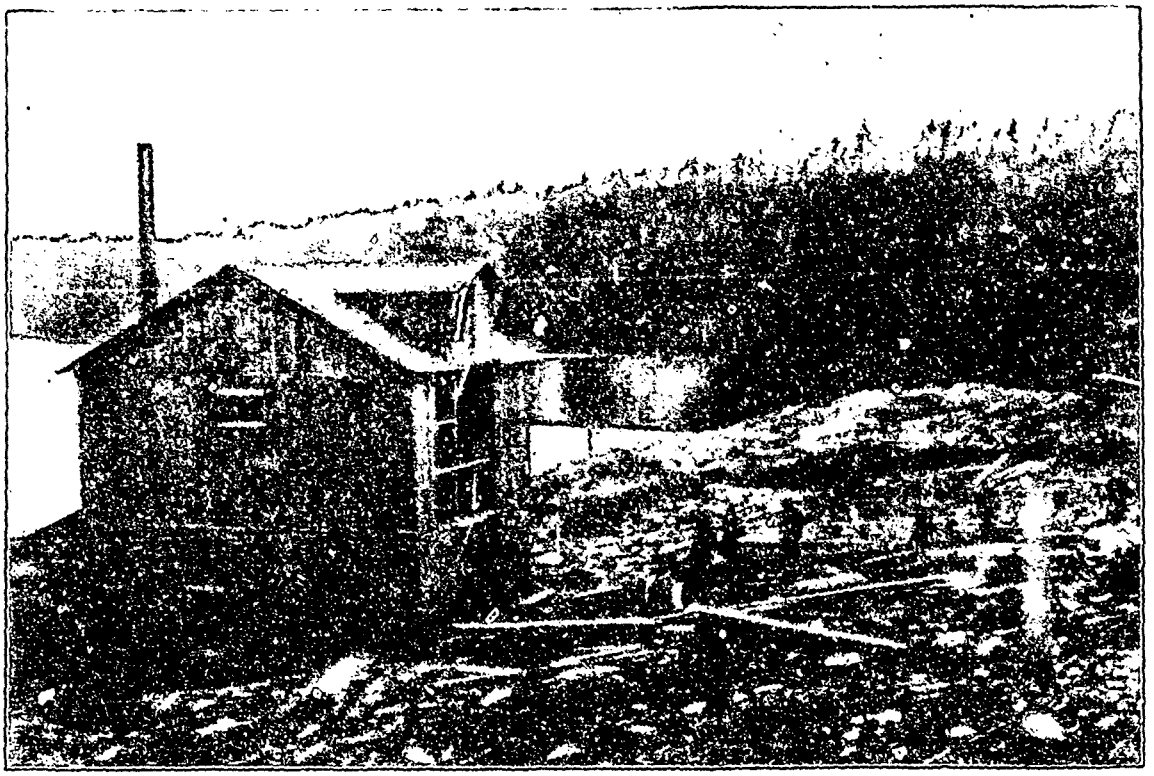
Major C. T. Dupont,
Golden River Quesnelle, Ltd.
Victoria, B.C.

Mr. Jas. Champion, C. & M. E.
Cariboo Gold Fields, Ltd.
Barkerville, B.C.

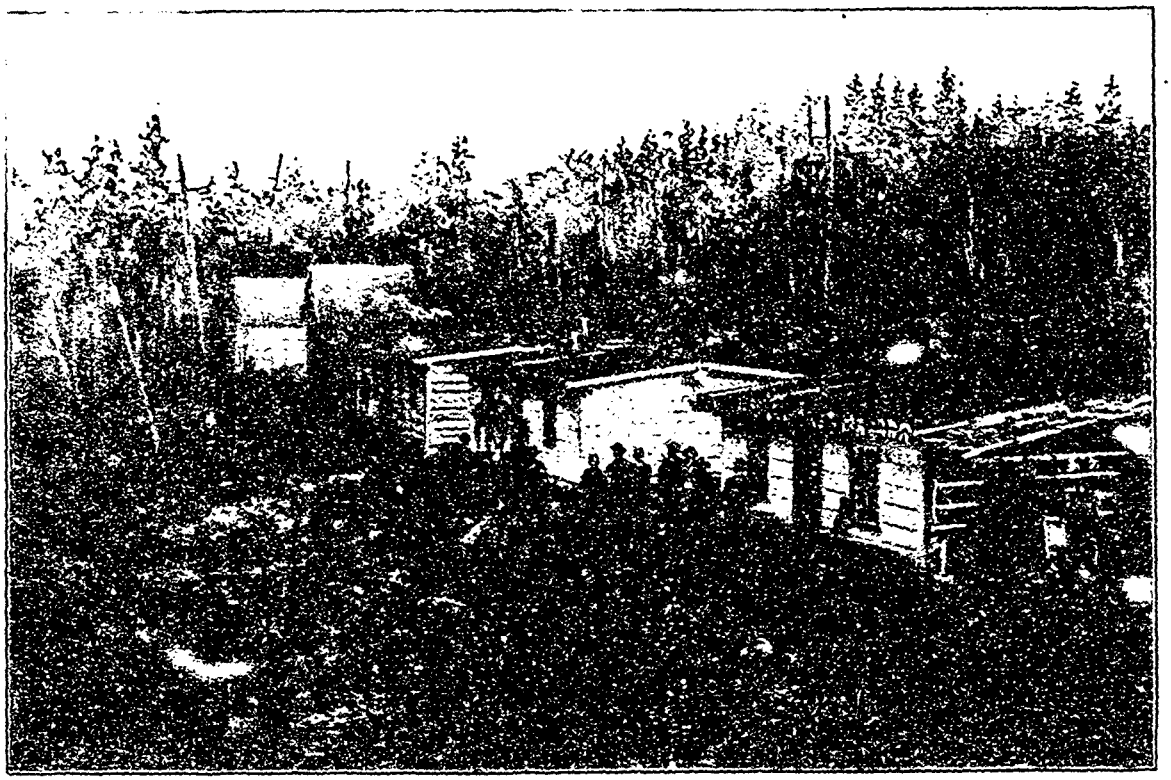
North Star Silver Mine, Fort Steele, B.C.—Solid Ore body, North-west Cross-cut 30 ft. level.



North Star Silver Mine, Fort Steele, B.C.—Solid Ore body in North-west Drift, 30 ft. level.



Stamp Battery, Crystal Mine, Lake Wahnapitae, Ont.



Camp at Crystal Gold Mine, Lake Wahnapitae, Ont.

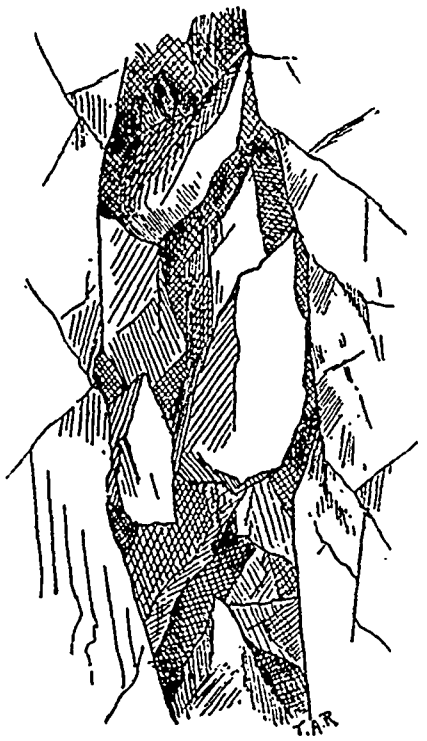
panied by any dislocation, but further examination will frequently show that there has been a displacement of the country along the dip of the sandstone and limestone beds, in the strike of the vein itself.

The question here arises, whether the formation of the ore-vein required the existence of an open fissure. In the particular case shown in Fig. 28, the quantity of foreign material within the vein is insignificant in amount; the "ore" being simply altered rock in place. That this rock became mineralized by the penetration of metal-bearing waters was probably due to the crushing of the granite by an original slight faulting movement, presenting facilities for circulation and consequent chemical interchanges. Minute spaces there probably were; but a clear opening, or a slow crevassing, such as accompanied the formation of the neighboring dike, seems hardly needed. The ribbon-structure of the Enterprise section, in Fig. 25, presents features much more difficult to explain.

When Werner and his school attributed the filling of veins to the agency of descending waters, the existence of open fissure at the time of vein-formation was conceivable, because the theory necessarily restricted such operations to the vicinity of the surface. But the acceptance of ascending waters as the main agents of ore-deposition, and the recognition of the conditions possible to the formation of large masses of sulphides, at once transferred the laboratory of ore-formation to a deeper horizon; and the suggestion that veins were filled by the deposition of layers of mineral precipitated from waters passing upward along fissures which were kept wide open during such time as was required for crystalline growth to choke them with ore, was immediately ridiculed by the miner, because his daily experience taught him that the vein once deprived of its filling did not remain open, but was inevitably closed by the pressure of the surrounding rock. In many cases, in the absence of artificial means of support, his mine-workings collapsed, so that where there was once a level wide enough for a man to walk through, there came to be only a seam of mud enclosed in shattered rock.

Despite the miner's objection, however, there is evidence that fissures do sometimes occur, which have been sufficiently open to permit the tum-

FIG. 30.



Mammoth Mine, Arizona

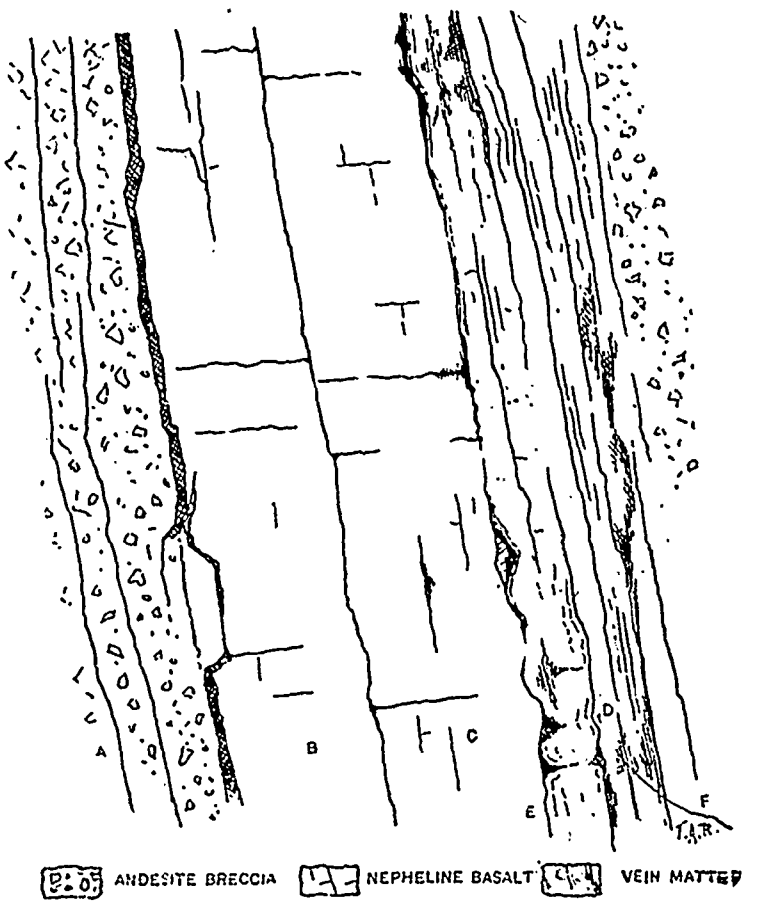
bling in of large pieces of rock. Such an occurrence was observed in connection with certain faults which disturb the Virginie lode at Roure, near Pontgibaud, in France,* where, at a depth of 164 feet from the surface, a fault-fissure encloses a mass of clayey material containing boulders of a black, soft and porous rock, which can be identified as pieces of scoriaceous lava. No such rock occurred elsewhere underground; and the boulders must have been portions of the Quarternary alluvium which covered the outcrop of the lode, and fell into it at the time of its intersection by an open fissure, which long post-dated the formation of the ore-vein itself. The mines are in a district which has frequently been subjected to earthquakes, and in the heart of a region formerly the scene of great volcanic activity.

We must be careful, however, to distinguish between the formation of cavities within the zone of the vadose circulation, and their existence in "the deep," where sulphide ores have their origin.

Two examples may be quoted. The first is shown in Fig. 29, sketched November 25, 1895, in the stopes above the 800-foot level in the Indiana mine, Gilpin County, Colo. The lode, which is the California vein, in its extension westward from the Hidden Treasure mine, is about two feet wide. There is no parting or selvage separating it from the country. The latter is a quartz-feldspar rock, best described as granulite. Near the lode it is seamed and sprinkled with pyrite, and sufficiently gold-bearing to be sent to the stamp-mill. The main pay-streak is almost entirely composed of black zinc-blende, which, by candle-light underground, contrasts strongly with its

* See Etude sur les gites metalliferes de Pontgibaud, par M. Lodin, Ingenieur-en-chef des Mines. Annales des Mines, April, 1892, and "The Lodes of Pontgibaud," by the writer, in Eng: and Min: Jour:, August 11 and 18, 1894

FIG. 31.



The Moose Vein, Cripple Creek, Colorado

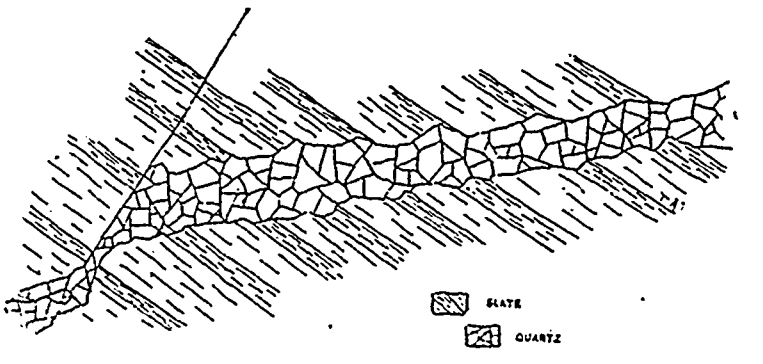
encasement of light gray country. The upper part of the vein, in this particular stope, consists of a breccia of zinc-blende, with an occasional spattering of wall-rock, the latter so disintegrated as to resemble gravel. At one point, A B, there is a shred of wall-rock lying across the vein. Lower down there are a number of cavities of vugs scattered among angular fragments of ore. It all looks loose, like an old stope filled with ore that has been mined, but the material is hard and difficult to detach without explosives. Lower again, the vein loses both its cavernous and its brecciated character, and consists of a compact body of blende. It may be added that, even where the brecciation is most evident, both walls are lined with a few inches of ore, unbroken and firmly attached to the wall-rock into which it gradates. The vugs, when first found, were full of gas (CO_2, probably) and the miners suffered from bad air when working in ground of this character. The pieces of blende are held together by a siliceous cement, which also covers each fragment in the form of a grey-blue chalcedonic coating. It is almost certain that the cavities above described contained water, previous to the drainage of the ground by the penetration of the level underneath.

Another instance is suggestive. In the Mammoth mine, Pinal County, Ariz., already described, the granite in the east cross-cut at the 300-foot level, north, has an extraordinary number of fissures partially occupied by broken pieces of rock, so wedged in as to leave open spaces. The pieces are not of any foreign rock, but are identical with the enclosing granite. Fig. 30 is a reproduction from a sketch made on the spot, March 15, 1893. The elongated cavities, such as that illustrated, were found full of water when first reached by the cross-cut; but they became drained as the workings tapped them, and thereby depressed the water-level of the mine.

This instance suggests why mining excavations collapse, and yet a natural cavity underground might remain open. The former contains unconfined air only, while the latter may be filled with a confined and practically incompressible fluid, water.

It is the usual experience in mining that when the abandoned workings of a mine are flooded they are less likely to collapse than when they are dry.

FIG. 32.



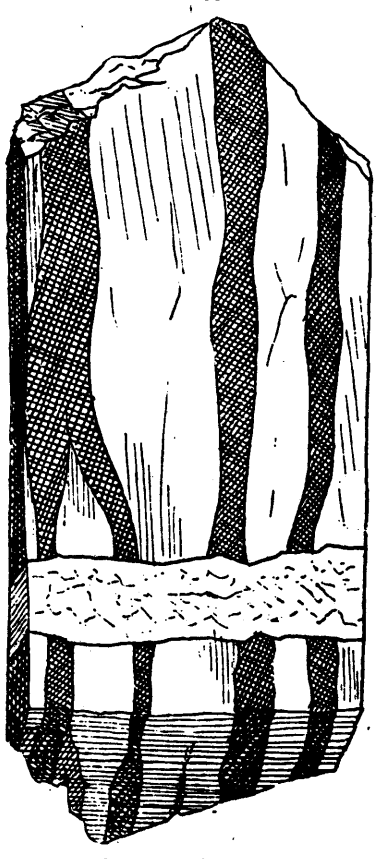
Drumlummon Mine, Montana.

This is due partly to the exclusion of air, and partly to the sustaining power of the water itself, as suggested by Mr. P. Argall, in the *Eng. and Miu. Jour.*, September 23, 1893, p. 314.

The formation of the hollow spaces occasionally seen in veins is, I believe, in most cases subsequent to the ore deposition, and may therefore have taken place at a time when erosion had brought that portion of the vein near to the surface. The Indiana section, Fig. 29, shows that the cavities have been produced by the shattering of a vein of zinc-blende already formed. The only occurrence of later date is the consolidation of the mass by the agency of water bearing silica, unaccompanied, so far as can be seen, by the deposition of any metallic minerals. In the Mammoth mine, Fig. 30, the blocks of rock wedged within the cavities were coated with crystals of vanadanite and wulfenite ; but there seems to be no connection between the presence of these later minerals and the formation of the ore-bearing parts of the lode. They are the result of secondary processes, of which the upper part of a lode is the characteristic zone of activity.

The vein in the railway-cut, cited above as a type, presents a filling readily recognizable as simply altered rock, containing only an insignificant percentage of material foreign to the composition of the original granite. Nor is this an abnormal type of vein-structure. The rich gold mines on the adjacent hills afford numerous examples of this very kind of lode formation. (And incidentally I would say that I know of no mining district which illustrates modern views on ore-deposition so clearly as does Cripple Creek.) Of such mines I would quote the independence vein, whose richness is such as to cause its commercial value to obscure its scientific interest. It does illustrate very aptly, however, this part of our enquiry, because the ore is so very evidently only altered country-rock. In 1893, when the workings had not penetrated far from the surface, the carloads of ore sent from this mine to the Denver smelters gave the impression that some one had blundered, and either shipped waste from a cross-cut or else switched cars of ballast into the place of loads of ore. One could see that it was the normal Pike's Peak granite with its big pink feldspar, but it required a trained eye to note that the mica had been largely removed, leaving small

FIG. 33.



Drumlummon Mine, Montana.

iron-stained patches. It was ore by courtesy, because there was enough gold present to give it a certain commercial value ; but to the petrographer it was clearly granite, not much altered, and but slightly mineralized.

The vein leaves the granite, and, going northward, penetrates into andesite breccia. Its character remains the same ; the ore is still altered country-rock ; only now it exactly reproduces the structure of its new encasement, and the habit of the andesite breccia is quite evident, although blotches of sylvanite and fluorite may occasionally try to obscure it. The strike of the vein, its width, its richness, all appear unaffected by the passage from one formation into the other, while the change in the structure of the ore is so marked as to render it easy for the observer to know what is the enclosing rock without looking at the walls.

In a case such as this—and it is not abnormal—it is not necessary to suppose the original existence of an open cavernous fissure, since the material of the vein is the material of the rock which was there before vein formation began. The vein follows a line which became a path for metal bearing waters. Minute interspaces there probably existed, such as would be produced by the crushing and slight dislocation of particles of rock lying along a line of fracture ; but a clear opening, a crevassing, such as accompanied the origination of the dike, seems hardly needed.

Occasionally, it is true, we do find veins full of minerals foreign to the encasing rock, and so symmetrically arranged in bands having a comb structure as to suggest to many investigators that they were formed by successive crystalline growth from the walls of a vacant fissure. Such, no doubt, would be the interpretation given to the section of vein illustrated in Fig. 25. The reversed repetition of the quartz, rhodochrosite and sulphides is evident enough ; but the most striking feature to me is the equal width of each of the two bands of the same mineral. Each vein of mineral would seem to have been fractured exactly in the middle, previous to the deposition of the next succeeding one.

This specimen, and numerous similar structures in the same mine, indicate that the rhodochrosite was the first laid down, replacing, in part at least, the crushed rock which encased an original line of fault-fissuring. Subsequently another fracturing occurred, and this time the line of least resistance was the rhodochrosite itself, which, being homogenous, broke down its center. The shattered carbonate offered an easy prey to the sulphide-bearing waters which laid down the blende and galena. The presence of bits of rhodochrosite within the sulphide band indicates that the substitution was irregular. Later, new disturbing forces were at play, and the vein was fractured not only along its middle, as heretofore, but also along the lines of its contact with the encasing rock. These fractures were healed by the deposition of quartz, accompanied first by iron and copper pyrite, and then by rich silver-bearing minerals, such as the stephanite. The corrosion of the sandstone on the hanging had on that side irregularly widened the vein so as to give it greater strength ; therefore the next movement, the last, took place along the foot-wall. This apparently resulted in nothing save the crushing of some of the encasing rock, and the formation of a selvage, whose removal produced the cavity which was so striking a feature of the stope.

Another typical illustration of this structure is presented by the Amethyst—Last Chance vein (at Creede, Colo.,) which is certainly a magnificent example of an ore-break.* The country-rock, trachyte, has undergone multiple fracturing, and ore has been deposited along the division-planes, so that there are walls *ad libitum*. The regular ribbon-structure produced by the deposition of agatized quartz in a sheeted rock is very beautifully marked, and the same process of silicification is further evidenced in those places where the lode consists of breccia, composed of pieces of country covered by concentric layers of agate. The lode itself is much wider than the pay-streak of silver-ore which usually follows the foot-wall. On the hanging the boundary between vein and country is fairly discernible ; on the foot less so, because for several feet beyond the ore there is a red jasperoid which gradates into country.

In the Enterprise example, Figs. 25 and 26, each succeeding fracture occurred in the mineral deposit which had healed the previous fracture. In other instances the mineral deposit appears to have proved harder than the encasing rock, and the second fracturing took place near the original one, but in the soft rock rather than in the hard vein, thereby producing a new break parallel to the first one, and close to it, causing a repetition of vein-walls such as have already been described in connection with the sections given in Figs. 1, 9, 10, 15 and 21. Or there may be the production of companion-fissures forming contemporaneous veins, such as are shown in Figs. 13 and 19. Finally, the companion-fissures may be so multiplied as to cause a sheeting of the country, and the formation either of one vein and several, subordinate, smaller and parallel to it, as in No. 15, or of a series of ore-streaks united by mineralized country, so as to form one large lode, as seen in Figs. 5, 14, 17 and 31.

The evidence of a multiplicity of fracturing, whether successive or contemporaneous, is the clue, I venture to believe, to many of the anomalies of vein-structure. No district within my knowledge so well illustrates this aspect of the inquiry as Colorado's new El Dorado, Cripple Creek, in El Paso county, where gold-veins occur as mineralized and enriched portions of dikes, phonolite and basalt, traversing masses of andesite tuff and breccia. Other types are observable, but these are to-day the most characteristic. The mineralized rock forming the vein, and that less distinctly gold-bearing country which encloses it, have been subject to such multiple fissuring as to produce a very marked division of the rock into parallel bands or sheets, which may be a fraction of an inch apart or several yards. This structure can be seen no less in hand-specimens than in blocks an acre big. The Moose vein, on Raven Hill, is a fair example. It is illustrated in Fig. 31, as seen October 27, 1895, in the back of the sixth (or 350-foot) level. A is andesite tuff and breccia, B C D is a dike of dark, blue-gray nepheline basalt, sub-divided into two barren parts, B and C, and one ore-bearing portion, D. Native gold and telluride compounds (sylvanite and calaverite) occur along the seams in the basalt where it is decomposed and iron-stained. The pay-streak extends from E to F, about 10 inches.

This sheeting or multiple fissuring was probably the result of shrinkage accompanying the cooling of the volcanic rock. The fractures have a contemporaneity of origin quite distinct from the successive ruptures discussed in connection with the ribbon-structure of the Enterprise section. The latter were marked by the precipitation of diverse minerals, while those of a Cripple Creek vein are characterized by a similarity of mineral deposition.

Cases also occur where there can be discerned a combination of both these types of multiple fissuring.

A line of weakness, or even a region of weakness, once developed in the earth's crust is apt to continue to be a line of least resistance available for future fracturing. Even when a quartz-vein is formed along a line of rupture, healing the break and strengthening it with a substance harder than the rock-walls themselves, we may suppose that the next break will take place along the line of weakness presented by the imperfect cohesion existing along the plane of contact between the hard quartz and the less resisting rock.

The gradual penetration of mineral solutions into the immediately encasing country may finally obliterate the divisions due to multiple fissuring. The sheets of rock separating one from the other would be replaced by ore, and nothing might remain of the original structure save faint partings in the lode, such as are less evident to the eye than to the hand of the miner, who instinctively uses them to assist him in breaking ore.

* At Red Mountain, in Ouray county, Colo., it has been the practice to speak of the veins (the Guston, Yankee Girl, and other celebrated lodes) as "ore breaks," a break in the rock accompanied by ore—a term, it seems to me, much preferable to "fissure-veins."

Thus, I believe, the collection of observations in various mining districts tends to the modification of that idea of clean-cut definition which accompanied the early ideas of vein-structure. The evident contact between two dissimilar rocks, such as is seen along the walls of a dike, will be often found in veins to be replaced by an indistinct gradation from mineralized to unmineralized rock, originally the same, but now rendered unlike by the selecting action of chemical solutions.

We are justified, however, in putting some limit to the depth of possible ore-formation, since that formation is dependent on the presence of water. The record of the largest number of careful observations has shown that as we sink into the earth the increment of temperature is 1° F. per each 48 feet of descent. At this rate the critical point of water would be reached at 34,704 feet, or 6½ miles from the surface. Where the temperature is that of the critical point (773° F.) water cannot exist as a liquid no matter how great the pressure, but becomes dissociated into its gaseous elements. Moreover, we are warranted in believing that the thermometrical gradient becomes more rapid at depths beyond those reached by human observation, because of a decreased conductivity in the rocks, or as Professor Prestwich, the best authority on these matters, puts it :*

"Taking into consideration the probable limitation of the percolation of water, and the possible dimunition of conductivity with increase of depth, if there should be any alteration in the thermometric gradient, at great depth, it will be more likely to be in the direction influenced by these more or less certain factors."

Therefore, taking these conditions into consideration, we may expect the circulation of water to cease at 20,000 feet or thereabout. But at the maximum depth the maxima of temperature and pressure must obtain. It must necessarily be a horizon of solution. Precipitation would hardly begin until a lowering of the temperature and a lessening of pressure permitted it. The deposition of ore is the direct result of precipitation ; therefore actual ore-formation is likely to be limited to a depth often of 15,000 feet.

It is not difficult to surmise why clean-cut fractures are not necessarily most favourable to ore occurrence. In the Drumlummon mine, Montana, the distribution of the ore appears to be connected with the change in the angle of intersection between the course of the veins and the strike of the slate country. Most of the ore-bodies have been found where the course of the veins (N. 15° E.(cuts the slates at an oblique angle, and the levels run out of ore when their direction is either at right angles to, or conforms with, the strike of the country (N. 17° W.)

Fig. 32 is a sketch made in one of the surface-workings of that mine, which illustrates in miniature the fact above noted. It represents a small quartz-seam 2 inches wide, traversing the slates, whose structure is very clearly marked by the color bands following lines of original sedimentation. Near the left of the sketch the quartz follows a joint and becomes narrowed, while where it crosses (along a line of slight dislocation) the country it has irregularities and bulges which answer to the alternatiug slate bands. A rough, ragged fracture, when continuous, may be expected to offer more surface to solvent action and more, but not too many, obstacles to a rapid circulation of underground waters. Its structure also means more opposition to the closing in of the walls, because the irregular faces of the fracture, when they come together, leave openings which, if not along one section then along another, have intercommunication, and so permit of a passage which would be badly impeded, if not absolutely stopped, by the closing in of smooth walls.

Fig. 33 represents, to actual scale, a piece of slate enclosing a quartz-vein, which came from near the end of the 700-foot level, also in the Drumlummon mine. It so happens that this is a true illustration in miniature of what the lode itself is doing at this point. The New Castletown lode, on which the level is driven, is at this point cutting at right-angles across the bedding of the slates and is barren of ore. In the hand specimen, reproduced in the drawing, a quartz-vein, not quite half an inch wide, cuts perpendicularly across the slate whose bedding is rendered beautifully marked by dark bands. The vein has a uniform width, it has regular well-defined walls guiltless of the projections and bulges noticed in the previous illustration. It may be only a convenient coincidence, but it is a fact that the quartz in Fig. 25 was opalescent and destitute of other minerals while that in Fig. 24 was true ferruginous vein-quartz.

Thus underground work bears daily testimony to the close dependence of ore-occurrence upon the geological structure of the enclosing country, a relation, the importance of which Mr. S. F. Emmons has done invaluable service by clearly stating in more than one of his contributions to the *Transactions*. Wanting a proper understanding of the structure of the rock encasing his vein, the miner gropes but blindly in a maze of tangled phenomena until the geologist, by their proper elucidation, gives him a light which dissipates much of the darkness obscuring his progress underground.

Economy in Mining.

(Excerpted from Mr. G. C. Mitchell's Presidential Address to the members of the Mining Institute of Scotland.)

Every year it becomes increasingly necessary to pay attention to economy in mining, and to-night I desire to speak to you on the importance of accuracy in the attention to details, and specially on the necessity of cultivating what may be called the arithmetical or mathematical faculty in dealing with such matters, or, in other words, the necessity of making the most careful preliminary calculations in connection with all the details of colliery management, or of submitting everything to the test of figures.

All recognize the necessity for careful calculations, and yet all will admit that it is exceedingly difficult to look at all sides of a question, to think of the various difficulties which may arise, to provide for these, and to adopt the policy which is likely to give the greatest economy and efficiency in any particular case. It is possible to cultivate the critical faculty requisite for making these calculations, and it is very necessary for all engaged in colliery management to do so, whether possessed of great experience or not. It is true that long experience enables many men intuitively to know, with fair certainty, what should be done in certain cases ; but even men with long experience may make mistakes, through the want of full consideration, especially as the constant progress of mining science makes it very necessary to consider arrangements in the light of the latest improvements. It need hardly be stated that experience is required in making the calculations.

The necessity for these careful calculations is evident in every stage of the development of a colliery, whether it be the choice of a mineral field, the choice of the position for the shafts, the fitting up of the machinery, the laying out of the workings, or the conducting of operations when the colliery is started.

Those who have been looking for coal-fields know how difficult it is to form reliable conclusions regarding the value of any particular field. This is so in all cases, but especially if the field is not in a well proved district.

The consideration of the value must take into account the position of the field as regards markets, the quality of the coal, the proportion of round coal to dross, the cost of working at the face, the cost of oncost due to the special circumstances of the field, the quantity of water, the output to be got and disposed of, the cost of sinking and fitting, the lordship to be paid, the cost of management, depending to some extent on the kind of coal to be disposed of.

As the profit on the working of coal per ton is, in average years, small at the best, and as it takes very little to turn an expected profit into a loss, it is evident that very careful calculations are necessary before expenditure is incurred. All the points named are of great importance, and an error with regard to almost any one of them may result in the outlay on an unprofitable subject or the rejection of what might be a fair venture.

The question of the expenditure involved must receive special attention, and it is worth while noting that a colliery where a large output can be got for a small capital may be a profitable undertaking over a series of years, even if it will not pay in bad times.

For example, take two collieries, each capable of producing 120,000 tons per annum of coals of the same value—(1) one which can be worked for a capital of £15,000, and (2) one for which a capital of £36,000 is necessary, the latter having a clear advantage over the former in the cost of working of an average of 6d. per ton, which is a very considerable advantage.

Let the value at the end of 21 years, including working capital of (1) be £6,000, and of (2) £9,000. Allowing interest on capital at 5 per cent. and redemption at 4 per cent., the interest and depreciation on (1) will be £1,031 yearly, or 2·06d. per ton, and on (2) £2,645 yearly, or 5·29d. per ton, being a difference in favor of the former of 3·23d. per ton. And this difference reduces the advantage in working costs to 2.77d. per ton.

Suppose that (1) makes a loss during some years, but makes over six years £6,000, or an average profit of £1,000 per annum, being £6 13s. 4d. per cent. on £15,000, (2), with the advantage of 2.77d. per ton, will make £14,310, or £2,385 per annum, being £6 12s. 6d. per cent. on £36,000.

This is only a rough illustration, but is sufficient for our purpose. In the circumstances, over a series of years, the colliery with the dearer working would give a slightly better return to the shareholders than the other. Consideration, of course, must be given to the fact that as much energy must be devoted to the superintendence of a concern which gives interest on a small investment as in the case of another where a larger capital is invested. If the companies are limited companies this would not be of any consequence to an ordinary shareholder who held the same amount of capital in both concerns, nor to the managers if the same salaries were paid in both cases. It would be of great consequence to an owner who superintended his own collieries, and who desired to invest as much as £36,000 in colliery property.

The same illustration clearly shows that it may be worth while to pay a large price for a really first-class colliery which yields a good return in bad times as well as in good.

The choice of the position of the shafts for a new field must depend on many things, such as the shape of the field, the dip and rise of the strata, the facilities for railway accommodation, the suitability of the ground for sidings, the position and size of dykes and faults, the quantity of water likely to be met with, etc. It is impossible for any general rules to be framed which will cover all circumstances. Perfect satisfaction with all the points to be considered cannot be got in any case, and all that can be done is, after the fullest consideration of the advantages and drawbacks of the different positions, to adopt the best possible solution of the particular case. Improvements in mining must be taken into account in the consideration which influence a choice in this as in other departments of mining. For example, the successful application of hydraulic and electric pumping-plant of recent years has to some extent overcome the greatest difficulty in connection with dook workings, and made it not so necessary as formerly to fix the shafts as nearly as possible at the extreme dip of the field. In certain circumstances dook workings may be quite as cheap as rise workings, and in some cases even cheaper. Capital outlay may, therefore, sometimes, be saved by sinking to a less depth than might, at one time, have been considered necessary.

The shape to be adopted for the shafts requires careful attention. It is strange that so few circular shafts have been sunk in Scotland. They have many advantages over square and oblong shafts.

In choosing the machinery to be adopted in fitting up a colliery, attention must be given to many considerations, such as the kind of coal to be treated, the life of the colliery, the probable output, and the nature of the markets to be secured. The calculations to be made must take such things into account as safety, efficiency, first cost, cost of upkeep, and cost of working, and there must be a due weighing in the balances of the different advantages and disadvantages of different suggested arraugements, and, when an arrangement is decided on, all details must be so carefully considered that no part will interfere with any other part. The plant should be thoroughly substantial, so that stoppages through breakdowns may be of very rare occurrence. It is a false economy—even at a great saving—to have plant that gives trouble in this way, as idle days are a source of great loss, and are apt to come at the most unfortunate and unexpected times. The plant must be sufficient for its work and machinery for ventilating purposes must have very special attention.

Perhaps none of the plant about a colliery at the present time is of greater importance or calls for more attention than that for handling the output on the surface, and such plant must vary in different circumstances

* "Controverted Questions of Geology," by Joseph Prestwich, D.C.L., F.R.S., etc., Macmillan, 1895, p. 247.

The aim should be to secure economy in the cost per ton of output, and also so to prepare the product of the mine that the best possible price can be realized. At one colliery simple plant only may be required, while at another more complicated machinery may be desirable.

There is a growing necessity for the careful handling of coal in all cases, and apparent extravagance in seeking to secure the best result may be well justified.

Take for example a colliery that is being fitted out with the expectation that an output will be got of 450 tons per day, or say, 112,000 tons per annum for 15 years. This colliery might be fitted with old-fashioned screening-plant, at say a cost of £500, or even less, and some engineers might consider this a sufficient sum to spend in the circumstances; or it might be fitted with good screening and cleaning-plant and washer for say £3,500, which seems a large sum until it is put to the test of figures.

The difference is £3,000, less say £500 more to be realized for the machinery at the end of the lease in the one case than in the other. Calculating interest at 5 per cent. and redemption at 4 per cent., £2,500, the extra outlay, is equivalent to £250 yearly; £500, the extra amount to be realized at the end of 15 years, at 5 per cent. interest, equals £25 yearly; extra upkeep per annum, including repairs, fuel, oils, grease, etc., equals say £125—total, £400 yearly. For the output named this annual amount is equivalent to 0·85d. per ton. There are few circumstances in which such a small difference per ton would not be more than covered by the extra price to be realized by the careful preparation of the coal. No account is taken here of the cost of washing, which must go against the extra price to be got for washed dross. There is, in addition, the probability that a more ready sale will be got. The result of the calculation would be much more favorable for a colliery with a larger output and a longer life.

Of recent years great attention has been paid to the construction of pitheads and to devices for saving labor. That such attention will be amply repaid is plain, when we consider that for a colliery to last 15 years on the same basis as in the last calculation, the saving of one man on a pithead, or £50 per annum, will allow a capital expenditure of £500. Gradients so arranged that four lads at 13s. 6d. per week can do the work of four men at 18s. per week will justify a similar outlay. The saving of a horse, at a cost of say £40 yearly, will allow an outlay on the railways of £400.

Then, as regards the kind of boilers to be employed, the saving of 4 tons of fuel per day for 15 years at 1s. 6d. per ton, or say £110 per annum, less say £30 yearly for extra repairs required, will allow an additional expenditure on boilers and heaters of £800, without taking into consideration the extra value at the end of the period and the saving of labor which results from the smaller consumption of fuel.

Too much must not be spent for economy in working. Take an example from another industry. Triple-expansion engines for steamships are looked upon as a necessity for economical working, and yet it has been contended with much force that for a river steamer, running only for a few months in the summer in a place where coal is cheap it is true economy to save the first cost by making use of the old-fashioned single-cylinder engine, even at the cost of a considerably increased coal-consumption.

According to the same reasoning, in fitting up plant for a small field to last only for a few years with a small output, it may be best to fit up second-hand engines and cheap boilers. Each case must be considered by itself.

Where it is not desired to invest a very large capital in a concern, arrangements may be justified which are not economical. In such a case care paid to the designing of arrangements may make it possible for improvements to be gradually made out of profits or otherwise when it is considered advisable to invest more capital in the concern. Carelessness in the attention to such details may put the colliery in the possession of many which require such radical alterations to put them right that the owners hesitate to spend the money required.

The most careful consideration must be given to the details of all the arrangements in developing the colliery underground, and in the conducting of all the various operations in connection with the output of coal. Much money may be saved by the careful laying out of pit-bottoms, and for large outputs, a large expenditure may be necessary.

The question of the kind of haulage to be adopted is important, and must be considered in relation to the nature of the roof, etc. The cheapest working haulage may not be the best, if it involves large outlay and heavy expense for upkeep, and, on the other hand, considerable extra first cost in roads and haulage may be justified by subsequent economy in working.

In considering the question of the system of working to be adopted and the laying out of these workings, all available data must be made use of. The comparative cost of working at the face of the difierent systems, the upkeep of roads, the cost of timber, the output that can be got, all call for consideration in estimating the advantages and disadvantages of each system.

For a large field it may pay well to experiment carefully with the different systems of working, where there is a doubt as to which is best, and the same may be the case in the consideration as to which of two seams should be worked first.

Concentration of output should be aimed at. Perhaps too little attention is paid to this, and it might be of advantage at times to make out cost-statements, not only for different seams, but for different sections of the same seam. It may be necessary to push the output of a small section by putting in extra men, or by double shifting, even at a considerably higher cost per ton at the face, if the cost is high for upkeeping the roads to the section, or for the haulages. If statistics were noted on this point some surprising results would be revealed. The same thing holds when a seam is nearly exhausted and the output small. The oncost becomes high and the cost for timber and other material is excessive. In addition to the general saving on the upkeep of roads and on haulage by concentration of output, there may also be a saving in the cost of the inspection necessary under the Mines Regulation Acts.

In connection with this point, it may be noted that the saving obtained by the use of coal-cutting machines, owing to the increased output from the face, may be greater than is generally supposed.

Take as an illustration a case from experience. A road, 1,188 feet in length, cost for upkeep for three months, £7 18s. 6d. for timber and £22 14s. 3d. for wages, or a total average per fortnight of £5 2s. 1d. Owing to the arrangement of workings, the entire length of working-face in connection with this road is 462 feet. The probable output from this face by hand-labour would be about 500 tons per fortnight, and the quantity that could be worked by a successfully operating coal-cutting machine would be about 1,000 tons for the same period.

The cost of the upkeep of the road on the basis of the actual cost for the three months in question would be 2·45d. per ton for hand-labour and 1.22d. for machine-cutting, showing a saving for the latter of 1·23d. per ton. In addition to this saving there would be the lower cost of haulage in favor of the machine, owing to the larger quantity taken over the same road.

It may be found of advantage to obtain concentration by the driving of cross-cuts between seams even at considerable expense, especially if a road with a good roof can be used for a seam where the roof is bad. By this means one haulage may be made to do the work of two, and, within reasonable limits, the larger the quantity to be drawn by a haulage the cheaper will be the cost per ton. By such an arrangement also, coal may sometimes be worked which would otherwise require to be left in to protect main roads, etc.

As showing the necessity for careful attention to every detail in colliery working an example may be given from experience in connection with haulage. At Gateside colliery, all the haulage is worked by means of a band-rope from the surface. This band-rope works in all five haulages, two in the ell coal-seam and three in the main coal-seam. In passing down the shaft and from the one seam to the other it goes over in all 14 pulleys, three of which are clip-pulleys, and none of which are less than 6 feet in diameter.

For the first few years after the haulage was started, the rope gave a great deal of trouble, and only lasted from 6 to 10 months. There was so much difficulty experienced in keeping the splice right that it was inferred that there was a great strain on the rope, and a heavy rope was used, it being got four times in succession 1⅛ inches in diameter. The ropes were got of various qualities, and for 33 months the cost was £358 17s., or £10 18s. 5d. per month. In order to ascertain really what power was being used, and what size of rope was actually required the engines were indicated. The diagrams showed only about 30 horse-power, when the engines were working with their heaviest load, and, by calculating the strain on the rope, it was evident that a smaller rope ought to do the work. The next rope was got ⅞ inch in diameter, and of improved steel. Two ropes of this description lasted 26 months, and cost only £63 6s. 5d. or £2 8s. 8d. per month. The saving in ropes therefore, on the basis of these results, has been £101 17s. per annum, and the smaller ropes have done quite as much work as those previously in use. The large ropes were apparently too heavy and stifi for their work, and damaged themselves by their own weight and by going over so many pulleys.

It might be a profitable calculation to consider how far it is wise to use slow speeds for band ropes, and whether higher speeds, with gearing in connection with the haulage-machinery belowground, could not be adopted with advantage. Ten miles per hour would not be too fast for a rope to run in a shaft: with such a speed, a very small rope would be sufficiently strong, and probably there would be less wear of the driving-pulleys.

It is a point worth noting that where any expenditure is found desirable with the object of making a saving in working costs, it is best to do the work as quickly as possible. There is often a strong temptation to spread such expenditure over a lengthened period, so that the oncost charges for any fortnight may not be unduly increased. This is not true economy, nor will it be found so when reduced to the test figures. Take for example an outlay, say on mine-driving, of £200, which will, when completed, give a saving of £3 per week.

Say that this work may be executed at the soonest in 2 months, or that it may be spread over 5 months. At the end of 5 months, the gain of the former method, on the basis of the same rate per fathom in both cases, would be as follows:—

	£	s.	d.
Three months at £3 per week, say	36	0	0
Interest, say	1	12	0
Total	37	12	0

In this case, therefore, £237 12s. spent in 2 months is no more, as regards results, than £200 spent in 5 months, and it would be worth while to pay a considerably increased rate to get the work quickly completed.

The question of when repairs should be executed is a matter for careful consideration. "A stitch in time saves nine" in many cases, but at the same time, while plant should be kept in good order, it is difficult to keep everything in perfect condition, and it may be better at times to have a little waste than to have constant expenditure.

Improvements in the Stamp Battery.

Is the stamp battery capable of further development? Apart from modification of detail, there would seem only two directions in which development may be expected. The one is the better adaptation of the battery to dry crushing. The other is the introduction of variable adjustment, enabling one and the same battery to stamp any class of ore. In dry crushing by stamps, one of the difficulties is that the discharge does not keep pace with the crushing. Unless there is instantaneous and thorough screening, the output is reduced, and, as the fines are ground still finer, while the larger pieces are in process of reduction, a perfectly uniform product is not obtained. Screening is sometimes accelerated by means of an exhaust, but attempts are now being made to supply intermittent blasts of compressed air low down in the mortar, so as to get rid of the fines as quickly as they are formed. Unfortunately none of these improvements can be effected without discounting a valuable advantage of the stamp battery—its simplicity.

As regards variable adjustment, or the capacity of altering at will the speed, drop and force of the blow, to the knowledge of the writer nothing has been done. No one set of stamps can at present deal in an equally efficient way with every class of ore. Batteries, therefore, range between the extreme slow stroke, long drop, light weight stamps, and those with heavy shoes, short drop and rapid stroke. These variations are not arbitrary

notions of manufacturers, but devices called into existence by actual requirements. For, though the object of crushing is one—namely, stripping the worthless gangue from the mineral, and, in most cases, the amalgamation of the latter, yet the method is necessarily manifold. One ore differs from another in its lithological, mineralogical, chemical and physical characteristics, and in consequence the most perfect separation and amalgamation demands battery work that may vary from slow crushing to rapid percussion. It is obvious that a friable, honey-combed quartz requires a different blow from a hard, tenaceous rock. It will naturally be said that, when the ore at the mine is known, the stamp details can be suited to it, and no further adjustment is needed. But this does not apply to custom mills; nor does it strictly hold true to private mills. For the ore in any one mine is seldom constant; lodes change as the depth increases, fresh reefs are struck, etc., and the alteration in the mineral makes some change in the battery advisable, if perfect crushing is desirable.

The reply, of course, is that milling is not to be a theoretically but a commercially perfect process; and, if the speed drop, and blows are fairly well adapted to the ore, the acme of perfection is not worth the additional complication to the battery. This is a very reasonable and conclusive answer, so long as the inventor does not bring a satisfactory and practical retort in the form of a simple and adjustable battery. Truly, it is not easy to see how this can be done. For practical reasons it is advisable to retain division of the stamping units, as in the present gravity batteries. But the use of steam, pneumatic and hydraulic cylinders, with other accompanying valves, etc., for every stamp, would convert the battery into a complicated engine. Electricity furnishes apparently the easiest solution of the problem, as its application to the percussive rock drill is well understood, and could doubtless be used in an electric stamping battery, in which stroke, speed and impact would be easily capable of multiple adjustment. But, considering the rough conditions under which most batteries have to work, is the gain worth the complication introduced? Possibly not. Yet there is room for a crusher that shall have wider limitations than either stamps or rolls in the present form.

British Columbia Association of Mining Engineers

MEETS AT NEW DENVER AND DECIDES TO FEDERATE WITH THE CANADIAN MINING INSTITUTE.

A meeting of the British Columbia Association of Mining Engineers was held at New Denver, B.C., on 17th ulto.

A letter was read from Mr. W. J. R. Cowell of the Victoria Metallurgical Works pointing out that the Provincial Government maintained an assayer in competition with private assayers, which he considered unfair to the profession.

It was decided to increase the council to ten and Messrs. J. D. Sword and J. B. Hastings of Rossland were accordingly elected to the board. The secretary (Mr. G. F. Moncton) moved that clause 4 of the Constitution and By-Laws of the Association be amended to read "members shall be professional mining engineers, geologists, metallurgists or chemists or persons practically engaged in mining, metallurgy, or metallurgical engineering." This amendment was carried thereby widening the scope of the Association. The question of federating with the Federated Canadian Mining Institute was next considered and adopted unanimously. There was considerable discussion as to the next place of meeting, Rossland finally being decided upon. It was also decided to hold under the auspices of the Association an important conference of mining engineers and mining men of the province at Vancouver in January.

The following new members were elected:

M. S. Johnson, Slocan City, B.C.
Roy Clark, Rossland
Frank Loring, Kossland
T. C. Cotherill, Revelstoke
Goodwin Ordway, Rossland
J. W. Sword, Rossland
C. W. Callahan, (Galena Mines Ltd.)
Alex. Dick, Rossland
Capt. Morrish, (New Gold Fields of B.C)
C. M. Wilson, Sandon
Dr. W. C. Howard, Vancouver
W. Ralph, Victoria
J. B. Hastings, Rossland
W. J. Tretheway, Kaslo
H. E. Carry, W. W. Gowen, and H. G. Nichols.

The secretary was instructed to ask the Secretary of the Federated Canadian Mining Institute if he would be present at the January meeting.

Since the meeting a number of applications have been sent in for membership. It is expected that after the Rossland meeting there will be at least 120 members. There are now nearly 90.

Breakage of a Winding Rope at the Hansa Mine.

Shaft No. 11, of the Hansa Colliery, Westphalia, is 389 fathoms (712 metres) deep, but the coal is wound from the sixth level at a depth of 363 fathoms (664 metres). The two-decked cages, which carry two tubs on each deck, are provided with safety catches. The winding ropes, of 2 inches (51 millimetres) diameter, and weighing 19 lbs. per yard (9½ kilogrammes per metre) are led over pulleys 16 feet (5 metres) in diameter, made up of cast-iron rims and wrought-iron spokes. The duplex winding engine is fitted with Kraft valve-gear, and provided with a steam brake, and also with one depending on the action of a weight. The ropes, which are wound up on and unwound from a drum 12 feet (3·7 metres) wide, and of 26 feet (8 metres) diameter, are 3 feet 2 inches (97 centimeters) apart in the shaft; and the winding rope is only partially counterweighted by a flat under-rope, weighing 15 lbs. per yard (7½ kilagrammes per metre). The distance between the drum and pulley shafts is 37 yards (34 metres), the height of the latter above the pit bank being 82 feet (25 metres); and the pulleys were directed to the central points of the two drums by skewing their bearings. Owing to these circumstances, and the slight distance between the shaft and the engine, the ropes had a tendency to wind up on the inner side of the drum; and in consequence thereof the edges of the pulleys nearest the shaft were subjected to considerable wear. The greatest load carried by the rope, including cage with accessories, four loaded tubs, and 766 yards (701 metres) of rope, was 14·36 tons.

On 30th June last, at 11.30 a.m., the rope of the rising cage broke suddenly above the pit bank; the upper end rebounded into the engine-room, wound itself round several iron beams, and pulled them out of their seatings in the brickwork, as the engine ran away, breaking the valve-chest. The rope of the descending cage was completely unwound, and broke where it was fastened to the drum, falling with the cage to the bottom of the shaft, although, as was shown by the guides, the safety catches came into action several times, without however engaging sufficiently with the timber.

There can be no doubt as to the cause of the accident, observes the report of the Dortmund Oberbergamt, published in Gluckauf, because the ground was strewn with pieces from the flange of the south drum which had worn very thin. So soon as the rope, in consequence of the pulley flange breaking, had lost its hold in the groove, it must, by falling on to the pulley shaft, have become slack for a moment. Before the few yards of the rising rope could be wound up by the drum, the rising cage must have come to rest, or have even commenced a downward course owing to its *vis viva* being annihilated. In the moment when the rope was again pulled taut a violent jerk must have ensued, as the winding speed at the time was 33 feet (10 metres) per second.

The broken pulley had not been a year in use, and the excessive wear mentioned above must have taken place in this short period. According to all appearances the extra-hard crucible steel wire rope, whose breaking strain was 95 tons per square inch (150 kilogrammes per square millimetre), must have worked in a too narrow groove; and in consequence of the side thrust, owing to the pulleys being slightly canted, and after a certain time, through the inner side of the flange wearing, the rope made for itself the necessary space.

The daily inspections of the winding gear, prescribed by the regulations of the German Government, were duly made, without revealing any unusual wear in the pulley flange; but such wear would be difficult to discover when, as in the present case, the rope groove is very deep, while inspection is rendered more difficult by the fact of the pulleys being covered with lubricating material. At several collieries in this district it is the practice to drill small holes in the flanges, so as to permit of easily measuring their thickness; and the case under notice shows that this practice is to be recommended for general adoption.

Scanning a Prospectus.

Mr. Hartley Withers' article, "How to Scan a Prospectus," in the *Cornhill Magazine* for the current month, is full of hard facts and good advice. He shows very clearly that the application of the joint stock system to industrial enterprise has up to the present chiefly benefitted the company promoter at the expense of society in general, and that "the joint stock failures have been so numerous in proportion to the successes, that many men say in their haste that all new companies are swindles." The majority of the prospectuses which come before the public in connection with new joint stock concerns, are denounced as examples of audacious impudence, and as giving lamentably emphatic evidence of public gullibility. "They," says Mr. Withers, "seldom give one-half of the information which anyone in his sense would require before investing in a new company, and yet it must be inferred that they do not display or conceal their charms in vain. Unless they succeeded in attracting subscriptions why should promoters waste money in covering the pages of the press with advertisements?" How true is all this! Yet investors have the remedy for the existing state of affairs in their own hands. "If," says our author, "the public would only give a little attention to the matter of prospectuses, and decide as to what they ought to state and in what manner, and resolve never to be beguiled by one which did not fulfil all the canons of an irreducible standard, there would be a change for the better at once. But instead of doing so, the public prefer to dub all company promoters thieves, and then to encourage them to be so by its own laziness. It looks at the estimated yield to shareholders without troubling about the basis on which the estimate is founded, and perhaps reads the names ot the directors, and if these are sufficiently ornamental it is enough. Any one who bought a house, or even a pair of shoes, on such terms would be considered a fit subject for medical examination, and yet one would have thought that such a matter as buying an interest in a new company required no less care and consideration." Mr. Withers divides prospectuses into several classes, and analyses each of these in scientific fashion. Of course much of what is said has been said before by other writers, but this notwithstanding the article is exceptionally well written, and we recommend our readers to carefully peruse it. The following extract is to our thinking particularly entertaining: "The mining prospectus is useful sometimes as showing what should be avoided. Most of them contain little but the glorification of the properties which adjoin the mine that is to be acquired by a privileged public. The regularity of the reefs, the consistently high grade of the ore, and the low rate of working expenses in the next-door neighbor, are brought forward as incontestable arguments, that the same satisfactory conditions will be found to prevail on the new company's side of the boundary. Thus crudely stated, the contention is exposed in all its illogical absurdity; but variations of the same weak syllogism in a more insidious form are often found in industrial prospectuses."

Classifying Tailings Before Concentration.

Messrs. W. Bettel and J. H. Johns have been carrying on at the Ferreira mill some novel experiments on behalf of the Chamber of Mines, Johannesburg. It was believed that better results could be got by classifying the pulp previous to concentration, but the anticipations were not realized. The experiments were in the direction of roughly classifying, by means of spitzluten and spitzkasten, and of passing that pulp alone which came from the spitzluten over the vanners. It was found that under these conditions the vanners have not caught their usual percentage of metal.

The explanation offered may be thus summarised: 1. Overloading. 2. To a principle which has hitherto not been recognized on these fields, but is well-known on the diamond-fields, that minute particles of high specific gravity will subside through a shallower layer of pulp suspended by agitation in a turbid medium (such as a mixture of coarse and fine sand, pyrites and clay) more readily than through a classified pump, consisting of coarse particles suspended in clear water. This may be explained by assuming a reduction of surface tension in the former case. 3. The proportion of fine gold escaping in sands and slimes is increased when an excess of water (over normal) is present in the pulp. 4. With Spitzluten, an increased clear water supply carries off fine gold and floured amalgam in considerable amounts in slime pulp. 5. The scouring action of the coarse sands, etc., from the spitzluten (free from slimes) prevents the collection of floured amalgam on the shaking amalgamated plates on the vanners, and this amalgam so lost is not wholly recovered in the concentrates collected.

The pulp (consisting of slime and finest sands) delivered by the spitzkasten is imperfectly concentrated on the third vanner, such pulp requiring a large area equal to a very shallow layer of liquid for efficient concentration. The finest slimes (solid matter in effluent from spitzkasten) are very rich in gold; this is attributed to the presence of suspended floured amalgam and free gold of extreme tenuity, probably coated with films of grease or sulphides, which cause the particles to exert an increased surface tension, sufficient to overcome the action of gravity to a very considerable extent.

The results obtained are, however, extremely interesting, and may, under other circumstances, have a distinct commercial value. When Frue vanners are used for concentration, previous classification, in the opinion of the experimenters, would not be advantageous, but where any other concentrator, not having a vanning motion, is employed, they would recommend a previous classification of the battery pulp.

COMPANIES.

Goldfields of British Columbia, Ltd.—The first ordinary or statutory meeting of the above company was held on 2nd inst., at London, Eng., under the presidency of the Right Hon. the Earl of Essex, chairman of the company. The Secretary, Mr. F. Callow Hole, read the notice convening the meeting. The Chairman said: As a rule a statutory meeting was merely a formal affair, but to-day he was in a somewhat different position, and was able to depart from the usual plan. A certain amount of work had been done, and there was reasonable expectation of paying substantial dividends before very long. (Hear hear.) The company was floated with a nominal capital of £600,000, of which the vendor agreed to take £40,000 in cash, and £360,000 in fully-paid shares. The directors, however, managed to reduce the cash payment from £40,000 to £25,000, the vendors taking the balance of £375,000 in fully-paid shares. The prospectus of the company was issued in March, at a time when the markets were very stagnant, and a depression was going on all round. In spite of that, however, they had a fairly satisfactory answer to their appeal, with the gratifying result that their list of shareholders now showed a large number of influential names. Since they went to allotment the directors had turned their attention to the proper transfer of the various and valuable properties which they had acquired, and the shareholders would readily understand that in order to comply with the Company Laws in British Columbia, there was necessarily a certain amount of delay in getting them transferred. All that had now been satisfactorily accomplished, and he thought that everything was now on the high road to success. Although the company had only been in existence for about four months, it had already given birth to a strong, healthy, and he might say, a good-looking child. (Laughter.) He did not know if they had ever discerned it, but the laws of nature were somewhat different from the laws of companies. Whereas, in nature children are entirely dependent for their welfare and well being on their parents, companies such as theirs were dependent not only for their welfare but for their very existence on the state of health of their children. The name of this promising child was called the Waverley Mine. It had been successfully floated, and the directors of the Goldfields of British Columbia were so satisfied as to the worth and wealth of that mine, that they had agreed to take merely a nominal sum as purchase consideration, just to pay the various expenses, such as the flotation of the company and the expenses incidental to bringing it out, and to take the remainder of the purchase consideration in fully paid-up shares. They had probably all seen the prospectus of the Waverley company, and if they would examine that closely they had every hope that the amount of ore there would average about 20 lbs. per ton. They would be, however, quite satisfied if it were only 10 or 15 lbs. per ton. The directors had been very fortunate in securing the services of Mr John Grant, who was to depart for British Columbia to-morrow, when he would turn his attention to making this Waverley mine as profitable as possible, and he hoped before the winter to make some valuable shipments over to this side. The directors of the Goldfields of British Columbia looked upon the Waverley as a most valuable asset, and they felt certain that as soon as the shares became known on the market they estimated that the company would make a profit of about £40,000, which would be ample to pay a very substantial dividend on the issued capital. He then called their attention to two reports. One was an extract from the *Kossland Miner*, dated June 12, 1897: "Good show of quartz and pyrrhotite on Jumbo Hill. Things are looking well at the Flossie L. This is one of the claims in bond to Grant Govan's London Co. Two tunnels are being driven, one on the ledge of the west side of the west block of little Sheep Creek, the other diagonally across the Jumbo Co's vein which comes down Jumbo Hill. Both tunnels are now about 150 ft. In the tunnel running to Jumbo Hill there has just been opened a fine body of quartz and solid pyrrhotite. Its extent cannot be definitely determined. Tunnel at this point has not made a depth of over 60 feet, but a little further on the hill rises rapidly, and depth will be made very quickly. The ore body found lies on the left, a good smooth wall appears on the side, and all the indications are favorable for a large ore chute. The tunnel is running thence into a mundic dyke, which runs down the west side of Jumbo Hill. This is the dyke which cuts off upright on the Rossland Camp. It is about 125 feet from the face of the tunnel to the line of contact, and it is reasonable to suppose a good ore body will be found somewhere in the mine now being opened up." Another telegram which comes from Reuter, dated from Revelstoke, June 29: "A train of eight cars loaded with copper bullion and matte from the Hall mines left here yesterday for Montreal for shipment to England. This is the first consignment from British Columbia. It is rich in silver and gold, the value being about $500 per ton." He thought they would agree with him that these were very satisfactory reports. Referring to the future of the company, he was pleased to tell them that Mr. Grant Govan had consented to go out to British Columbia and act as managing director. He had already left for the scene of action, and he asked the chairman to tell them how sorry he was not to have been at the meeting, but Mr. Govan thought, in the interest of the Goldfields of British Columbia, that the sooner he got out there the better. It was mainly to Mr. Govan's ability and untiring energy that the successful operation to which he had alluded had been completed, and it was mainly owing to him that the parent company had been formed at all, and when he told the shareholders that Mr Govan had a very large stake in the company they would be perfectly certain that he would do his utmost to ensure a successful future. Besides Mr. Govan they had three names that appeared in the prospectus of the Gold Fields, which he felt sure would carry great weight, viz.: The Hon. David W. Higgins (Speaker of the Legislative Assembly of British Columbia); David R. Ker (President of the British Columbia Board of Trade, Victoria); and the Hon. Chas. E. Pooley, Q.C. (President of the Executive Council of British Columbia). He thought that these three gentlemen would be absolutely invaluable to the Board. Owing to the mountainous and heavily timbered state of the country, the work of prospecting had been very difficult, but now that the place has been opened up by railways and other means, that difficulty has been somewhat abated, and prospecting is being carried on with vigor. The result is that the LeRoi mine has been proved, and also the War Eagle, and fresh finds are being continually made, which only require a little proper development and expenditure of capital to make them paying concerns. I will only cite one instance of the remarkable value of the mines out there, and that is in the case of the Lanark mine. The reports came to hand not very long ago, and they show a profit in May of £3,000, a profit in June of £4,000, and hopes are now entertained of the profits amounting to between £6,000 and £7,000 a month. The Lanark mine is situated very near the Waverley. To sum up in one word he thought the company had a great future before them. Everything was in their favor. It was a white man's country and a white man's climate, and although he did not for one moment profess to say that this company was going to make its fortune in a single day, yet he hoped and believed that with a little careful management, and a certain amount of luck which they could not do without, the directors would be able to justify the confidence the shareholders had placed in them, by returning a good and substantial dividend

Fraser River Gold Mines, Ltd.—The first ordinary (statutory) general meeting of this company was held in London, on 6th instant, Mr. John Lowles, M.P., (Chairman of the company) presiding.

The Secretary, Mr. W. A. Stearns, read the notice convening the meeting.

The Chairman said: Gentlemen, this is the statutory meeting of the shareholders, held in accordance with the obligatory clauses in the Companies Acts. It is not usual to make any very lengthy statement, and one does not expect, as a rule, a very large attendance. But perhaps I may be allowed to say that this is the first issue in a double sense of the new goldfields of British Columbia. That is a strong company, which was formed under excellent auspices, and I do not think it has any cause to be ashamed of its first offspring. The property has been transferred, and we have in charge one whom we think to be a most capable, responsible and expert engineer, in Mr. W. F. Gore, of Vancouver, from whom we have recently received information with regard to this property. I ought, perhaps, to say that we have two classes of property. We have, in the first place, ten miles of the Fraser river. We are advised that this is the best ten miles of the Fraser river, both for working purposes and for its gold contents. And then we have two placer properties at no great distance from it, which will be worked under the same management. Before we took the property up—I am speaking now of the New Goldfields—we had the advantage of the advice of Mr. Cox, of Messrs. Bainbridge, Seymour & Co., who had himself just returned from the locality. He confirmed the very high opinion, based not merely on his own experience of British Columbia, but also from his experience at the Antipodes, of the capacity for profitable dredging on the Fraser river. We received this telegram on June 4th from Mr Gore, with regard to the machinery: "Expect to receive all the machinery within the next seven weeks. Dredge will begin to work about the middle of September." On June 18th we had this cable: "Machinery will soon be completed; everything going on most satisfactorily." With regard to the two placer properties of which I have spoken to you, we received this cable, dated June 23rd: "Subject to your approval, shall commence work at once on either one or the other hydraulic mining property." So that the happy position we want to get at as quickly as possible—of winning the gold, and being able to store some of it to our credit at the bank—will, we hope, be an accomplished fact before very long.

Empress Gold Mines Co. of Ontario, Ltd.—The following statement of accounts was submitted to the shareholders, under date of 29th ulto.:

RECEIPTS.

Sale of 8,000 $5 shares at $2.50	$20,000 00
Sale of 132,380 $1 shares at 25c., less commission	27,726 90
Bullion	1,408 45
	$49,135 35

EXPENDITURE.

Insurance		$ 369 75
Interest		182 74
Plant as under—		
Assay outfit	$ 225 00	
Stamp mill machinery, freight and duty	5,576 07	
Engine, boiler and freight	1,342 00	
Compressor plant and freight	1,984 50	
Compressor plant fittings	171 32	
Compressor boiler and freight	646 39	
Compressor drills, columns and hose	678 00	
Pumps	212 50	
Mill fittings and water pipe, etc	950 27	
Boarding house	600 00	
Blacksmith shop	250 00	
Assay office	100 00	
Stable	100 00	
Oil house	50 00	
Tramway	1,500 00	
Mill building, foundation, placing machinery, and dams for water supply	8,423 04	
		22,809 09
Transfer office (1 year's salary)		400 00
Roads		599 43
Wood lot		407 47
Management and office		1,313 00
General expense		5,189 14
Mining and milling		16,054 16
Mining and milling supplies on hand as follows:		
Dry goods	$ 304 40	
Groceries	382 45	
Hardware	533 40	
Hay and oats	64 00	
Oil	51 15	
Cordwood	531 00	
Dynamite	600 00	
Fuse, candles and detonators	135 00	
Drills	180 00	
		2,781 40
		$50,106 18
Less—		
Profit on boarding house	$ 597 04	
Accounts unpaid	1,659 54	
		2,256 58
		$47,849 60
Balance on hand and in bank		1,285 75
		$49,135 35

LeRoi Mining and Smelting Co., Ltd.—The following shows the dividends paid by this company to date :—

October 2, 1895	$ 25,000
February 6, 1896	50,000
March 4, 1896	25,000
May 15, 1896	50,000
June 10, 1896	25,000
July 15, 1896	25,000
October, 22, 1896	25,000
December 3, 1896	25,000
January 6, 1897	25,000
January 29, 1897	25,000
February 26, 1897	25,000
March 29, 1897	25,000
April 30, 1897	25,000
May 29, 1897	25,000
July 3, 1897	25,000
Total	$450,000

Ontario Government Gold Concessions, Ltd.—Registered 29 May. Capital £80,000. Head office, Finsbury House, Blomfield st., London, E.C.

Rocky Mountains Exploration Co., Ltd.—Registered May 29th, by O. B. Thomas, 59 Chancery Lane, with a capital of £10,000, in £1 shares (500 Deferred.) Object: to search for, prospect, examine, and explore mines and ground supposed to contain minerals or precious stones. The directors are F. Davies, H. B. Wuttig, E. R. Grant, G. R. Schoeber, and J. A. Sedemayn. Qualification, £50. Remuneration £50 each per annum. Registered office: 13, Copthall Avenue, E.C.

Syndicate, Ltd.—Registered May 24th, by M. Murchison, 66 Finsbury Pavement, E.C., with a capital of £25,000, in £1 shares (3500 deferred.) Object: to acquire, develop, work, and deal with lands, mines, mining rights, claims, minerals, ores, mills, etc., in British Columbia and elsewhere, The directors are to be elected by the subscribers. Qualification £200.

Slocan, British Columbian, and General Mining Syndicate, Ltd.—Registered by Cheston and Sons, 1 Great Winchester street, with a capital of £50,000, in 49,750 £1 Ordinary and 5000 Deferred shares of 1s. each. Object: to acquire any mines, mining rights, grants, leases, claims, concessions, metalliferous land, alluvial ground, diggers' rights, options of purchase, etc., in any part of the world, and to develop, deal with, work, and turn to account the same in such manner as the company shall see fit; as miners, smelters, metallurgists, builders and contractors, electricians, mechanical engineers; to construct and maintain telegraphs and telephones, wharves, docks, piers, rail and tram roads, etc., to lay out land for building puoposes; to develop the resources of land by clearing, draining, planting, irrigating, and cultivating the same.

The number of directors is to be not less than three nor more than seven. Registered office: 13 and 14 Abchurch Lane, E.C.

Harris Fraser River Gold Recovery Co., Ltd.—Registered by T. Simpson 8 Union Court, E.C., with a capital of £100,000, in £1 shares. To operate a lease of five miles.

Hastings (B.C.) Exploration Syndicate.—The first (or statutory) general meeting was held at the London offices of the company on 21st ulto. Mr. James Head, who presided said: You have been informed by circular that the board have purchased eight claims in the Fort Steele district (British Columbia) between the Sullivan and North Star groups, and from the advices of the managing director and others, we believe we must have the North Star and Sullivan lodes The North Star mine has been shipping ore regularly for some time; but Mr. Dewdney's last letter informs us that the route from the south has received a check by the loss of two steamers. The North Star and Sullivan mines will be criterions from which to judge our own properties. There may be some difficulty in locating the veins owing to the large quantity of float on the property; but, as every mining man knows, the only way to discover the lodes is to sink a shaft and crosscut east and west, or north and south, as the case may be. There is nothing further to be told to-day, but as fast as news is received the shareholders will be informed of the same by circular.

Princess Gold Mining Company of Ontario.—The case against this company entered for the assize court at Rat Portage by Wm. James and James Gordon, had a hearing recently before Judge Robinson, and judgment was reserved. The plaintiffs claim payment for a shaft 60 feet in depth, at $22.50 per foot. That was the original contract, but a mistake occurred in the location to begin work, and it was abandoned at a depth of 30 feet. The plaintiffs claim payment in particular for the 30 feet of worked ore, and damages for the balance of the contract. The defendant company disputed this payment, on the ground that the plaintiffs assumed responsibility for the location of the shaft, and knew that they were not working on the Princess property as called for by the contract.

Canadian Lake Superior Syndicate, Limited.—Registered June 25th, by Hollans & Co., 30 Mincing Lane, London, E.C., with a capital of £3,150, in £1 shares. Object: To adopt a certain agreement, and to acquire, work, and deal with property, mines, and rights of all kinds.

North-West Mining Syndicate, Limited.—Registered July 19th, by Wilson & Co., 1 Copthall Buildings, London, E.C., with a capital of £20,000, in £1 shares. Object: To acquire, develop and work any farms, lands, properties, buildings, timber, mines, minerals, leases, concessions, claims, etc., in British Columbia or elsewhere.

MINING NOTES.

Nova Scotia.

We are pleased to note that the Symon-Kaye mine at Montague is once more on the producing list. Mr. Oland has shown us some very handsome specimens taken from a new shaft which has recently been sunk. Six tons of ore taken from this shaft yielded 76 ounces of gold and it is estimated that not less that 30 ounces of gold in specimens were taken from this lot.

Tributers on the Stuart-Hardman block of areas at Goldenville are meeting with tremendous success; 218 ounces were taken out in June by four men. By the way, we understand that there has been a hitch in the sale of this property. It was bonded by a strong Halifax syndicate, who paid a fifth of the purchase money as a deposit, and have now we understand, relinquished the bond.

"Faint heart never won fair lady," nor did it ever successfully work a gold mine. The famous Golden Lode mine has been shut down through the "funkiness" of some of the shareholders. The time arrived when it was necessary to add more machinery to effectively work the mine, and notwithstanding that it has paid the original shareholders every cent back and has a reserve fund of some six thousand dollars, some of the shareholders have shown the white feather and the mine is now closed down.

Mr. Archibald's returns from his mine in Uniacke are probably unique. The last entry at the Mines' Office shows 153 ounces of gold from 17 tons and this is a fair sample of what the old gentleman is in the habit of returning periodically.

Chetichamp is certainly getting to be a field of considerable interest, neither wall has yet been cut in the galena lead and now a big lead of copper pyrites has been found which from general appearances we are inclined to think may also contain nickel. The northern part of Cape Breton is undoubtedly rich in minerals and has been very little prospected.

There has been another find of remarkably rich quartz at Renfrew and all the vacant ground in the district has been taken up.

We regret to have to record the death of Mr. McDonald (Chummy) of Renfrew and Mr. Robert Wright, manager of the Elk mine at Caribou.

Mr. R. R. McLeod is meeting with considerable success at Malaga; the last return was 131 ounces.

During the last three months the New Egerton mine at Fifteen Mile Stream, has produced 750 ounces of gold. The new 30-stamp mill is working up to its full capacity and giving satisfaction.

The Richardson mine cleaned up 283 ounces for the month of June. This property has been coming to the fore again lately and is paying its shareholders good dividends.

There has been quite a rush for areas at Wine Harbour lately although we have been unable at present to hear of any new finds to justify the same.

The Guffey-Jennings Mining Co are spending a considerable amount of money on the old Sanders mine at Caribou and are opening it up in a systematic way. We sincerely hope they will meet with the success their enterprise deserves.

HALIFAX, 15 July, 1897. F. H. M.

CAPE BRETON.

Since last writing nothing out of the ordinary line of business has transpired, work at all the collieries being steady and shipments good.

Caledonia colliery had an output of 1,801 tons for one day—a good yield when it is considered that all this coal was hoisted through one shaft.

Considerable local discussion is at present going on, as to the merits, *pro* and *con*, of compressed powder, a form of blasting powder altogether used in the pits of Great Britain, and which is now being tried in the Cape Breton pits principally on the merits claimed for it, being safer, giving less smoke, and better coal in regard to size. I am promised the results of some of the tests, which have taken place both in Phalen and Harbor seam, and at an early date will send the full results.

An additional Babcock & Wilcox boiler is being placed at Dominion No. 1 colliery, as the working of this new colliery demands an increased steam plant.

The boiler capacity at Old Bridgeport is also being added to. The erection of an 8-foot Murphy fan will give them a much better supply of air in this pit, and will do away with all furnace ventilation in all the Dominion Coal Co. pits, with the exception of Gowrie.

The Hub colliery is ventilated by means of a steam jet, which gives satisfactory results.

At Sydney mines the management have awarded the sinking of their new shaft to Mr. Robert Bansom, an old and experienced sinker. It is calculated that this shaft will pierce the No. 3 seam at a depth of 500 feet.

The results of the last few years' workings at Sydney mines have been so favourable, that the proprietors are putting their property in such a position that they can at any time meet any increased demand, and extend their trade whenever the opportunities offer themselves.

The S.S. Strathtay loaded at the Louisburg pier one of the largest cargoes shipped in Cape Breton, amounting to 6,100 tons.

Nearly all the shipments for the month of July have been made at the International pier, and this week the total will be over 30,000 tons from Monday morning to Saturday night.

Thursday, July 15th, 7,000 tons going over the road as the output for that day.

The following returns show the quantities of coal raised and shipped during the month of June:

Gowrie	colliery	3,440 tons
Caledonia	"	35,894 "
International	"	19,439 "
Dominion	"	28,475 "
Old Bridgeport	"	20,970 "
Reserve	"	34,601 "
Victoria	"	10,591 "
Hub	"	12,918 "
Tons hoisted for the month		166,328

The shipments for that month were:

From International pier	105,979
" Victoria	10,117
" Louisburg	27,966
" Railway	201
" Reserve	616
Total shipments	144,649 tons.

GLACE BAY, 15th July, 1897. J. G. S. HUDSON.

British Columbia.

WEST KOOTENAY.

The month of June shows a slight increase in value of mineral production over that of April and May. In June the output was $382,903. This brings up the total for the first six months of 1897 to about $3,500,000, an increase of over 100 per cent. on the first six months of 1896.

Nelson division is receiving a large amount of attention from prospectors and investors. The revival of interest in that section began about this time last year, in the finds along Wild Horse Creek and Salmon River. There are evidently some good-looking prospects thereabouts, as it is said the Hall Exploration Co. bonded the solitary claim, Blackcock, for $70,000.

The same company has ceased development work on the Lemon Creek properties, finding these properties would not warrant the payments called for. This, coming after the Two Friends affair, has given this section a sudden check. Speculation has been a little wild in places, and the prices asked are enough to keep out bona-fide miners. This will be changed now, and the camps will recover themselves after some hard work and development.

In the Nelson division in the month of June the weekly number of location records made averaged about 120. This, notwithstanding the very wet weather, which has almost barred getting out in the hills. Also some small shipments of ore are being made, notably from the Athabasca, a more or less free milling property, now in the hands of the British Canadian Gold Fields Co. A shipment of this ore, treated at Nelson, returned $67 per ton.

The greater number of new locations are being made S.E. of Nelson, adjacent to the line of the Nelson & Fort Shepherd Ry., upon Salmon River, Wild Horse Creek, Sheep Creek, Porcupine Creek and Fawn Creek; also a few on Toad Mt., where the Hall mines are, and a few along the slopes west of Kootenay Lake, adjacent to the Kokanee Creek finds of last fall.

In the Slocan the prospecting field is getting small. There is still a large area between the Sandon country and Trout Lake, which is pretty rough. Wilson Creek, now being prospected largely, heads up in this district. The hills west of Slocan Lake continue to furnish nothing of much value. This state of affairs may cause more interest to be shown in actual development. The chances of selling wild cats in future seem depressing. The camps will have to stand on their development, and generally there seems to be a turn in the direction of legitimate mining.

If some of the outside investors could see the M. E's upon whose report they put in their money they would certainly be astonished. There are some sudden transitions from dense ignorance to a state of marvellous penetration in mining matters. A case in view occurs, where the expert accepted the kind offices of a friend to put his deductions into decent English. In the most costly enterprise of mining, where good judgment is so necessary, there is absolutely no protection for the investor, or for the trained and experienced professional, whose conclusions do not invariably indicate a general expansion and richness of ore bodies "as you go down."

Under the possibility of there being an export duty upon our ores, we are receiving more attention from smelter men. Representatives of the Great and Omaha concerns are sizing up the camps, and the Guggenheim Bros of Pueblo have also been on a tour of inspection. It is very possible that Southern West Kootenay will become a great smelting section. Robson is generally spoken of as a first-rate location, as it can draw ores from Rossland, Lardeau, Slocan and Kootenay lakes, and bring in fuel and fluxes from the eastern districts.

There have been some heavy transfers in Noble Five stock lately. This stock originally issued at 25 cents; last season went up to 67 cents during the winter; it is now between 45 and 50 cents. Good strikes of ore are reported.

Rossland is putting out more ore now than in the palmy days of the promoter. Five mines are shipping more or less, the Le Roi reaching as high as 170 tons in one day. Otherwise the place is quiet. The shippers are: Le Roi, War Eagle, Iron Mask, K. & C. and Centre Star.

An unusually wet June has interfered with all operations not absolutely underground, and even some tunnels and shafts have been very wet from surface waters. This weather appears to have passed at last, and the mining barometer will rise steadily until the snow flies.

Waggon roads are being built up into the Jackson basin. Extensions of the McGuigan road into the Best basin, and another one from Burton city to Mineral city, on Cariboo creek. These roads cost about $1,000 a mile, more or less. There may be roads built up Springer creek and Four Mile creek later on if development warrants them. The Provincial Government giving half the cost and the local mine owners the remainder.

A tramway is being built for the Payne. They will have no concentration at present, as the ore is pretty clean. Also the Rico is having surveys made for an aerial line, to terminate somewhere between Sandon and Cody.

The Hall mines smelter has begun the production of blister copper from its matte. The capacity is about 15 tons per day, and the product is about 97 per cent. copper. The total value is between $50c and $600 per ton. A train load of this (160 tons) recently went east.

Many rumors are going of the Pilot Bay smelter re starting, but nothing is definite in this direction. Ainsworth for a time was depressed on account of its closing down, but is now very actively engaged in development and some shipping.

In the Southern Slocan, where there is a period of partial eclipse—according to the outside judgment—things are going along fairly well. The Howard Fraction, now in the hands of the British Canadian Goldfields Co., recently made a shipment of 22 tons, which ran 125 oz. silver and $19 in gold.

The Arlington is making a shipment, and the Meteor is filling ore sacks, so that there is some consolation for the lack of investors.

The gold district of Lemon Creek is showing some very rich ores of small body. There are great possibilities in this section for those who undertake to mill or treat these ores on the spot. The ore runs from traces in gold up to several hundred dollars. It is very hard to sort. Most of the gold is not free, but in pyrites. A general average of veins gives fair values for local treatment.

J. C. G.

SLOCAN CITY, 15th July, 1897.

CARIBOO DISTRICT.

A mining event of considerable importance to Cariboo took place at Horse Fly last week. The ten stamp mill that has been in course of construction for the past three months at the Horse Fly Hydraulic mine was completed on Saturday morning the 10th July. Mrs. Hobson, the wife of the manager, on that morning turned on the water that started the machinery, and let drop the stamps of the first cemented gravel mill ever built in Canada.

The mill has been built and equipped in a first-class manner. It will be run by water power during the summer and by steam during the winter months. There are ten stamps of 850 lbs. each, arranged to crush 120 tons of cemented gravel each 24 hours. As the cemented gravel in this mine is known to be rich, good results are certain to be obtained from this method of working it.

While the mill was being built, foreman G. W. Snyder, with a force of miners, was driving bed-rock tunnels, uprising to gravel, running cross drifts and blocking out large bodies of gravel ready for extraction and delivery to the mill. The mill is now running steadily.

Considerable other work has been done at Horse Fly this season. Many new claims have been located, and are being energetically prospected.

At the Miocene gravel mine the prospect shafts have been sunk 240 ft. in good-looking gravel, but bed-rock has not yet been reached. Senator Campbell, the manager, has gone to Vancouver to purchase additional machinery. On his return sinking will be resumed, and continued until bed-rock is reached.

The hydraulic elevators are working successfully at Ward's mine (the old Harper claim), but the result of manager Ward's clean up last month has not been made public, but rumor says it was from $20,000 to $25,000.

Ontario.

The Ottawa Mining and Milling Co. has contracted for the construction of a 20-stamp mill, to be erected at Keewatin, under the superintendence of Mr Snyder, the company's superintendent. The materials will, we understand, be mainly supplied by the Wm. Hamilton Manufacturing Co. of Peterborough, Ont., and the Jenckes Machine Co. of Sherbrooke, Que.

A correspondent to the *Financial Bulletin*, a London paper, writes respecting the progress of gold mining in western Ontario, as follows:

"The area covered to date by locations surveyed and taken up is merely a fringe along the shores of the lakes and rivers, and bears but a small proportion to that yet unexplored and the legitimate application of the argument is that there are as good fish in the sea as ever came out of it. It would indeed be a remarkable thing if all the best properties were selected and operated in the first year. And in respect of this there is no safer or more legitimate method for a syndicate to start operations on a small scale than by outfitting and sending into the field a survey and exploratory party, capable of searching for, testing, and securing deposits of auriferous quartz, thus coming in on the ground floor without responsibility to innumerable small shareholders, and vexatious restriction by the Limited Liability Act. This, I hear, is already being done to a considerable extent. One trouble with which the practical miner has to contend—and it is not the least of them—is that many men whose mercantile progress has been based on prudence, forethought and sound common sense, apply none of these qualities to a mining investment, but expect 100 per cent. a month, whereas 15 per annum would be regarded as eminently satisfactory with regard to their own business. There seems to be an aureate microbe in the air, which upsets the balance and undermines caution. If a prospective investor sets aside a sum, say of $1,000, as something which is not required for his business, and of which he can tranquilly bear the possible loss, well and good; but neither the investor or the mining world is benefitted by the application of money to mining purposes which is elsewhere involved and necessary. I fear the truth of this will come, in the near future, home to many who are now anxiously looking for returns from small investments, made on strength of an inviting and plausibly worded prospectus. I do not write for the mining man, who, it is to be presumed, knows his business better than I can teach it to him, but I do speak to those who feel the temptation to invest, and can ill afford to lose. Unless information from the "inside" is available, and the investor is thoroughly satisfied with the reasonableness of the undertaking, and probity of those whose names are published in connection therewith, I offer *Punch's* immortal advice to those about to marry."

BOUNDARY CREEK MINING AND MILLING CO.

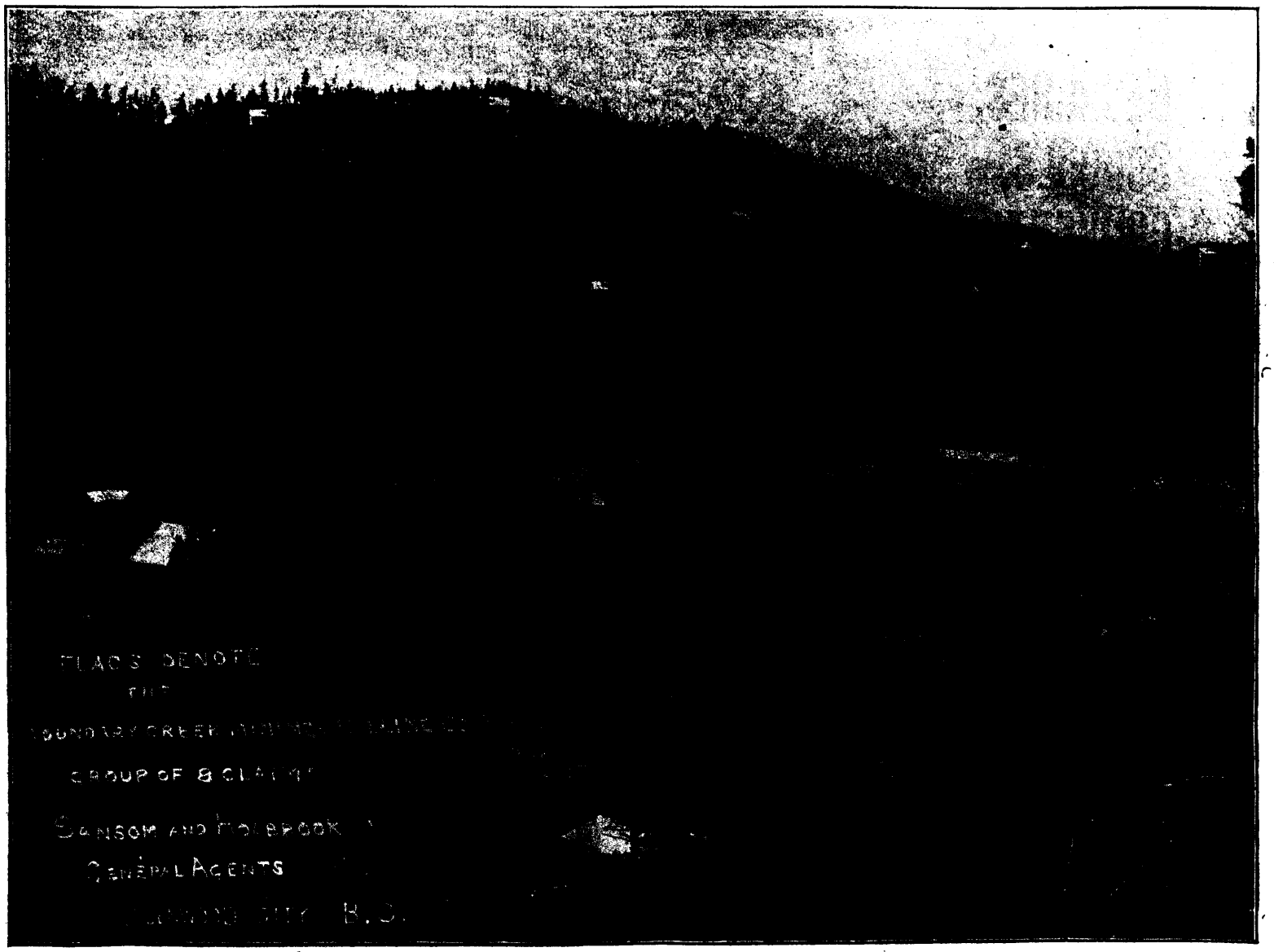
INCORPORATED OCTOBER 21st, 1896.

CAPITAL, $1,500,000. **1,500,000 SHARES AT $1.00 PER SHARE.**

700,000 Shares in the Treasury for Development.

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

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



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

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

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

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

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

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

BOUNDARY CREEK MINING AND MILLING CO.

SANSOM & HOLBROOK - GREENWOOD CITY, B.C.

CANADA;
Province of Quebec,
District of Athabasca.

IN THE SUPERIOR COURT.

No. 125.

IN THE MATTER OF

The American Asbestos Company, Limited,

IN LIQUIDATION.

The undersigned Joint-Liquidator will sell by

PUBLIC AUCTION

at the office of Messrs. ROYER & BURRAGE, 87 Wellington Street, Sherbrooke, Que, at eleven of the clock in the forenoon, on the

EIGHTH DAY OF SEPTEMBER NEXT, 1897

the Asbestos Mining Property and Plant of the said Company, at Black Lake, in the Province of Quebec,

situate upon the parcel of land known and distinguished as the southerly ends or halves of lots number twenty-seven and twenty-eight, in range B of the Township of Coleraine, in the County of Megantic, containing about one hundred and four acres of land.

The property is situated about one mile from Black Lake, on the Quebec Central Railway, on the main road leading from Black Lake to Thetford mines. It is in the midst of the asbestos bearing belt of serpentine from which the greater part of the world's supply of asbestos is mined. The mine has been operated by the American Asbestos Company since 1888, and has been a steady producer of a very fine grade of asbestos, nearly the whole of the output of the mine since that time having been supplied to prominent European manufacturers of asbestos goods. The property is splendidly situated and well adapted for the purposes of asbestos mining, and is thoroughly equipped with the most modern machinery for the economical handling of the rock and manipulating of the fibre. Special machinery was placed last year for fiberizing, the result proving very satisfactory. There are a number of workmen's dwellings on the property, sufficient to accommodate a large number of men.

The machinery consists of four steel boilers (300 h.p.,) 16 x 24 Rand air compressor, 6 Ingersoll & Rand rock drills, 4 duplex Bacon winding engines, Blake rock breaker, special crusher for fiberizing asbestos, Blake and Knowles steam pumps, boom and cable derricks, ropes, pitcars, steel rails, and a miscellaneous lot of tools, the total value of plant and improvements amounting to about $45,000.

Tenders for the property will be received up to the date of sale, the Joint-Liquidator reserving the right to accept any such tender and withdraw the property from sale, and further reserving the right to place an upset price upon the property at such sale, and make such other conditions as they may see fit. The property is open to inspection at any time. Inventory can be seen, and any further information will be furnished on application to the undersigned.

JOHN J. PENHALE,
R. R. BURRAGE,
Joint-Liquidator.

Sherbrooke, Que., May 31st, 1897.

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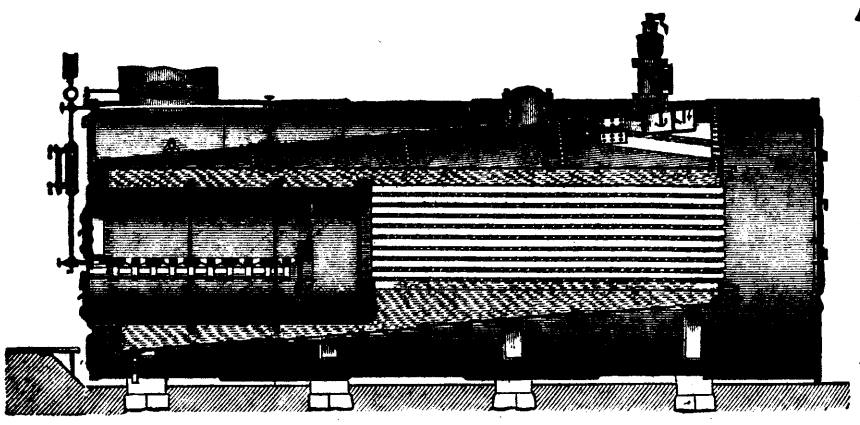

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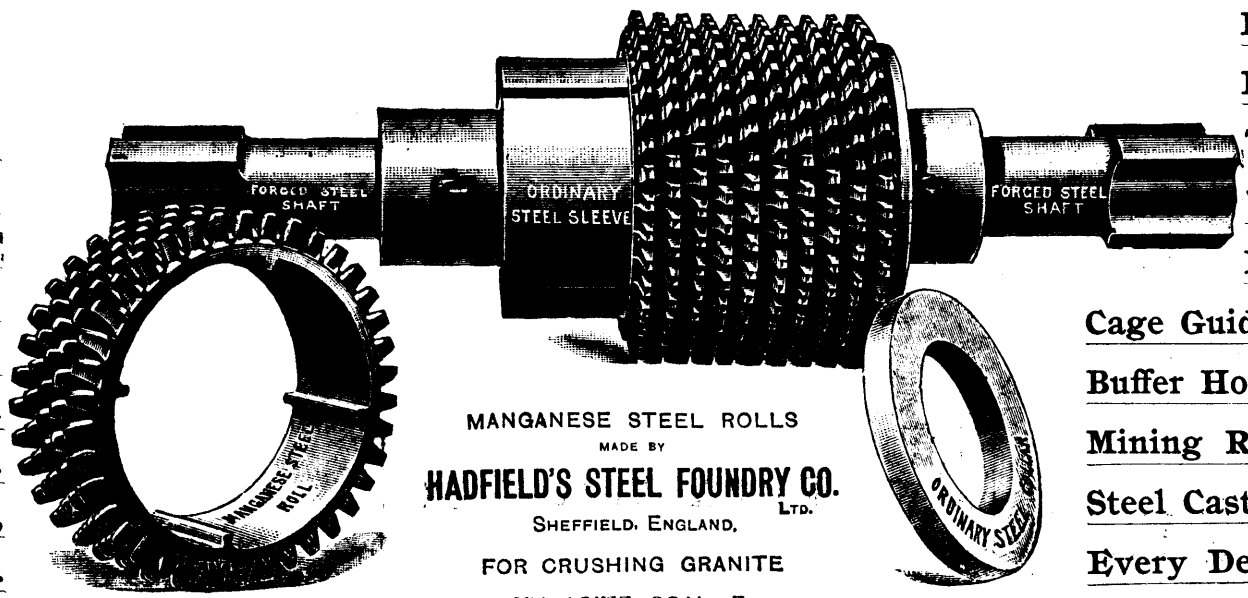

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