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THE MONTH.

THE proposal of the Government to appoint a commission with a view to investigating the working of the mining law, has met, in certain quarters, with much strenuous objection and adverse criticism. This would be justified were the motives for holding such a commission such as are generally supposed.

NECESSARY TO THE AMENDMENTS MINERAL ACT.

We are, however, assured on very excellent authority that the Government has no intention of interfering with existing industrial conditions, nor would the much-vexed question of the "eight-hour law" be again opened. Moreover, neither the mine-owners nor their association are in any way responsible for the origination of the idea, which emanated entirely from the Department of Mines. In short, the object of the enquiry is to discover and remedy technical faults in the mining law, to suggest improvements and changes in regard to the Placer Act, which at present is far from a perfect measure, and to frame suitable clauses applicable to hydraulic mining leases wherein the present act is deficient. No serious objections can surely be raised to the suggestion if carried out upon these lines, provided always the men appointed to sit as commissioners are unbiased and properly qualified to deal with the subject in hand. It is the "if" in this case, however, that is all-important. Meanwhile a commission rightly composed would undoubtedly accomplish a great deal more effectively a task that under ordinary circumstances would be entrusted to the Mining Committee of the House, many of whose members are ignorant of mining in the practical sense. In fact, the idiotic "tinkering" to which the mineral acts have been subjected may be largely attributed to the ignorance of the so-called Mining Committees in the past. The mining industry in this country has now been sufficiently long established to admit of a very fair opinion being formed of its requirements from a legislative standpoint and there should therefore be no occasion for the constant changes in the law that nearly every session of the local Legislature brings forth. But notwithstanding amendment following amendment, and repeal following repeal, the Act is still woefully inadequate and inapt in many important particulars. Hence the need of a thorough revision once and for all by a commission or board of practical men of experience and judgment. It would be impossible within the limits of a short article to point out the many advantageous improvements that could be made in both the acts relating to mining, but in view of recent occurrences one suggestion at least is permissible. The clauses in the Mineral Act relating to the observances imposed on the holder of un-Crown grant mineral properties are much too stringent. A case in point was the jumping of certain fractions adjoining the Velvet mine and belonging to the company operating the Velvet. Here is brought into strong relief the risks of grave injustice which follow from the various forfeitures of title which bestrew the Mineral Act. It does not appear just that mineral ground, undermined by many thousands of dollars' worth of work, in active operation and having upon it expensive mine buildings should be subject to the total risk of forfeitures by reason of failure to make what in such an instance is a purely conventional declaration of certain work done and the payment of a fee of $2.50 for so doing. Were this an isolated instance it might be argued that some extraordinary negligence on the part of the company had taken place and that if people would not pay $2.50 to preserve title to very valuable property they fully deserved to lose it. Which is very true, but unfortunately this is by no means an isolated case. Others have occurred and have had a bad effect on the interests of British Columbia through disgusting men who had invested large sums of money in this province. And this is the point of view from which the matter should be judged, not that it is the business of the Legislature to protect those too negligent to carry out the conditions under which mineral rights are held, but to protect the interests of the province by making these conditions as plain and simple as possible, and by minimizing the risk of forfeiture and its heavy losses as much as possible. Another recent instance was that in which $20,000 was invested in

the development of a mineral claim in South Yale, both the money and property being lost as a result of a cast-iron technicality of law. Naturally the men placed in this unfortunate position have withdrawn themselves and their money to a safe distance from British Columbia. A third case is that of a joint stock company owning a fraction adjacent to certain Crown grants they also mined. For some reason the company was not working its mine and had only a representative agent in the country. To hold this fraction which is very valuable, it has not only to do and record assessment work, but also keep up a license of $100 yearly, thus running the risk of two separate and distinct forfeitures in the course of one year. Not only so, but its miners' license taken out in July or August would only run to May 31st, a subtlety of departmental regulation which a foreign company might well be excused from fully appreciating. A case which actually occurred of even more grievous hardship is also to the point. An investor purchased two adjoining mineral claims, and in order to obviate any risk of loss of title set to work at once to have the ground surveyed with the object of Crown Granting. This was duly done and work in excess of the legal amount was performed. The certificate of improvements was applied for and during the specified time no adverse claim was filed. The recorder of the district, however, refused to issue the certificate until ten separate affidavits were filed and paid for setting out in separate portions of $100 the work for which he already had surveyors' affidavits tendered to him as amounting to over $1,000 in value. These ten affidavits the surveyor would not make, as he had not "done nor caused to be done" the work in question. While he was trying to get in touch with the owner who was travelling at a distance the claims ran out and were jumped. So here a man lost his property through his very eagerness to secure title as rapidly and effectively as possible. The investor in this instance was a man of influence, in a position to command large amounts of capital, but he literally and metaphorically shook the dust of British Columbia off his feet, and has since persistently decried the country and its laws. Innumerable other cases of hardships of this description could well be cited, but enough have perhaps been given for present purposes. Meanwhile it is quite clear that some further protection should be afforded not only investors but prospectors and others from the forfeiture of valuable and improved property on merely technical grounds, and we therefore submit the following suggestion to the attention of the Government, or should the appointment be made, to the commission on mining law:

(1.) The failure to record assessment work on before the expiration of the present time-limit shall not render the property liable to forfeiture, but omission in this respect shall be punishable by fine on a system of cumulative penalties. For instance, if a record is made within one month after the legal limit, a fine of, say, five dollars, shall be imposed; if within three months, the sum to be paid shall be fifteen dollars, or twenty-five dollars if the extreme limit of the six months' extension is not exceeded. After six months the property should revert to the Crown.

(2.) No location or mineral claim on which one assessment, or work to the appraised value of one hundred dollars, has been performed, shall be "jumpable" or open to re-location, but shall revert as a claim with designated boundaries to the Crown. At stated periods, of which adequate notice must be given, properties thus forfeited shall be sold at public auction by the Gold Commission or Mining Recorder of the district, a minimum reserve price being placed on every claim thus offered for sale.

(3.) The present clause relating to the location and recording of mineral claims should be repealed, and the Colorado law of compulsory assessment before a claim can be recorded substituted therefor.

These suggestions, if acted upon, would be productive of several, in our opinion, beneficial results. In the first place the man who spends either his time or his money in a bona fide attempt to develop a mineral property, but who by ill-chance or even carelessness omits to regard a trivial technicality of the law would be reasonably safeguarded against serious and complete loss by forfeiture. Secondly, if opportunity was not taken of the reasonable chance afforded, the Government would benefit by the acquisition and sale of the property and not some private individual or "jumper" whose moral, if not legal right, to the work of others is certainly questionable. Again by the means proposed promiscuous staking of claims in new districts would be largely checked, by preventing re-location after one assessment, and lastly a large increase in revenue from mining districts might be counted upon for the prosecution of useful and necessary public works in those localities.

The present government has doubled the tax on a tax upon the output of coal mines. The first of these two measures has raised quite a storm of pro- the output of metalliferous mines and has imposed test as calculated to restrict the employment of capital in the development of the mineral resources of the province. In face of the facts such an outcry is ridiculous. The amount realized from the tax last year, when the mineral output of the province from lode mines exceeded $6,750,000 in value, was the large and important sum of $31,000. The estimated return from the increased tax is $65,000. Even the increased figure is not a very burdensome impost upon an industry whose gross output of virgin wealth is $6,750,000. It is true that in making this estimate of the return from the new tax the financial advisers of the government have shown the same genial ignorance of the mining expansion in the province characteristic of the year 1900, which cast a veil over the Queen's Speech in this regard. Without calculating the normal increase in districts already productive, two districts, East Kootenay and Boundary, will add this year between two and three millions to the gross output of the province. The output of the metalliferous mines of British Columbia is now in excess of $10,000,000 a year, and the Finance Minister would have been quite safe in taking this figure as a basis for the returns of the new tax. Upon this basis the tax would as originally imposed return $45,000 and doubled, will return not less than $90,000. This is a handsome increment to the provincial revenue and cannot be considered an oppressive burden upon the mining industry. The mining industry pays the bulk of the revenue of this province in addition to enormous contributions to the Dominion revenue. Directly or indirectly most of the sources of revenue which the province possesses, owe their buoyancy to the mining industry. So much is this the case that the increased stumpage tax and the tax on coal will

both fall to some extent upon the mines, which are large consumers of both timber and fuel. It is inevitable that mining should pay the expenses of administering this province, because mining is the only industry which makes it worth while administering this country as a province at all. The whole fiscal system of British Columbia must be based on mining. Its future prosperity must be derived from mining. Its status as a province must be preserved by mining. Therefore we must have taxation which will not cripple and legislation which will foster the mining industry. Liberal laws, wise expenditure and fair taxation are the main requirements of the mining industry. Nor is the increased taxation of this year in any way opposed to these requirements when the large sums spent in the development of new districts are considered. It will be time enough to cry out when the mining industry is being milked for purposes alien to its own development. The tax upon the output of coal is in every respect a good one. The coal resources of British Columbia are practically limitless. Every year a larger and larger production will be maintained and every year a larger and larger revenue result from the imposition of this tax. In both the taxes imposed the government has shown wisdom and common sense. The contention that the inflow of capital into the province will be restricted is unsound. It is true that if the taxation of a country is so great as to put serious burdens upon capital that capitalists will take those burdens into consideration before investing in the country. But $90,000 spread over the mining industry of the province is a negligeable quantity when the returns hoped for from mining investments are the returns actually being reaped from those mines called upon to pay the tax, are kept in mind.

Another curious incident has been added to the history of mining in British Columbia in the closing down of the Wakefield mine and the particulars in connection with it revealed at a special meeting of the company held in Glasgow on the 9th of July. The mine was originally purchased for a Scotch syndicate by David Bremner and development was carried on under his management for some time. It possessed characteristics in common with many other Slocan properties. There were fairly good bunches of high-grade ore occurring in sufficient numbers to make economical development and shipments highly profitable and had the mine been worked in this limited way the chances are that its purchasers would now have nothing to regret. But after Bremner severed his connection with the syndicate a new and ruinous policy was adopted due to the ignorance of the directorate and their misplaced confidence in the mining engineer, Mr. E. A. Paterson, who was in charge. Mr. Paterson's statements in reference to the property were so extravagant and his calculations so magnificent that either the Wakefield was the greatest silver lead mine in the world or else he himself was wholly unreliable. It has turned out that he was wholly unreliable. His method was extremely simple. He took the cubic contents of the vein and called it ore. He thereupon calculated a great tonnage in sight and led the directors of the company like sheep to the slaughter, upon a policy of mill and tramway building which the mine had never been and would never be able to afford. Such a method of calculating ore in sight would be reckless and vicious in reference to any mining property, but applied to a Slocan mine was nothing short of insanity. The outcome has been disastrous and of course British Columbia will get part of the blame. This is both very unjust and much to be regretted but inevitable. The canny Scot has lost his money and one cannot expect him to realize the fact that no one is to blame except himself. This is the more to be regretted as the shareholders in the Wakefield are men of good standing and reputation in Glasgow where an ill word spoken against British Columbia will close the Glasgow market to British Columbia properties for some time to come. For our part, we would rather trust our money to the greatest rogue unhung with some mining experience than to the culpably honest and ignorant management of the Wakefield mine. The rogue will at least display some prudence and is not likely to ruin his own credit for an inadequate compensation, a variety of simplicity peculiarly reserved to the fool. However, British Columbia can stand the blame. Mining is fortunately in such a position now that when people who lose their money in foolish speculation blame the resources of the country, those who know the resources of the country can afford to laugh at them. There are certainly elements of humor in the story of the Wakefield mine. Consider if you will the effect upon a canny and reputable board of directors of the following telegram : "Regret to inform you that mine does not look well for the present and not likely to improve. Grade of ore at various points of development is not maintained. Is petering out rapidly," which came upon them like a thunderbolt just when they were starting out on a full voyage of prosperity —in their minds. Their reply sustains the humor of the situation: "Directors very much disgusted. Are we to consider your past reports unreliable and calculations valueless."

Still funnier is the report of Mr. T. Trafford Wynne, who had charge of the mine during Mr. Paterson's absence, in which he says that the mine is probably much as it has been all along. But the climax is reached in the suggestion of the chairman that Mr. Paterson's telegram was due to the state of his health. We humbly submit that there are sub-oceanic depths of humor in the idea that a mining engineer was so run down in health as to blurt out—the truth.

There are two main factors which will affect the copper-gold industry during the coming autumn and winter. These are the final testing by actual smelter receipts of the great ore bodies of the Knob Hill and Ironsides at Phoenix and the resumption of shipments by the War Eagle and Centre Star at Rossland. The Canadian public having given way to a wild burst of enthusiasm in reference to the Boundary country in general and the Knob Hill and Ironsides in particular, which grew out of the great boom in Rossland mines, notably the War Eagle and Centre Star, is now undergoing an alternating fit of cold depression. The man who a year ago believed that the War Eagle was a veritable bonanza, that the Centre Star was another name for inexhaustible riches, and the Knob Hill and Ironsides were greater than the Le Roi, War Eagle and Centre Star put together, has now the gravest doubts about the permanence, stability or wealth producing characteristics of any one of them. It is needless to say that his opinion does not affect the status of any one of the properties in the slightest degree; but it does affect the liberality with which he opens

his purse for investment in mines. And as British Columbia doubtless contains many undiscovered and undeveloped Le Rois his good opinion is of vital importance to the country. From this point of view, as well as from that of the more direct advantage of the communities in which these mines are situated, the rehabilitation of British Columbia in the minds of investors is a consummation devoutly to be wished. The indications so far are very good. The development of the Centre Star and its economical equipment are now almost completed. Extensive improvements are being carried on at the Trail smelter which indicate that a large supply of copper ore is expected there in the near future. Ore is now being delivered to the Granby smelter at Grand Forks from the Phoenix mines and a rate has been quoted by that smelter for custom ore which should render the profitable mining of the Knob Hill and Ironsides ores probable. The great record also made by the Le Roi mine should do much to re-establish confidence. The Le Roi mine now exports £45,000 worth of gold, silver and copper every month, an output greatly in excess of that of the Alaska-Treadwell, which has long been a household word as one of the great mines of the North American continent. It is evident that this production does not require to be increased but only steadily maintained to place the Le Roi in the very front rank of the world's gold mines. During this year of great production British Columbia has suffered from the untoward disturbances in the industry which occurred last year. It is comforting to reflect that it is equally inevitable that we must eventually reap the benefit of the magnificent showing being made now.

Apropos of cheap smelting in Boundary Creek it is clear that the copper ores of this district are susceptible of treatment at a much lower cost than those of Rossland. There is more copper in them in the first place. The chief part of the values from a number of the Boundary properties is in copper. In addition to this there is enough lime in the ores to make them practically self-fluxing. There is a steady flow of lime rock from Kootenay Lake to the Trail smelter every day of the year for fluxing purposes. The cost of reducing the ore is thereby added to considerably. At the Northport smelter the supply of lime on the spot was not found adequate and lime has to be shipped to that point also. Another difficulty with the Rossland ores has always been lack of copper to collect the gold. Ore containing a high percentage of copper has always been in great demand both at these points and at Nelson. A Rossland mine-owner who had a chute of solid copper pyrites averaged about nine per cent. used to sell his ore to the smelter at great advantage and was in the habit of saying that the smelter charge was sprinkled with his ore out of a pepper pot. Actual experiment with the British Columbia ore at the Trail smelter has demonstrated the fact that nearly twice the amount of ore may be run through the furnace in the same time required to treat Trail Creek ore. The cost of fluxes is thus done away with to a large extent and the labour expense also diminished. It does not follow from this that the cost of smelting in the Boundary will be reduced below $3.50 a ton. But it must be remembered that $3.50 a ton is not the real cost of smelting copper ore. There is a deduction made of 1.3-10 per cent. of the copper in the ore which the smelter appropriates to cover cost of shipping the matte to refineries, bullion brokerage and so forth. Why this charge, necessary and legitimate as it is, should be expressed in a percentage of the value in the ore and not reduced to dollars and cents is one of the hermetic mysteries of smelting. It may shrewdly be suspected that it originated in a device to cover from the miner's eyes the fact that he was paying more for the treatment of his ore than he justly ought. But however it originated the keen competition for copper ores has reduced it to a minimum.

The Americans are nothing if not a practical people, and perhaps to this quality is due in a large measure the flourishing condition of the mining industry in their country. The mining press of the States is equally notable for its eminent practicability, and we extract the following from the columns of our excellent contemporary, the *Mining Reporter*, of Denver, Colorado, as most fittingly illustrating this statement:

"TO EASTERN READERS.

"If you are contemplating an investment in mining in any part of the West, investigate along some of the following lines:

"Send for a copy of the local paper and give it careful study. If you observe that it contains a number of patent application advertisements, you may be assured that the mine owners think well enough of the region to secure a perfect title to their ground. If you observe in it the card of two or more deputy United States mineral surveyors, and of several assayers, you may safely conclude that the district is an active one, that the prospectors are interested, and that the professional men are making a fair living. If you find the advertisement of a sampling works, or of parties who buy ore, it is a sure proof that a number of the mines are producing with considerable regularity, and that some of them are making money. Or in the absence of this testimony, if a railroad has been built to the town, the same conclusion may safely be drawn. If the paper contains the advertisement of one or more banks, the prosperity of the place may be considered certain. It is then only necessary to ascertain whether it is what the miner calls a 'One Mine Camp' or otherwise. One mine camps are settlements around a mine which has proved to be pre-eminently profitable. In such places the mine generally owns the principal stores and the bank, is interested in all the public utilities such as water, light and telephone plants, and does not encourage the coming of outsiders; and outsiders will often do well to stay away from such districts, for the proper place to search for a bonanza, is at some little distance from one already discovered.

"Usually the local weekly publication will, to the careful observer, tell a plain story. If the signs mentioned are found, open correspondence with an assayer and surveyor, enclosing a cash fee of say $10 in your letter, and ask their professional view on the locality. These people are generally gentlemen and men of honour. Often they are college graduates. Their opinions are worth having. After obtaining them, if the outlook is favourable, subscribe for the local paper and also for the weekly mining journal of the nearest large commercial centre. Study both carefully as they come along, and explore the advertising columns of the latter for the names and ad-

dresses of mining engineers who make it a business to report and examine mines. Address two or more of them, and enclose a $25 fee, asking frankly their opinion of the camp. Finally, if the general report on the whole is favourable, take the train and go right to the district and examine the proposition yourself. There is no mystery about the business of metal mining. Any man of average common sense can, if he will take the time, satisfy himself whether the property before him contains the elements of success or failure. There comes a time, it is true, when it is proper and necessary to purchase trained practical assistance and professional advice; but if a proposing investor will first personally look into the proposition offered in about the way suggested, he will be entirely capable of deciding whether the expert to whom he finally applies for technical aid is worthy of the trust reposed in him. There are rascals in all professions. There are many shysters and quacks among mining engineers as among lawyers and medical men. A glib tongue and an attractive presence will cover much mental vacuity, except to those who know. It is a fact, which may be easily demonstrated, that the bulk of failures in mining are due to the inertia of the investor, who is too lazy or too busy to think for himself."

The statement issued by the secretary of the Iron Colt Company at Rossland is not by any means encouraging. It appears that the Iron Colt has been explored since last December to the extent of 748 feet of drifts and cross-cuts in addition to what had been done before, without the discovery of any body of ore of a shipping grade At the same time the work done on the Iron Colt was in the nature of an approach to the body of mineral presumably lying within the boundaries of the North Star. Upon this ore the management of the Iron Colt made many tests, and finally having bonded the claim, shipped the dump of fifty tons of mixed ore to Trail smelter, getting returns of from $5.60 to $9.60. The tunnel on the Iron Colt is expected to develop this North Star ore body at a depth of 400 feet. If the ore is found in place and of pay grade the combined properties can fairly be reckoned on as a mine of considerable productive capacity; if not the exploratory work has been carried on with the greatest possible economy and without any attempt to mislead the investing public. Special interest attaches to the development of this property because of the similarity to the vein of the Columbia Kootenay mine, which is being opened on an enormous scale without any definite information being given out as to whether large bodies of shipping ore have been developed or not.

The output from Rossland for the first eight months of the year amounts approximately to 120,000 tons. Production at present is about 6.000 tons a week, but the output of the Le Roi No. 2, which is now beginning and an early resumption of shipments now beginning an early resumption of shipments from the Centre Star and from other new producers will increase considerably the average weekly shipments from the camp for the remainder of the year. The result should therefore be a moderate increase on the output and aggregate values of 1899, which were 172,665 tons and $3,229,086 respectively. The output for 1900 should reach 230,000 tons and although some of the ores now shipped from Rossland have been of lower grade than those of last year, the aggregate values of ore production for the year should not be less than $4,000,000 on a conservative estimate.

The prospects of the local smelting industry certainly never seemed so bright as they are to-day. The Trail smelter is being enlarged, the works at Grand Forks has made an excellent beginning of operations on a large scale; the Hall Mines smelter has re-opened with much custom work in hand; the Greenwood smelter rapidly approaches completion; a new smelter on the pyritic principle is to be built at Boundary Falls, and there is some prospect of the re-opening of the Pilot Bay smelter, though this last is doubtful. Meanwhile the small smelter at Van Anda has its operations to some extent impeded by lack of sufficient capital and other causes, but continues to treat a fair number of moderate sized shipments.

The July output of the San Eugene mine at Moyie is very satisfactory, being 2,396 tons of concentrates and clean ore, representing over 10,000 tons of ore mined and treated. If the mine during June made a net profit of $70,000, as is currently reported, with an output of 1,900 during July, $100,000 net must have been placed to the credit of the shareholders. The San Eugene is said to be the biggest silver-lead mine in North America with one exception. Whether that be so or not it is evidently a very great mine and one whose output will have a splendid effect on the mineral statistics for 1900.

The output from the Slocan country for July is given at 3,315 tons of ore and concentrates. If this rate is maintained, as it undoubtedly will be, if not materially increased when rawhiding commences in the winter, the country will go back to its old level of production in 1898, if it does not actually beat the record year of 1897. The silver-lead output of British Columbia with the Slocan maintaining its old position, and with the splendid accessions now being made from East Kootenay must show a very marked advance during the present year.

Although Lardeau's development is temporarily checked by lack of transport facilities and consequent excessive cost of ore shipment, several of its richest mines either are making or will make fair shipments. The owners take care of course to send out for treatment only the highest grade of ore from the mines, but this is quite excusable if not absolutely necessary, where transport and treatment charges together run to between $40 and $50 a ton. Notwithstanding this, the Triune mine, near Ferguson, has by making a shipment of nearly twenty tons of $290 ore, become a payer from the grass roots and encouraged its owners' hopes of sending several other lots to Trail by the close of the year. The owners of two or three Lardeau mines have also ore sufficiently rich to stand the present heavy cost of shipment and treatment and are consequently likely in the course of the next few months to ship several hundred tons of ore from this locality. The Lardeau ores now being shipped are not only of high grade in silver and lead but also contain much gold, and judging by the beginnings now being made, it seems not unlikely that certain of the best Lardeau properties may rival in point of both production and value the substantial and profit-earning mines of the Slocan.

There are encouraging signs of a revival of mining activity about Ainsworth, which has too long remained quiescent. The Highland group of mines has just been acquired by a body of very substantial British capitalists, who evidently intend to spend large sums in developing the property. One of the directors of the concern, Mr. Hammersly Heenan, of Manchester, England, a well known mechanical engineer, has the reputation of proving thoroughly any mineral enterprise in which he interests himself and believes to possess merit. He is one of a number of men, who for some ten years operated gold mines held by the Darien Company on the Central American isthmus of that name. Year after year passed disappointing high expectations of results, but recently after well nigh a decade of hope deferred, the mine has begun to yield well and justified its owners' expectations If the other directors of the Highland be of similar type to Mr. Heenan the property will at any rate be well exploited.

Mr. R. McBride, the New Minister of Mines.

It is understood that negotiations are in progress which will, it is hoped, result ere long in a resumption of work at the Savonas Cinnabar mines. The present increasing demand for quicksilver, which has risen much in price, is bringing Cinnabar deposits into much greater request than they have been in the recent past.

If it is true, as reported, that Mr. Maynard H. Cowan and other Montana mining capitalists with extensive smelter connections have acquired and will shortly work a large area of coal land in the Crow's Nest country near Livingston, we may expect next year a great extension of the already steadily proceeding development of one of the greatest coal fields in the world. Mr. Cowan asserts that owing to the more advantageously situated locality of the syndicate's property, he will be able to mine and produce coal more cheaply than the Crow's Nest Pass Company. We do not, however, believe that Crow's Nest shareholders have any cause to fear for their future dividends.

It is suggested by a mining engineer of Vancouver that a tax be imposed on the values of mineral claims held idle for speculative purposes. The principle of such taxation is unassailable, but there is only one way to apply it in practice, and that is by taxing all Crown granted claims, but allowing a rebate on the levy to owners who could swear to having performed a certain amount of work in the course of the year. This idea is not original, though published for the first time, but in common with many others equally as practical, was evolved from the inner consciousness of Mr. John Houston, the member for Nelson.

The Provincial Government is to be commended for its resolve to issue frequent bulletins and statistics of mine production and output, and if, as the Minister of Mines, Mr. McBride, hopes, these returns can be made either monthly or at intervals not very much greater, they will certainly advertise in the most effective possible way the mineral resources of the country.

The fact that the provisional boundary arrangement in Alaska for the time being concedes to this province about half the Porcupine mine district, is terribly perturbing to our American cousins. Indeed Mr. Bryan has already used the point in one of his anti-expansion speeches and asserted that since the present Republican administration has hauled down "Old Glory" in Alaska, it should not be impossible to hand over the Phillipines to native rule. The Porcupine district now provisionally placed within the borders of the province, is in area small, and its placers only at present produce about $125,000 in gold annually. But according to experts, there are also in the district promising copper prospects. Mr. Justice Martin will find it no easy task to settle the various points in dispute as to Porcupine mine titles, but he will probably—as did his colleague, Mr. Justice Irving, in Atlin—manage to solve the problem by taking the equitable rather than the technical view of the merits of the various cases submitted to his decision.

At the London Bankruptcy Court a public enquiry was recently made into the circumstances attending the promotion, business transactions and failure of the Klondike and Columbian Goldfields, Ltd., which

was formed in August three yaers ago with the object of operating in mining and other properties in the Yukon and British Columbia. The promoter in chief of this undertaking was Mr. J. Morris Catton, or "wild-cat-ton" as he is now dubbed by the London press. The *Financial Times* of recent date devotes five columns to a report of the proceedings and they make entertaining reading. From a certain point of view Mr. Morris Catton is undoubtedly a great man and a strategist of no mean order—but this is to be expected from a War Office clerk. Meanwhile as a result of the enquiry disclosures of the most disgraceful character have been made and on several counts there should be enough evidence to send Mr. J. Morris Catton to serve a considerable term of penal servitude. But people in British Columbia take very little, except a morbid interest in the fate of London floated Yukon mining concerns and their promoters. This is a mistake, because unfortunately the British investing public are associating the Yukon and British Columbia together, and the Klondike and Columbian Goldfields swindle and other Yukon "fizzles" are certainly likely to further antagonize the London market against this province. It is, therefore, time that attention should be paid to the operations of gentlemen like Mr. Morris Catton. Moreover thanks are due from us to the *Financial Times* and the *Critic* for the part both have taken in putting a stop to Mr. Catton's little games.

It is gratifying to learn that the showings of iron ore at Barclay Sound are to be thoroughly exploited by a syndicate of Pennsylvanian capitalists, to whom the property is under option. Little is yet known of the iron resources of this locality, except that the surface indications are enormous, and the specimens taken therefrom show the quality of the ore to be all that could be desired. The only question is whether the iron will continue with depth or, as in numerous other instances, the surface showings are not merely cappings of copper-bearing ores.

The Central Canadian Chamber of Mines, an organization which began its career by commenting on the somewhat remarkable fact (only it happened to be far from a fact) that not a single Canadian mine was listed on the London Stock Exchange, has settled down to business and has begun a series of periodical statistical bulletins which contain a vast amount of information useful to investors and will undoubtedly do much to attract capital to the central Canadian gold fields. It is really astonishing that British Columbia, with its long record as a gold-producing province, and with a mining industry which has already reached considerable proportions, should be so far distanced by the prairie province in the scientific adaption of means to the end of developing its resources. This really remarkable production gives in a succinct and tabulated form the result of mill crushings up to July, 1900, as a preliminary step to furnishing an accurate return month by month or quarter by quarter. It also details the names, localities, amount of development done on each of them; and certificates of assay value at different points of a great number of prospects. The information given is precisely the information wanted. It is given in the form most convenient to the press and to the investor. The Central Canadian Chamber of Mines has shown a rational appreciation of the requirements of the gold-bearing district it has been formed to foster. British Columbia might well profit by the example shown.

From all the mining districts most satisfactory reports are being issued of steadily growing mineral production, which this year will considerably eclipse all previous records. In the Nelson district the July output aggregated in value $66,000 from three properties which are yet hardly beyond the development stage. Of these three the Ymir crushed 450 tons of ore, having an estimated gross value of $39,500; the Athabaska's clean-up realized $17,100, and the Granite crushed 1,040 tons, from which a return of $9,550 was made. When the Hall Mines resume operations Nelson's contribution to the mineral production of the Province should easily reach a million dollars per annum.

Meanwhile few people, if any, at the present time have any idea of how the mineral output of British Columbia is growing. It is not too much to say that the present rate of output is double the average rate of last year from metalliferous mines. It does not follow from this that the total output of the year will show an advance of 100 per cent. The marvellous increase in production now noticeable has only come into prominence since May, and although it is likely to be maintained if not increased during the balance of the year, still the totals will not bear the same relation to one another as the present rate of production does to the average rate of last year. The following table gives an estimate of the value of the mineral output of the Province, excluding placer gold, for the month of July:

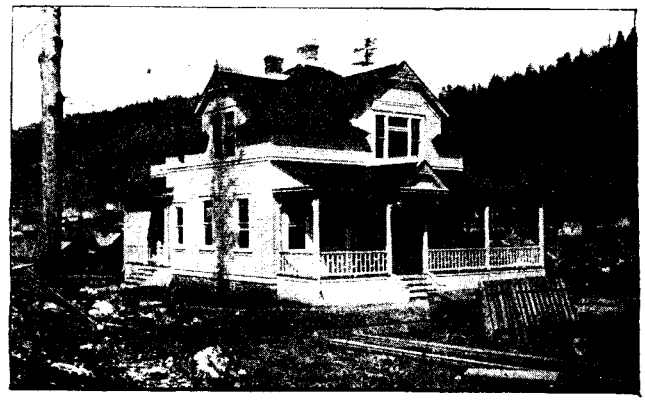
Trail	$ 300,000
Slocan, including Ainsworth and Lardeau	300,000
East Kootenay	317,720
Nelson	66,000
Boundary, including Camp McKinney	132,500
Coast and miscellaneous	60,000
	$1,176,220

These figures are not mathematically exact, but they are certainly not greatly, if at all, over the mark. When it is remembered that the output of our metalliferous mines for last year came to only $6,751,000 and the total output, including placer gold, to $8,000,000 in round figures, their significance will be really understood.

THE LE ROI FLOTATIONS.

MR. WHITAKER WRIGHT is certainly entitled to the credit of being the shrewdest speculator on the London mining market. For some time past the various groups of mines controlled by the London & Globe and British America Corporation have been raided by "bear" operators. During the general mining stagnation which has prevailed prices were unmercifully hammered and so dead was the market that every fresh depression in a stock seemed to give occasion for and to justify further sales. Mr. Wright seems to owe his success to his faculty for never doing what everyone expects he should do. He chose this particular inanimate period to bring out Le Ro No. 2 followed immediately by Le Roi No. 3 and then by Le Roi No. 4. That he should do so at the very time when properly constituted mine promoters were crawling into their holes and drawing their holes in after them, would naturally seem to that peculiar abstraction known as the market as a very good joke. Not only was it a very good joke, but one out of which the intelligent speculator could make a little profit for himself. It is a convention on the English market that the shares of every large flotation must go to a premium before allotment and maintain it till after the first settlement if possible. The reason is that when an issue is made by a certain

group the shares are taken up by semi-professional speculators who apply for a great many more than they intend or are willing to hold. And woe to the promoter who saddles these gentlemen with the bulk of any company's shares. Unless he allows them to sell out at a profit to the bona fide investor, some other speculator or himself, his chances of appealing to them in some future promotion are uncommonly small. Hence the reason for the aforesaid conventional premium. When in addition to choosing the worst possible time Mr. Wright chose also a property in the worst possible country, British Columbia, for his experiment with the market, his effrontery was justly regarded as amazing. The market has the lowest possible opinion of British Columbia. On all sides the Le Roi No. 2 was scoffed at. That great bodies of ore had been patiently developed in the property was not known, or if asserted was not believed. The market looked upon Le Roi No. 2 as a very speculative extension of a mine, the Le Roi, which had still to accomplish much to justify its existence. This extraordinary ignorance of what may justly be called a great gold mining field has been largely fostered by the tone adopted towards the Rossland camp by the press and public sentiment in Canada, and throughout British Columbia. Such being the attitude of the public mind to Le Roi No. 2 the market proceeded to have its little joke with Mr. Whitaker Wright. Two things the market overlooked, first that there were a number of people who believed in Le Roi No. 2 as an investment, quite enough people to prevent the shares ever going to a very small price, and second that Mr. Wright knew more than the market did about the capacities of the mine and, apart from that, was apt to play the game of speculation with a dangerous amount of daring and abandon. It would naturally occur to the ordinary individual to consider when Le Roi No. 2 shares were forced to a premium which the press was unanimous in declaring could not be maintained, that with a minimum of risk he could well afford to sell short, as the Americans have it, on so unpopular a stock. The premium must shortly disappear and a good margin be made by the acute bear. The trouble seems to have been that this easy way of making money occurred to too many people at the same time, and incidentally, that Mr. Whitaker Wright took a diametrically opposite view of the situation. All the shares that anyone was prepared to sell he was prepared to buy, and not only so, but to bid higher and higher prices for the stock. It finally of course resulted in his possessing contracts for delivery far in excess of the actual capitalization of the company. He could then very well afford to take the shares of the actual alloters at a very high price, and so establish a complete corner by means of which the only limit to the price of the stock was the figure at which he could resell to those who had already given him contracts to deliver. He is reputed to have netted £750,000 by the transaction. The stock was marked up to over £12 for the £5 shares, around which price a general settlement of accounts took place. It is not necessary here to discuss the ethical bearings of such speculation. John Stuart Mill defends it as economically rational and proper; Messrs. Chadband and Stiggins denounce it when they happen to be on the wrong side of the market; and the ordinary grocer who adulterates his tea and sugar thanks Heaven that he is not endowed with as much brains as Mr. Whitaker Wright. It will be remembered that the fortune of the late lamented and pious Presbyterian, Mr. Jay Gould, was accentuated in much the same sort of operation, only he used his genius in the direction of railways, not of mines. Mr. Gould was always careful to have merit at the back of his railway combinations. Given two or three competing railways through a productive but undeveloped country Mr. Gould's *modus operandi* was first to wreck them, then combine them, and then foster their business in the territory they controlled. Strange paradox as it may appear, the rapid industrial development of many important sections of the United States was directly due to the railway wrecking genius of Mr. Jay Gould and his feebler imitators. In applying the parallel it is not necessary to consider the abstract morality of Mr. Wright's financial methods, merely the uncommon shrewdness, economy and success of his mining methods. The mines controlled by Mr. Wright in British Columbia are models of patient and intelligent development. They are worked in the most scientific way possible and have so far achieved excellent results in the matter of producing gold and copper. So long as this solid foundation of merit exists it is unnecessary to waste any sympathy upon the misguided bears. The market has always been consistently and persistently hostile to British Columbia;



Superintendent's Residence—the B. C. Copper Co., Anaconda, B.C

Mr. Wright and his friends have always been consistently and persistently friendly to British Columbia. The analysis of the Le Roi No. 2 boom is simply this, that the friends of British Columbia have abstracted a large amount of money from the pockets of the enemies of British Columbia and put it into their own. By this operation they have enormously strengthened the financial standing of the group of properties they control and have greatly bettered the prospects of the province, provided these properties are good ones. In this respect these properties may justly be considered beyond the problematical stage. Without Mr. Whitaker Wright Rossland would not be the sheet anchor of British Columbia mining as it is to-day. A most unfair comparison is sometimes instituted between him and Mr. Horatio Bottomley. But we humbly submit that it is one thing to "bluff on a pair of deuces" and quite another to bet high on "four aces and a king," although the two operations look precisely the same before the hands are "called." In conclusion it may be said that there is no reason whatever why Le Roi No. 2 should not pay fair dividends even on its enormous capitalization, although, perhaps at present, the outlook for No. 3 and No. 4 is not so favourable and the financail press of both New York and London are not far astray in the criticisms which have been passed on these promotions.

B. C. COPPER COMPANY'S SMELTER AT ANACONDA, BOUNDARY CREEK.

(By E. Jacobs.)

IN the spring of 1898 the British Columbia Copper Company, Ltd., was organized in New York with the object of carrying on a mining and smelting business in the Boundary district of this Province. The company at once acquired the Mother Lode mine, situate in Deadwood camp, Boundary Creek. For about two years previously a prospecting syndicate, known as the Boundary Mines Company, had been engaged in prospecting the Mother Lode. Eventually it became evident that the big body of copper ore only partially opened up by the mining operations undertaken up to that time was sufficiently extensive and valuable to warrant its being developed by the aid of suitable power plant and machinery, so the British Columbia Copper Company was formed with a capital of $1,000,000 and the property was taken over and equipped and development work, particulars of which have been regularly published in this journal month after month, was entered upon and systematically carried out. An illustrated description of the Mother Lode mine appeared in last September's issue of the RECORD, so it is hardly necessary to here repeat what was published then. Suffice it that it be briefly mentioned that the main shaft of the mine is now down 325 feet; that one big ore shoot has been proved to be at the 200 foot level from 80 to 100 feet in width along a distance of 350 feet, with good indications that further development will show it to be of greater length; that other ore shoots not yet opened up to any considerable extent are known to occur in the mine; that the total number of feet of work done in underground development now exceeds 4,500, and that the mine equipment of plant and machinery, including the larger air-compressor, drilling appliances and steam hoisting engine ordered but not yet received, is of sufficient power to develop the mine down to the 1,000-foot level.

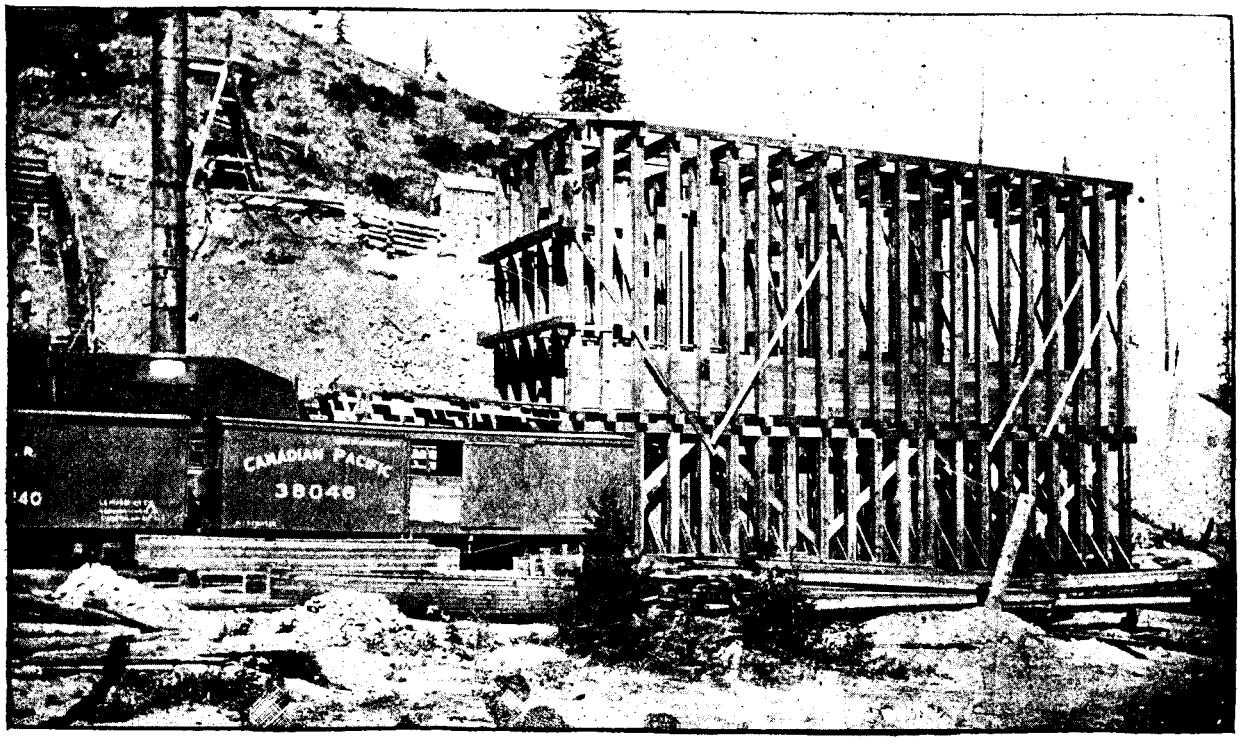
The fact having been established that there was a very large body of ore in the mine, the question of its treatment and reduction engaged the careful attention of the management. Eventually arrangements were made with Mr. Paul Johnson, M.E., a smelter expert of much practical experience, gained during many years' active connection with smelting enterprises, to proceed to the Boundary district and to there erect a smelter. Mr. Johnson reached Boundary Creek last fall and after having closely studied the local conditions he found a site at Anaconda to be suitable, having due regard to the requisites of proximity to mine, water supply and railway. This site is at

1—Mr. Paul Johnson, Manager Smelter.
2—Mr. R. Lidea, Supt. 3—Martin Anderson, Gen. Foreman.
4—Assay Office and Laboratory.

the junction of Copper Creek, coming in from the northwest, with Boundary Creek flowing southwards, and its general adaptability to the ordinary requirements of a gravity system can readily be grasped after examination of those of the accompanying views that exhibit its topographical features. Reverting to the considerations above mentioned as of importance in choosing the site, it may here be pointed out that the Mother Lode mine is situate about three miles northwest, with a down grade all the way to the smelter; that the immediate vicinity of Copper and Boundary Creeks ensures a water supply and that whilst the Columbia & Western main line runs alongside and below the smelter site its Deadwood branch, giving rail connection with the Mother Lode and other mines, passes immediately above it, joining the main line a mile from the smelter. Transportation facilities are accordingly convenient and adequate, for whilst spurs run from the branch line above to the upper ore bins for the delivery of ore, and go over the yard lower down for the delivery of fluxes, fuel, stores, etc., it will be easy to make connection with the main line below by a spur 200 or 300 yards in length and so provide at small cost a suitable outlet for the matte and other marketable products of the smelter.

Mr. Frederic Keffer, General Manager.

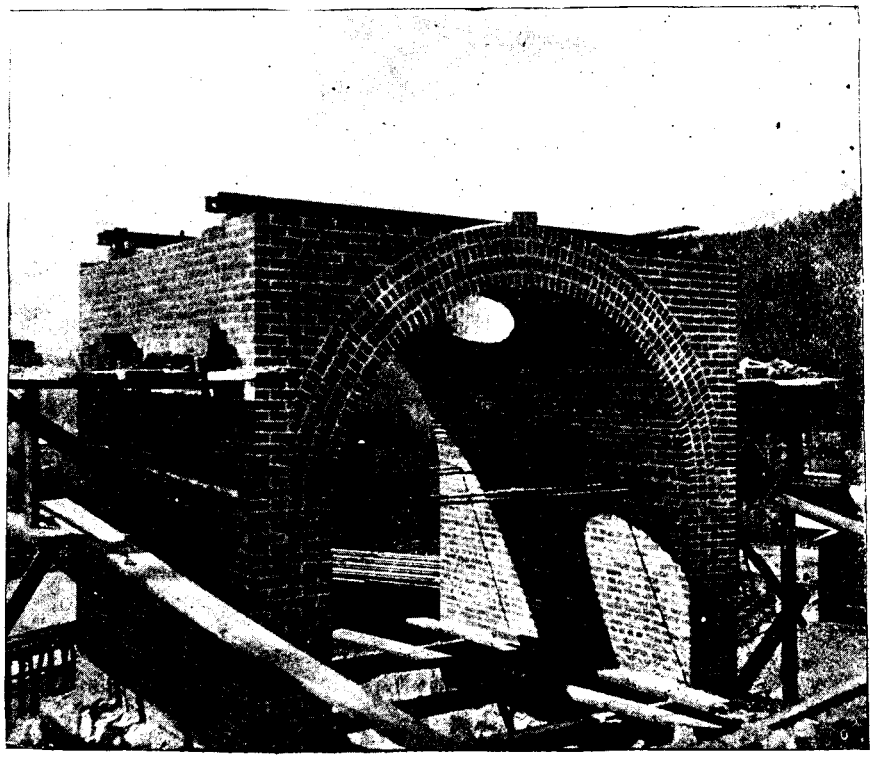
Starting from the top of the works the upper ore bins come first. These are six in number, substantially framed with 12x12 sawn timbers, and lined with 3x12 planking. They are built in two parallel rows of three each with a double railway track over them. Each bin has a holding capacity of about 500 tons, so that the total capacity of these receiving bunkers is about 3,000 tons. Beyond them a trestle will be built wide enough to carry the double track. This will be inclined towards the bins, over which and on the trestle there will be room for sixteen railway cars. The ore will be taken out of the bins through chutes below into ore cars which will be run down an incline tramway, the highest bent of the



Ore Bins in Course of Construction at the Mother Lode Mine.

trestle supporting which is 36 feet high, to the sampling mill.

The sampling mill building is a three-story frame structure 79x65 and 48 feet high to the eaves, and having a corrugated iron roof. Its full capacity when supplied with the requisite ore bins, etc., will be about 3,000 tons, but present arrangements only include provision for a much smaller quantity. The building is large enough to accommodate three sets of plant, together equal to sampling about 1,000 tons in ten hours. Only one set is, however, to be put in to start with, and this will comprise three Gates' crushers, one pair Cornish rolls, one coffee mill or sample grinder, three Johnson's automatic samplers and a steam engine to operate this plant. The lowest floor of the sampling mill will be about 23 feet above the yard and two feet higher than the top of the lower ore bins.



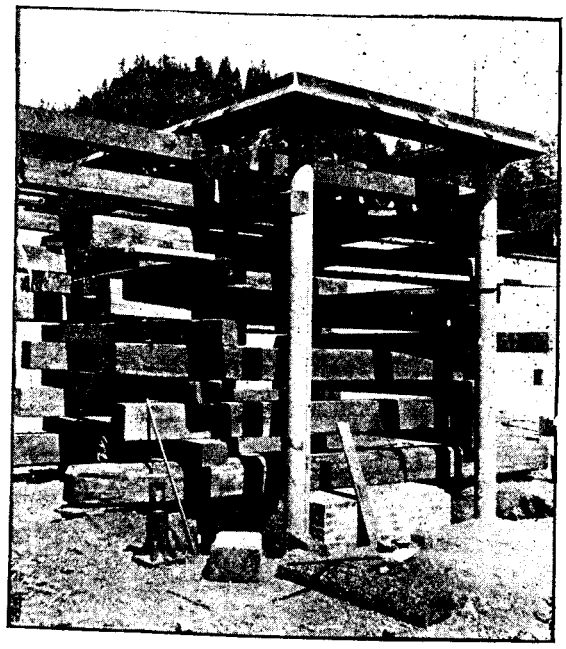
Brick Base for the Steel Stack.

There are twelve bins in the lower set, arranged in four parallel rows of three each. They are similar in structure to the receiving bins, but slightly smaller in individual size, their total holding capacity being about 5,000 tons. They are crossed by parallel railway tracks each about 400 feet in length and carried on trestles 21 feet in height. One of these crosses at the rear end of the bins and the other at the front. They are spurs from the railway line and over them fluxes, coke, etc., will be brought in and dumped in the yard underneath. On the same level as the yard are the carpenters' shop and dwelling houses for the two foremen.

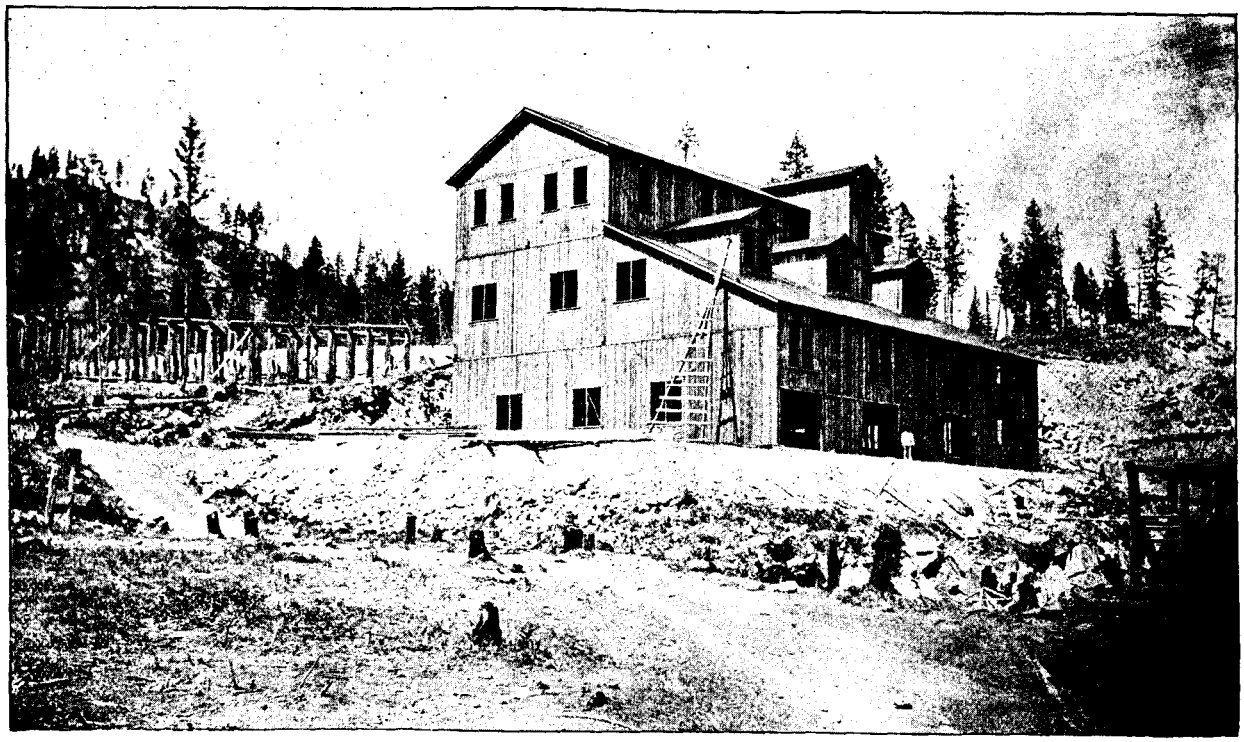
The dust chamber runs below the lower ore bins at right angles to them for nearly 300 feet, thence diagonally for about 100 feet and thence up the hill side 215 feet to the base of the smoke stack. This chamber or flue has thick masonry walls brick-lined in part and is now being arched over with brick. One of the illustrations herewith shows it in its incomplete state. A steel plate smoke stack, 90 feet high, will be erected on the brick base shown in the view, but space has been left and the foundation prepared for a brick smoke stack whenever it shall be deemed necessary to erect one.

A 300-ton stack matte furnace has been received at the smelter from the Milwaukee, Wisconsin, works of the E. P. Allis Co., who are supplying the smelter plant. One of the illustrations shows the furnace in course of erection with the cribbing upon which the heavy iron plates were raised not yet removed. Besides the columns and plates shown the water jacket, casting, fittings and down-take are all on the ground, so that the furnace will shortly be set up. Later a building, largely of steel, will house it in. On the same level as the furnace is the boiler and blower house, which is a roomy lumber building similarly roofed to the sampling mill. This building is ready to receive the boilers and machinery and the electric light plant, which will also be placed in it. Near by is the blacksmith's shop. There is plenty of room below this level for the slag dump.

Provision is made for taking the ordinary water supply from Copper Creek, from which to the level of the top of the receiving bunkers and thence down to the furnace about 3,000 feet of eight-inch pipe will be laid. A 10,000-gallon tank built at a higher level will be kept full for emergency purposes, and as a reserve supply, pipes will be run from a pump on Boundary Creek to the different parts of the works. The Copper Creek supply will, it is calculated, give a head pressure of 100 feet and will furnish ample water for the water jackets, granulating the slag and for general purposes.



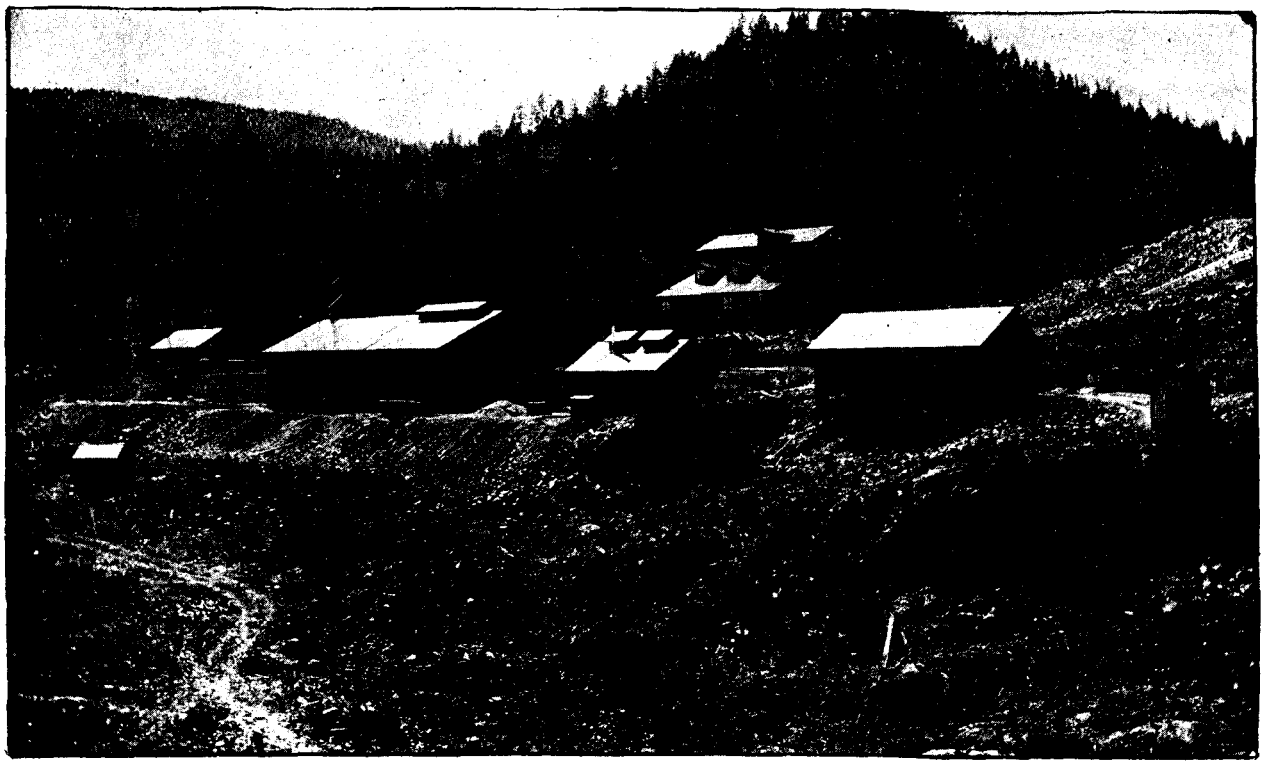
The Furnace in Building.



The Sampling Mill.

The general office building is across Boundary Creek, in the town of Anaconda, a short distance from the offices and residence of the company's general manager. The smelter superintendent's office and the laboratory will be in a building located near the superintendent's residence. The accompanying illustrations will serve to convey a good idea of these buildings (except the general office, which is not shown). Other illustrations include portraits of Mr. Frederic Keffer, M.E., general manager for the British Columbia Copper Co.; Mr. Paul Johnson, M.E., manager smelting department; Mr. Rudolf Linden, M.E., superintendent of the smelter, and Mr. Martin Anderson, general foreman of construction. A view is given, too, of the ore bins now being constructed at the mine.

General View of Smelter Site Looking North from Anaconda.



General View from Assay Office.

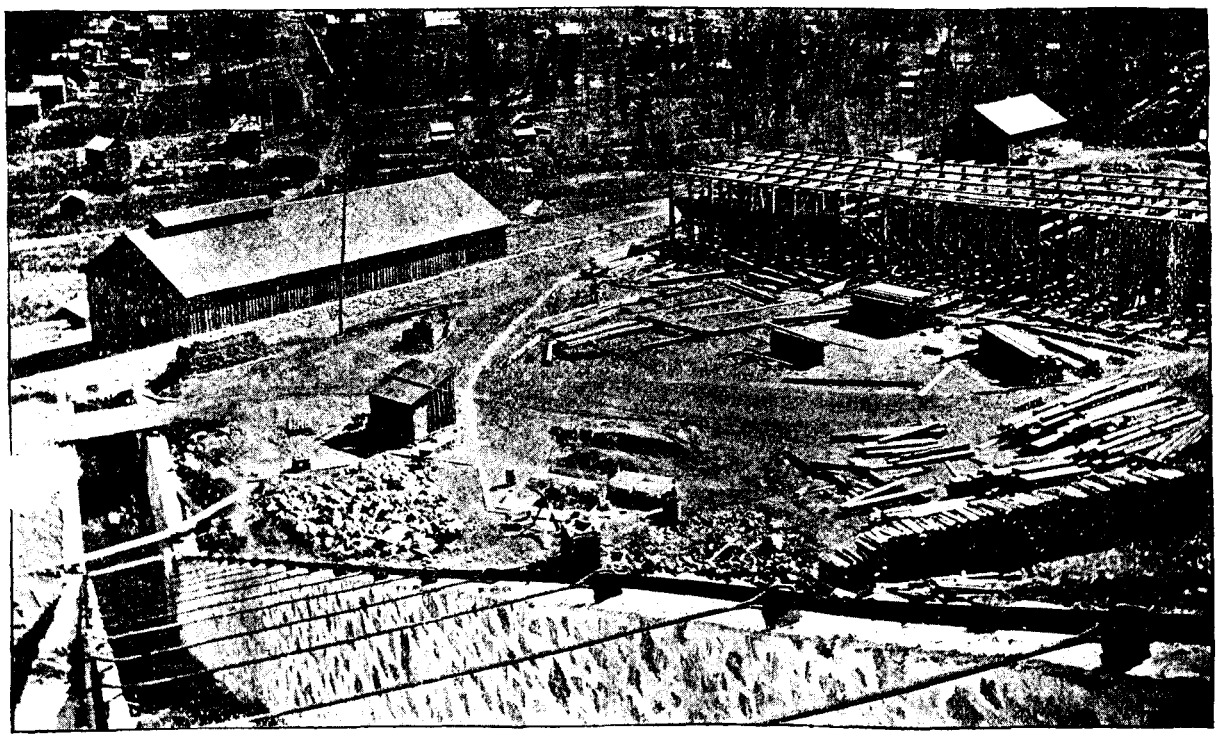
It must be noted that construction work although well advanced is not yet completed, which fact will explain any unfinished appearance noticeable in the views. The plant for the smelter has been ordered but as it is probable the fall will be well advanced before the whole of it shall have been received, it will be seen that the smelter will not likely be in operation until October or November next.

THE ORE-BODIES AND GEOLOGY OF ROSSLAND CAMP.*

(By Prof. Arthur Lakes.)

THE Le Roi and War Eagle mines, within a few hundred feet of each other, employ 1,400 men, and the pay roll of the camp is $130,000 per month.

*Mines and Minerals.



View of Site from the Top of Dust-Flue—Anaconda in the Distance.

The town is a very pretty one, located on a flat in a deep pit-like valley surrounded by wooded mountains. In the distance the hills fade into the purple peaks of the Selkirk Range.

The fondness of the old-country miners for home and flowers is shown in pretty little cottage gardens full of big English sunflowers, hollyhocks, sweet peas, and other plants characteristic of old-country cottage homes. The climate is mild and moist, and everything grows luxuriantly.

The country rock is all eruptive, consisting of gabbro, porphyritic diorite or porphyrite, a peculiar rock called monzonite, which is an augite diorite, carrying both orthoclase and plagioclase feldspar. A series of syenite also occurs.

In these eruptive rocks lie the veins or mineralized zones of the Le Roi, War Eagle, and other mines.

The Le Roi vein consists of a zone of country rock mineralized by copper pyrites and pyrrhotite (magnetic iron pyrites), both being often in massive bodies. Although there are numerous slips and surfaces, evidencing motion having taken place in the rocks, the positive signs of true walls, such as are usually associated with so-called fissure veins, are more or less wanting, the ore often grading into the country rock bounding the mineralized portion. It is probable that the line of fissuring and planes of the walls have been obliterated by the mineralizing solutions.

The ore body has a dip of 50° to 60°. The strike of the vein is N. E. S. W., or nearly E. and W. The vein or mineralized zone appears to be of the class known as "shearage zones," or "composite veins," the ore occupying a series of cracks and fractures along a zone of rock caused by shearage movements. In this sense the veins of this district may be called true fissure veins. Calcite is not infrequently found with the vein and is said to be a good sign of gold.

A peculiar feature in the Le Roi mine is, that at a certain point in the mine the mineralized zone or vein ends abruptly against a dark dike of mica diorite, and so far has not been found beyond that. It would seem that the dike occupies the line of a fault fissure and that the ore body has been faulted by the dike. By following the course of the dike according to the laws of normal faults it is probable that the ore body will be recovered again on the side where it is at present missing. Prospecting is on hand to prove this. The ore of the Le Roi runs from $12 to $40 per ton, about $5 being in copper, the rest in gold. The product of the mine depends more upon the great quantity of low-grade ore than on the quality of the ore. The copper alone, by itself, would not pay if it were not enriched by gold.

An enormous dump, seemingly of refuse matter or third-class material, lies on the hillside at the entrance to the mine that will shortly be shipped wholesale to the large mills at Northport with an expectation of a good return of low-grade values.

The width of the vein is from 5 to 65 feet. In the seventh level there is a large stope which shows the vein there to be 60 feet wide on an ore shoot 400 feet long. The square-sets supporting the roof are of very thick tamarack timber.

The outcrop of the big vein is easily followed along the side of the railroad track as a dark greenish rock full of oxidized ore. The development of the mine is by shaft and tunnels on the vein. The shaft is down 800 feet. For a depth on the slope of the hill of 280 feet, adit tunnels come out to daylight, but below that there is no such egress, as the mine descends below the bottom of the valley.

There are nine levels in all. The mine is remarkably dry. The output is 400 tons daily, all of which goes to the big mill at Northport. In the plant are two very large air-compressor engines of Canadian make. The cylinders are 22" high pressure, 40" low pressure, 48 inches stroke; 500 horsepower each; running forty 3 1-3 inch drills of the Rand Drill Co. pattern. The hoist, also of Canadian make, is 300 horsepower, and handles two skips holding two tons each.

We may derive an idea of the extent and development of the mines of this young camp by a paper read before the Canadian Institute of Mining Engineers by Mr. Carlyle, the late superintendent of the Le Roi, and at present in charge of the Rio Tinto copper mines of Spain.

In the B. A. C. properties alone there has been done 23,000 feet of underground work. The work in Rossland has been mainly development work, yet the camp has paid $1,400,000 in dividends. The work now being done is with a view to the future.

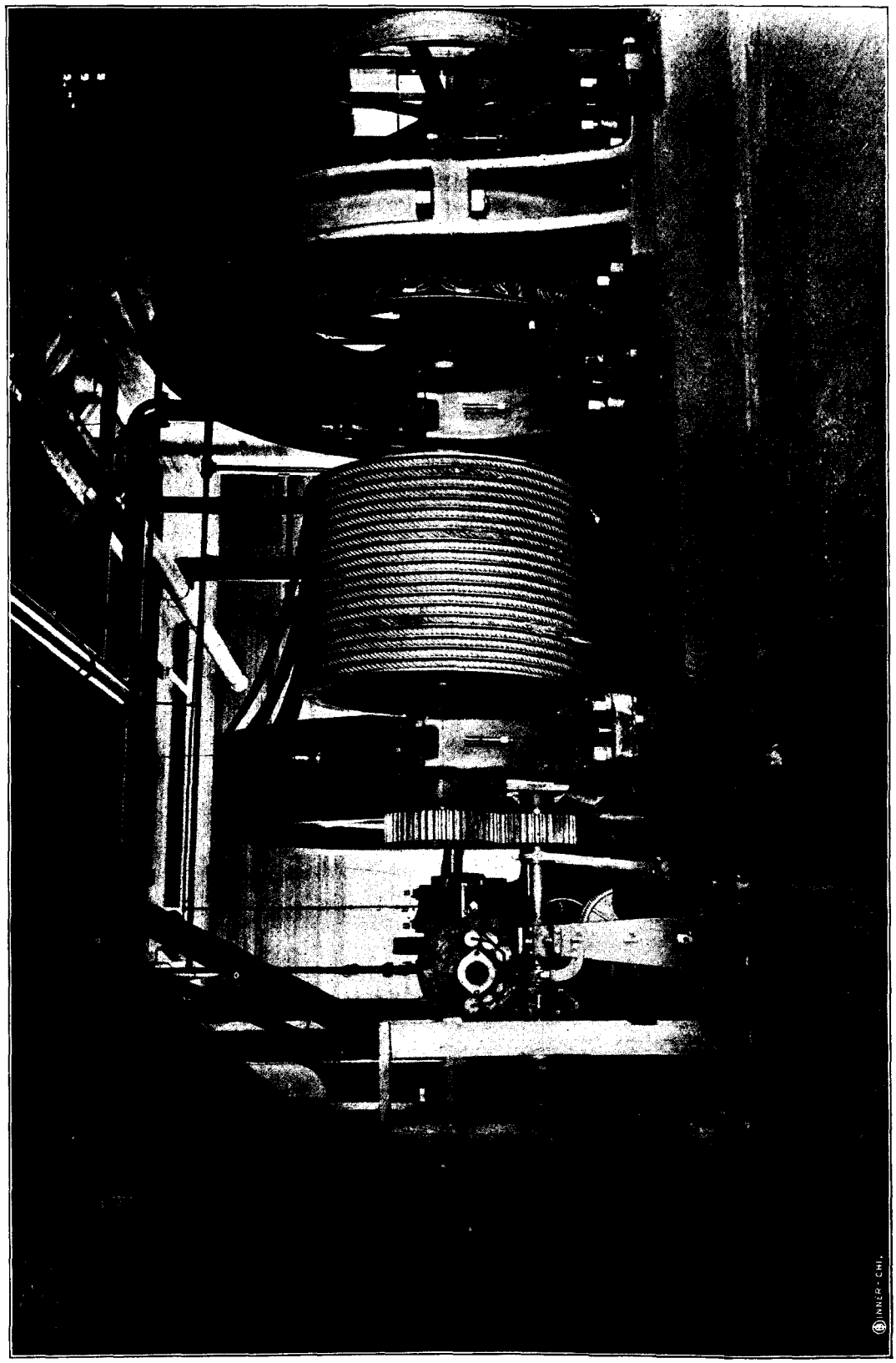
The policy of the Le Roi is to prepare still larger reserves of ore, and only small shipments comparatively have been made, yet the company has to its credit a sum that would make a very respectable dividend.

In driving the Le Roi, a rate varying from 110 to 160 feet a month is attained. With three shifts, over 200 feet a month have been driven. The mine is equipped with a 40-drill compressor, equal to all demands. This is to be supplemented by a new 60-drill plant. The introduction of electricity will work wonders and there will be a great increase in the amount of work and output. It is likely, too, that other veins will be discovered.

GEOLOGY OF THE CAMP.

The leading features of the geology of the camp and its ore deposits are that the camp is located on the site of an ancient volcano, in this respect not unlike Cripple Creek, Colorado. The central core, plug, or neck of the volcano is formed of massive, dark eruptive rocks, gabbros, and diorites. This is the area that is penetrated by the fissure veins of the district. Outside of this, forming a rudely defined ring, are bodies of fragmental lava tuffs and breccias that fell around the periphery or edge of the crater during the time of its explosive eruption. Several varieties of lava were erupted from the same volcano, having a general family likeness to one another, as if they were but differentiations of the same molten magma. These dark basic lavas we have already mentioned.

As at Cripple Creek, Colorado, so here, the original lavas appear to have, after consolidation, been disturbed by another eruption, fissuring the rocks and filling the fissures with dikes of another variety of lava, as the phonolite dikes of Cripple Creek fill the fissures in the original andesite-breccia lava. The fissuring and faulting of the older lavas during the later movements are often filled by dikes, and the lines of the faults are either shown by a narrow ravine or by the presence of a dike or by both. A



Electric Motor Driving Air Compressor—War Eagle Mine, Rossland.

ravine descending from the Little Josie mine marks the line of a fault occupied by a dike, and so on in many cases.

The veins are essentially fissure veins in that they occupy a fissured zone of rock commonly known as a "shearage zone," limited by more or less defined walls. Such shearage-zone veins are also characteristic of Cripple Creek, as at the sheared granite of the Gold Coin vein, and the sheared mineralized dikes, generally of the so-called veins of that volcanic camp.

There are at present only two or three notable mines in this Rossland camp, though there are many

small ones in a prospective state. Judging from the character of the formation there seems a probability that, as in the case of Cripple Creek, several other mines of like nature and value as the Le Roi will be found in course of time.

Rossland in early days was noted for the amount of heavy machinery installed on its prospects. The record is still maintained. The big steel hoist of the War Eagle is one of the largest frames of its type in the West. Another hoist of similar design is to be erected in the Centre Star, the War Eagle's neighbour.

Power is derived from the big electrical camp at Bonnington Falls on the Kootenay River, 30 miles distant. The power is sent at a high voltage to the mines at Rossland, where it drives the air compressor of the bigger mines.

The arrival of the Canadian Pacific Railway into Rossland has greatly reduced smelting rates—from $11 down to $7.50. Since then the War Eagle and Centre Star have jointly let a contract for treating 300,000 tons of ore at Trail Creek within the next two years, and the rate they will get is believed to be in the neighbourhood of $6.

At Northport, near Rossland, is the only smelter in Eastern Washington. It was erected by the Le Roi Company to treat the ores of the Le Roi mine, but in addition it handles considerable custom work. In the vicinity are some copper gold claims, and in Boundary camp some silver-bearing leads.

A detailed account of the geology of this camp is appended, taken from the expert reports of Messrs. Clarence King and Waldemar Lindgren, published in the Rossland *Weekly Miner* and by the courtesy of the editor of that paper submitted to us for epitome and production.

A GEOLOGICAL SKETCH OF THE CONDITIONS OF ROSSLAND CAMP.

The district about Rossland is part of that great mountain system that borders the Pacific from Cape Horn to the Arctic. Its widest expansion, about the latitude of San Francisco, is 1,400 miles. The quantities of rock involved in the Cordillera system are vast, upwards of 120,000 feet of overlying strata in vertical thickness. They involve a history from near the dawn of geological history until to-day, of enormous dynamic action, consisting in the upheaval, depression, crushing and folding together, as well as dislocation of enormous blocks of territory.

The sedimentary rocks over 100,000 feet thick are derived from the older rocks in their neighbourhood. Sometimes a series of strata 40,000 feet thick has been piled up continuously without a break. These episodes of sedimentation have ended in a destructive dynamic period. They have been crushed, uplifted, or depressed, and then the process of sedimentation has begun under new terms.

These dynamic disturbances are due to the unbalancing of the forces of gravitation and equilibrium. If you load an area with heavy masses of sediment, that area sinks or subsides. If you unload it, it rises. Consequently, when an area rises near an area which is stable, or sinking, there is a strain, and if that strain passes cohesion, or the point of elastic limit of the rocks, they are ruptured by these tremendous strains. The action ends in eruption and readjustment of the equilibrium—an eruption of melted matter from the underlying area.

It is in these periods of strain to which the rocks and whole mountain ranges have been subjected that the crushing, straining slipping, fracturing, and fissuring takes place which is the birth of a mining district.

Mineral veins owe their origin to two processes. One is the fissuring of the rocks, or the solution of soluble rocks on lines of fissure. The other, or second process, is the filling or deposition of mineral matter on, in, and along, and near these fissures. A mining district requires the two periods of action to change a mountain mass into a mineral district.

These periods of crushing have never occupied a very great part of geological history. There are sudden convulsive episodes, following periods of accumulation of strata, periods of upheaval, and periods of depression. They have, however, ended in deluging enormous tracts of this Cordillera system with eruptive rocks, molten when they came out and cooled under, or upon, the surface. There are fields of these eruptive rocks which cover many thousands of square miles, as in Washington, Idaho, and Oregon.

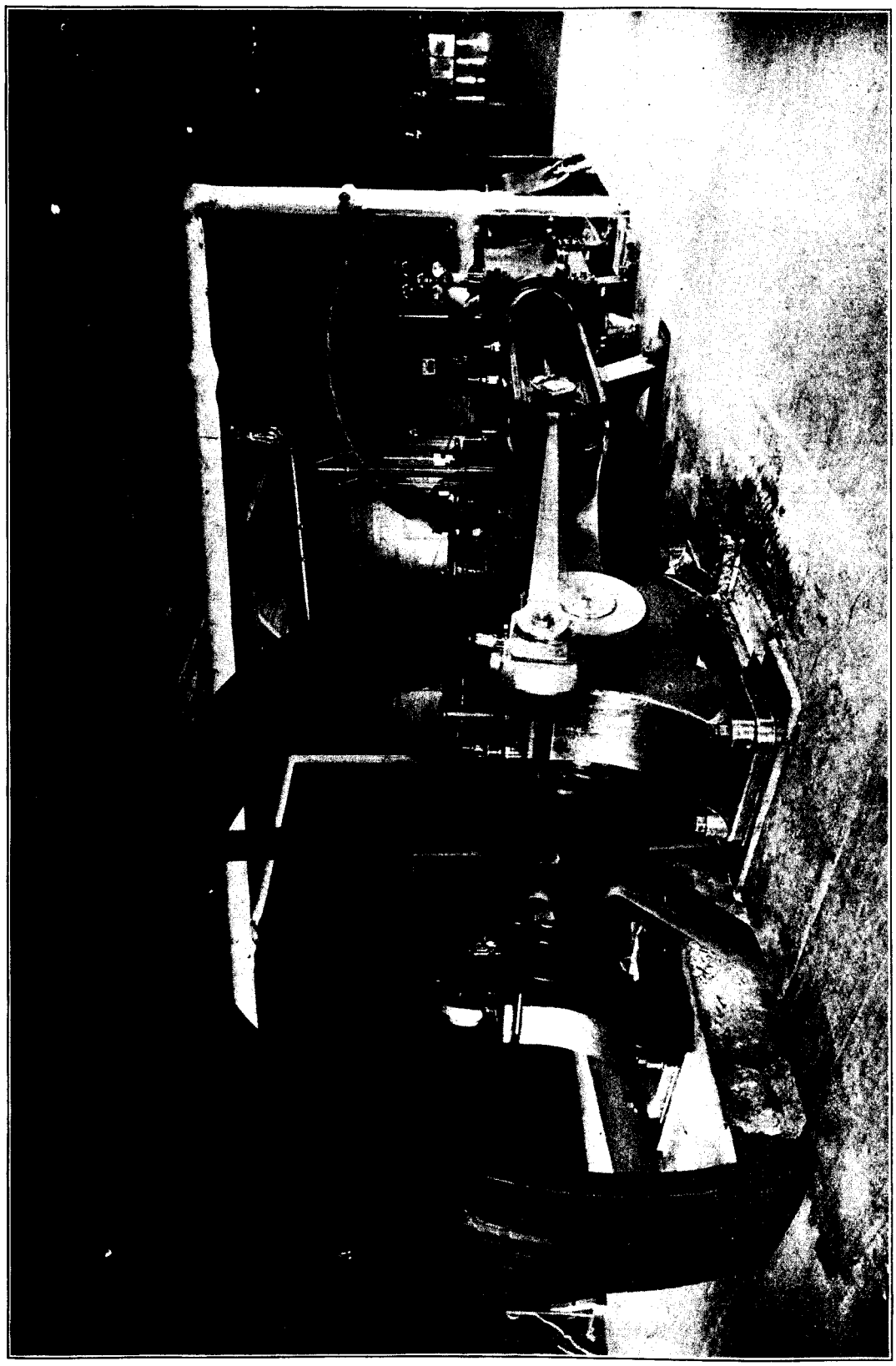
These periods of disturbance and volcanic eruption began in the earliest geological ages, and have gone on practically to the present. These rocks are earlier than the dawn of life. They have many shades of difference in texture and composition, but their chief distinction from modernly erupted rocks lies in their prevailing decomposition. We rarely get from the earliest period any form of lava as fresh and new as those which are being erupted now. They have undergone more or less chemical decomposition. So the ocular examination of a district of erupted rocks enables one to form a fairly rough estimate of about when that district was built. The study of the geology of this region leads us to think the eruptions took place in middle geological time, or about the Cretaceous period. The rocks bear a certain textural resemblance to those we know elsewhere to have been erupted about that time. They may be later or earlier.

We are here on the vent of an extinct volcano, one which reached its head high above the present surface and went through various stages or episodes of eruption.

These episodes are recorded here, first in a complex mass representing the base and centre of a volcano, and, secondly, by a later and overlying eruption of fragmentary rock, associated with the eruption or ejection of water, so that, to a very large extent, the rocks show the effects of water. They are often volcanic muds, and may be classified under the head of volcanic tuffs.

They surround the region in a ring, and can be seen half way from here to Trail Creek, and between here and where the Red Mountain Railroad descends towards Sheep Creek. They are on the top of Red Mountain, and on the other side of the valley, southward, forming a ring, leaving this central axial part of the volcano an isolated mass of dark, fine-grained rock, with a width of one and a-half miles north and south, and five miles east and west. The rocks of that central mass are those which are of interest to the miner here.

The rocks show three easily determined types. One is the country rock of these immediate and neighbouring mines. It is a dark greenish-gray colour, fine or coarse grained, tough, breaking with



Black Bear Compressor—Le Roi Mine, Rossland, B.C.

difficulty under the hammer, porphyritic, or spotted with white feldspar crystals. It is composed of black augite crystals, and light-coloured traclinic plagioclase feldspars, with a varying production of monoclinic feldspars. It is an augite diorite of the variety known as monzonite.

East of here in the Iron Horse claim is a darker close-grained series of rocks, also formed of black augite and plagioclase, but without the orthoclase feldspar. This type is known as gabbro.

At the extreme west of the body where the Josie ravine comes down to Sheep Creek, there outcrops a

third variety of eruptives of the same general family, consisting of black hornblende and orthoclase feldspar, local variations of the same melted matter.

A peculiarity of a volcano is, that it erupts at one period one type of rocks, and another type at another period. These rocks are all found to possess certain family characteristics, and are merely differentiations of one great molten magma. Here there are three differentiations from one magma, which have come to the surface successively, and perhaps alternatingly, and together form this central mass which is the green, heavy country rock of this immediate neighbourhood. There are thus alternations of the three types of rock in the mass. Subsequently to this there has been a strain from north to south which has opened up nearly vertically, and often in a parallel direction which have been filled immediately by intrusive dikes, and that is the rock which is the basis of this district.

The veins belong to a single type. They are distinctly and predominantly, fissure veins. Through such a mass of rock as this, chemical solutions could not pass or penetrate without cracks, or interstices, and therefore when any mineral matter is found foreign to the rock itself, it may be classed as an intrusive dike or as mineral matter which has come along fissures, however large, and in whatever directions. The mineral-bearing veins here are characteristic fissure veins, and some of the larger are known as "shear zone" fissures.

Shear-Zone Veins.—Shear zone differs from the single fissure. While a single fissure may result from a vertical action, or be the result of two horizontal compressions, through compressing forces, the shear zone is made under very high compression, holding the rocks tightly together, preventing a wide opening of the fissure. The shear zone is the result of a disturbance of opposing "couples" of pressure; the disturbance of the couple by a vertical force. While the plain open fissure may result from a direct upward thrust, the shear zone is always the result of a very powerful compression, and since that compression is very great, and almost equals the disturbing force, whatever it may be, that produces the fissure, it is apt to break in more or less parallel seams or fissures, that make a family of fissures, whose exterior boundary is assignable if you cross-cut or find the surface well exposed. Instead of being an indefinite amount of parallel fissures extending into a country an undiscoverable distance, it is always a zone of a discoverable and limitable collection, or a family, of more or less parallel fissures. In general they are a series of parallel "platings" of the rocks.

These platings may or may not have slipped at all, *i.e.*, a movement in any one plane may have been infinitesimally small, less than a hundredth of an inch.

If these veins are fissured deeply, they offer an avenue for ascending heated waters carrying mineral substances in solution and depositing them in the fissures, also decomposing the minerals along the lines of these minute fissures, until, in some instances, the whole matter between two fissures will be eaten out and replaced by chemical elements brought in solution by the percolating waters.

All deep-seated springs are mineral springs. Those solutions being hot at great depths have their solvent power enormously increased, and their function is to dissolve and find their way upward through any avenue they can, and according to their chemical nature, to dissolve, or redeposit their load of dissolved matter.

It is a peculiarity of this class of veins that their mineral deposits within the general limits of the exterior fissures of this shattered and plated zone may be deposited on any one plane, or they may eat up all the rock between two planes and deposit another matter in its place, or they may occupy the whole zone, or mineralize one particular fissure and go through a small crack into another fissure, and travel upon that and so on. According to the accidents of structure and movement, they may mineralize upon one, or all of the planes. These veins are of enormous extent in some places, such as 100 or 200 feet in width, *i.e.*, the shattered plated zone.

The veins of Rossland are shearage veins occupying this plating zone due to parallel fissures. They are essentially fissure veins. In particular they are shear-zone veins. The peculiar mineral combination which here forms the ore and is part of these veins is a mixture of pyrrhotite and chalcopyrite.

Over the neighbourhood of these veins, and in portions of them, atom by atom, the crystals which make up this original rock have been replaced by those minerals in solution. In other words they have made or taken a cast, or filled up the original whole form, and now occupy the area, or bulk the cubical contents of what was formerly the crystalline ingredients of these rocks. Near the Iron Horse vein, large augite crystals are seen lying in the neighbourhood of that vein, making, as it were, a kind of porphyry, of which the crystals were already passed over into ore minerals, and the surrounding country was only partially transformed.

The process of replacement is the origin of the sheeted bodies of ore which occupy and are made originally in contact with those fissures. A vein of that sort may be made along a single fissure, in which case the percolating solutions would fill the fissures, and all you would have would be a plate of metallic minerals fading gradually into the country rock on either side, which for the distance it existed as a solid body would entirely have destroyed the plane itself which gave it birth. We see that, in a small way, all through the neighbourhood of these veins.

ROSSLAND VEINS AND ORE DEPOSITS.

Professor Lindgren confirms Mr. King's opinion as to the veins being shear-zone veins, and goes into considerable detail on the veins themselves, especially those of the Iron Mask and Centre Star, which may be considered as typical of this district.

Along the croppings are two continuous parallel streaks of sulphide ore from shaft to shaft. There are also a number of planes dipping from 35° to 65° along these croppings, well shown in the railroad cut. There is a streak of solid pyrrhotite and a little chalcopyrite. Above are two or three walls separated by country rock. On the south of this is altered country rock four feet, followed by streaks of ore. On the foot wall side are again two or three planes or walls several feet apart, and again from these, two or three more planes or walls.

There is a width of twelve feet of rock penetrated by a number of these shearage planes, the walls dipping north, and showing streaks of solid sulphide ore. This outcrop is the apex of the vein.

The vein of the Centre Star is a composite, or shear-zone vein, consisting of five or six, or more,

shearage planes, at distances apart varying from a few inches to a few feet, and together constituting a shear-zone or composite vein, such as is common in the Rockies and elsewhere.

The country rock is an igneous crystalline rock of granular texture, an augite diorite, or monzonite. composed of orthoclase and plagioclase feldspar and augite.

The ore minerals are chalcopyrite and pyrrhotite, occurring in more or less regular streaks within the walls. Beside is a great deal of altered country rock known as vein or gangue matter resulting from the country rock by the introduction of minerals foreign to the country rock. In this case these minerals are quartz, calcite, pyrrhotite, chalcopyrite, and a kind of brown mica. The vein matter fills the space between walls. The replacement of this country rock was caused by the introduction of the solutions bearing different minerals, gold, copper, iron, and other salts. This solution acted on the country rock, introducing some minerals and forming others from the constituents which were already there, changing the whole aspect and composition of the country rock.

In favourable places the change to pyrrhotite and chalcopyrite went on more intensely. The minerals of the country rock were more or less completely replaced by these minerals.

Their substance was dissolved out, and instead of the original substance the chalcopyrites were decomposed. The replacement was like that of petrified wood.

This impregnation of the Centre Star vein is subordinate to the main process of replacement already outlined. A third process is filling, *i.e.,* the accumulation of metallic and other minerals along, and in, open spaces formed during the shearing action, which produced the fissures.

This is not so common as the general replacement system. The vein is sometimes a quite irregular plane changing in dip quite considerably at different portions of its extent.

The vein, in places, consists, of solid chalcopyrite and pyrrhotite, and a considerable amount of quartz. There is an average of what might be termed ore. There are numerous dikes associated with the veins.

The "mud seam," or "flat fault," as it is called, is a persistent seam dipping 35° south, striking north 70°. The thickness of the seam is from a few inches to two feet. The seam occupies the plane of a fracture in the rock. It is similar to a vein fissure, only not mineralized.

The filling is an attrition product from the grinding of the walls of the fault by compressive force.

Any strain or shearing stress producing fissures is accompanied by breaking and shattering. This shattered zone is a few inches to a few feet wide, following the seam continuously. It consists of ground-up rock for a thickness of a few inches to a foot ground up in place. The seam has been a water-course and carries water in a number of places. The filling has been reduced to a mud. The Iron Mask and Centre Star veins intersect.

THE TARIFF AND LEAD SMELTING.

(By G. O. Buchanan.)

THE Associated Boards of Trade of Eastern British Columbia, at their second annual session, held in Nelson, August 1st to 4th, 1900, passed the following resolution:

Moved by E. S. Topping, of Trail, seconded by T. G. Proctor, of Nelson:

"That this association recognize with approval the action of the Dominion Government, in granting the request of this association, made at its last annual meeting, for the free re-admission into Canada of lead of Canadian origin, smelted in Canada, but refined abroad; and that this association re-affirm its decision of last year, that import duties on manufactured lead, should be increased to a parity with the duties levied upon other lines of manufactured goods, and we ask particularly that the duties upon dry white lead, now admitted at 5%, and litharge, now admitted free be increased to a minimum rate of 20%. We believe that this charge would have the effect of providing a profitable home market for about 7,000 tons of lead per annum used in Canada in the manufacture of paints."

By reference to the Canadian tariff of customs duties lead and its products will be found treated as follows:—

Ores of all kinds	Free
Lead—old scrap, pig and block	15%
Bars and sheets	25%
Shot	35%
Manufactures of N. E. S.	30%
Dry white and red	5%
Litharge	Free
Lead—Ground, and liquid paints	25%

I add a few illustrative excerpts from other sections of the tariff:—

Oxides, umbers, burnt sienna, etc.	25%
Ochres, ochrey earth, and colours dry, N.E.S.	20%
Linseed oil	25%
Asbestos, other than crude	25%
Plumbago, ground, and manufactured	25%
Brick	20%
Drain pipe	35%

By way of further illustration I add the lead schedule of the United States tariff.

Lead in ore, 1½c. per lb., equal	40%
Lead in pigs, bar, scrap, etc, 2½c. per lb., equal	60%
Lead in sheets, pipe, shot, etc., 2½c. per lb. equal	50%
Lead, dry white and red, 2⅞c. per lb., equal	50%
Lead, mixed in in paint, 2⅞c. per lb., equal	50%
Litharge, 2¾c. per lb., equal	50%

Articles which are the product of Great Britain or of certain of her colonies when shipped to Canada from any port in the British Empire, are, under the preferential clauses of the tariff, subject to a deduction of 33 1-3% of the amount of the duties otherwise levied.

Thus the rate of 15% collectable upon pig lead coming in from the United States or other foreign country becomes 10% upon pig lead (of British origin) coming from the ports of Liverpool or London. And the rate of 5% levied upon raw leads to be used in the manufacture of paints, becomes under similar conditions 3 1-3%.

As Canada is one of the colonial possessions of Great Britain which is entitled to these privileges it follows that lead mined in Canada may be shipped to the United States, undergo any process of manufacture and afterwards by way of Great Britain be returned into Canada at the reduced rate of duty.

It is well known that the bulk of the Canadian and Mexican lead smelted in the United States is thus reshipped to Great Britain. Such lead passes through

the United States in bond, and of course encounters no duty in Great Britain, and commands there a price which is always less than 1½ cents per lb. lower than the New York price.

From the returns of the Department of Trade and Commerce we find that the importations of lead into Canada amount to about 13,000 tons per annum, classified as follows:—

	Tons.
Pig lead	3,000
Pipe, shot, sheet and other manufactured forms	3,000
Lead in paints, dry and mixed	7,000
	13,000

We have in Canada with headquarters chiefly at Montreal and Toronto certain mercantile firms who supply in mixed forms, and ready for use, the pigments which in blazing red, glorify our barn roofs, and in lily white pricked out with striping of gold, blend with the dainty fittings of our ladies' boudoirs. Some of these firms are old and well established Canadian institutions. Others are mere branches of American concerns, maintaining in Canada warehouses in which by the simple process of grinding corroded lead in a mill, and mixing with it more or less linseed oil they absorb to themselves the difference between 31-3% payable upon lead unmixed with oil and 25% which would be payable upon the same lead if run through a mill and mixed in oil prior to its advent to Canada. (The 25% would of course be subject to 1-3 rebate if the mixed paint came in under the preferential clauses.)

The Trade and Commerce returns show results such as would naturally be expected.

First.—Importations of lead in any form from the United States and other foreign countries have almost entirely ceased and Canada is supplied with lead from Great Britain entirely.

Second.—Importations of mixed paints into Canada have fallen to very small proportions.

For eleven months ending May 31st, 1900, the importations of paint and paint material of all kinds is given as $828,289, and the duties collected, $79,789, Upon mixed paints at the full tariff of 25% the duties would have been $207,072.25. At the same time the fact that mixed paints do to some extent continue to arrive, suggests the inference that the price of the home mixed article has not been appreciably lowered to consumers.

The production of lead in Kootenay is now going on at a rate of 25,000 tons per annum, and the smelters at Trail and Nelson are successfully bidding against their American competitors for the treatment of a large share of this output. Under the privilege of free re-entry these smelters are now returning a portion of their lead output into Canada, after having it desilverized in the United States. The Canadian market is therefore now available to the extent of the consumption of pig lead, viz., 3,000 tons per annum, and already some attempt is being made for the establishment in Eastern Canada of such works as are necessary for the manufacture of pipe, sheets, shot, etc., calculated to consume an additional 3,000 tons.

Responsible parties are also in sight who are prepared to undertake in Canada the corrosion of lead, and the successful inauguration of this business would in the words of the resolution quoted, "afford a profitable home market" for the further quantity of 7,000 tons per annum of our product. Such an industry requires the investment of large capital in plant, equipment, and stock, and must expect to encounter the active opposition of those now in possession of the market and it is in the interest of their enterprise that the boards of trade ask that the duties upon dry white lead which would be their chief product should be increased from the present rate of 5% to 20%.

The Associated Boards of Trade, it is needless to say, is a strictly non-political body, and deals with questions that come before it upon their merits, as commercial propositions, without any intention of promoting or prejudicing the fortunes of any party whether Dominion or Provincial. As a matter of fact the request presented by the boards can be dealt with by either of the parties in the Dominion Parliament without self-stultification or inconsistency.

The lead tariff as it stands is the work of the Conservative party and was framed at a time when the principle of protection to home industries enjoyed the ample endorsation of the people. It was framed at a time that there was no home production of lead in sight, and lead in crude forms was dealt with as raw material which manufacturers must necessarily import. Conditions have now arisen which heretofore did not exist, and the effect of which neither of the parties has until the present moment been called upon to consider.

The pre-election declaration of the Liberal party was for a tariff that would do injustice to no class. The lead producing class are now in a position to fully supply all the lead consumed in Canada. Its representatives therefore ask that the duty upon lead products be increased to a parity with that levied upon similar classes of goods. They are not asking as with much justice they might for a tariff identical with that of the United States, a tariff frankly and finally prohibitive as against the world, but they think themselves that they have the same "incidental protection" as is afforded to those who produce within Canada oxides, umbers, ochres and ochrey earths, asbestos and plumbago, brick and drain pipe, that there should be placed upon the dry white lead coming into competition with them, the same rate of duty as is levied upon the linseed oil in combination with which the white lead is made into paint.

From a provincial standpoint our case is perfect. We are consumers to an enormous extent of dutiable goods, paying into the treasury 30% upon the value of all the goods that we buy from the Americans and into the pockets of our Canadian brethren an addition of 30% which the tariff enables them to add to the price of the goods we purchase from them, and yet there is scarce an item in the tariff that favourably effects any product of our province.

The retention within the Dominion of the sum of one million dollars per annum now sent abroad for paints is an object that must commend itself to all Canadians, and is one for which I must now in closing bespeak the aid of your popular journal, and of your numerous and influential readers.

BLAST FURNACE SLAGS IN LEAD SMELTING.*

(By Capt. C. C. Longridge, M.I.M.E., M.I.Mech.E., Etc.)

WITH the high grade and pure lead ores treated in reverberatory there is little gangue, and its separation by slagging presents no special difficulties. But in blast furnace smelting, which deals chiefly with moderate or low grade ores, the question of separating the large quantities of earthy and worthless gangue is a matter of great importance. For good

*London Mining Journal.

separation, it is desirable either to mix the ores or to add such fluxes as will combine with the ore gangue and impurities easily fused and sufficiently light and fluid to readily separate from the lead work, matte, and speiss. For lead smelting, the ordinary slag density should not exceed from 3.4 to 3.6, as the density of the ordinary lead matte ranges from 5 to 5.3, the separation margin is a narrow one. A readily fusible slag is very desirable, inasmuch as it economises fuel by enabling larger charges to be smelted per unit of fuel. There is, however, a limit beyond which this property should not be developed, for too rapid a fusion, and, therefore, too frequent an addition of fresh ore, may unduly lower the furnace temperature and decrease its reducing power. The exact degree of fusibility, therefore, has, in every case, to be determined experimentally. But, generally speaking, the lead smelter adopts a monosilicate slag—that is, a combination in which the oxygen of the bases bears to that of the silica the ratio of 1:1. Such a slag is expressed by the formulæ 2 $RO+SiO^2$, or 2 R^2O^3+3 SiO, and the fusion temperature would be about 1030° C. When a high temperature, say, 1273° C., is desirable, it may be preferable to use a bisilicate slag—that is, one in which the oxygen of the bases is to that of the silica as 1:2. For such slag the symbol is $RO+SiO^3$, or R^2O^3+3 SiO^2. Between the degrees of fusibility, corresponding to these slags, is that of the sesqui-silicate, which may be regarded as a simple mixture of mono- and bi-silicate slag in equal proportions. In the sesqui-silicate, the oxygen of the bases is to that of the silica as 2:3; and the slag may be expressed by the symbols 4 $RO+3$ SiO^2, or 4 R^2O+3 SiO^2.* Any intermediate mixture can be calculated from the figures given in the following table, cited by Hofman:—

Table showing the Combinations of Silica and Bases in Various Slags.

One part by weight of Silica requires.	Parts by weight of Basis.†	One part by weight of Base requires.	Parts by weight of Silica.
For Mon-Silicates.		For Mon-Silicates.	
Lime	1·86	Lime	0·535
Baryta	5·10	Baryta	0·196
Magnesia	1·33	Magnesia	0·750
Alumina	1·14	Alumina	0·873
Ferrous Oxide	2·40	Ferrous Oxide	0·416
Manganous Oxide	2·36	Manganous Oxide	0·422
Zinc Oxide	2·70	Zinc Oxide	0·370
Lead Oxide	7·43	Lead Oxide	0·134
For Bi-Silicates.		For Bi-Silicates.	
Lime	0·93	Lime	1·070
Baryta	2·55	Baryta	0·392
Magnesia	0·66	Magnesia	1·500
Alumina	0·57	Alumina	1·747
Ferrous Oxide	1·20	Ferrous Oxide	0·832
Manganous Oxide	1·18	Manganous Oxide	0·845
Zinc Oxide	1·35	Zinc Oxide	0·740
Lead Oxide	3·71	Lead Oxide	0·269
For Sesqui-Silicates.		For Sesqui-Silicates.	
Lime	1·24	Lime	0·803
Baryta	3·40	Baryta	0·294
Magnesia	0·88	Magnesia	1·125
Alumina	0·76	Alumina	1·310
Ferrous Oxide	1·60	Ferrous Oxide	0·625
Manganous Oxide	1·57	Manganous Oxide	0·633
Lead Oxide	4·95	Lead Oxide	0·202

*The term "quarter," "half," "three-quarter," "one to one," applied to slags expresses the ratio of lime to iron, the latter being taken as unity. The following are examples of such slags:—

"Quarter" Slag 30 SiO2 -|- 48 FeO -|- 12 CaO,
"Half" Slag 32 SiO2 -|- 38 FeO -|- 20 CaO.
"Three-quarter" Slag 32 SiO2 -|- 33 FeO -|- 25 CaO.
"One to One" 34 SiO2 -|- 28 FeO -|- 28 CaO.

The above proportions are calculated according to the rule that elementary or compound substances unite together chemically, in certain fixed proportions. These proportions by weight, reduced to their lowest relative value and expressed with reference to that of hydrogen, which is taken as unity, are called the atomic weights or combining numbers of the substance. Assume, then, that it is required to calculate the amount of lime (CaO) needed to combine with silica (SiO^2) to form a monosilicate slag. The atomic weight of CaO is 40+16=56, and that of SiO^2 is 28.5+2 (16)=60.5 Taking the formulæ for the monosilicate slag 2 $RO+SiO^2$, where R=Ca, 60.5 parts of silica will combine with 2×56 parts of CaO, or every part of silica requires $\frac{112}{60.5}$=1.85 parts of lime.

The principal bases for slag making are the oxides of iron and lime, FeO and CaO. Where, as is usual, an ore contains small quantities of other bases, the calculation for slag-forming may be simplified by equating these minor bases to the iron or lime, and substituting their equivalent value thus proportionately adding to the iron and lime present. The required equivalency is obtained by comparing the atomic weights. For instance, the atomic weight of MnO is 72, while that of FeO is 71. The two are, therefore, practically equal, and any MnO in the ore may for slag making purposes be considered and treated as iron oxide. The earthy bases, such as MgO and BaO, may in like manner be treated as CaO. Thus, the atomic weight of lime being 56 and that of MgO being 40, every part of MgO=.71 CaO, or conversely CaO=NgO×1.4. Again, the atomic weight of BaO being 153, every part of BaO=2.7 CaO, or CaO=BaO×.4 If present in small quantities ZnO may be treated as CaO, the values being ZnO=1.4 CaO or CaO=ZnO×.7.

In like manner FeO=×Fe$\frac{9}{7}$or Fe=FeO×$\frac{7}{9}$

Before discussing in detail the effect of various constituents of slag, the composition of several thoroughly tested and useful slags for lead smelting, cited by Collins and Hofman, are given below:—

TABLE I.

Examples of Ordinary Lead Smelting Slags.

No.	Oxygen. Ratio in Bases: Silica.	SiO_2.	FeO. MnO.	CaO. BaO. MgO.	Al2. O3.	ZnO.	Total.	Remarks.
1	1:1	28	50	12	..	..	90	
2	1:1	30	40	20	..	..	90	Al2O3+Zno
3	1:1	33	33	24	..	..	90	under 7 per cent.
4	1:1	35	27	28	..	..	90	
5	4:5	34	50	12	..	..	96	
6	5:7	36	40	20	..	..	96	Al2O3+Zno
7	2:3	39	32	25	..	..	96	under 2 per cent.
8	1:1	34	24	30	10	..	98	
9	1:1.3	40	26	16	10	4	96	
10	1:1.3	33	36	16	..	7	92	Al2O3
11	7:8	30	36	16	..	10	92	under 5 per cent.
12	1:1	25	33	14	3	16	91	Also ZnS 4 per cent.
13	1.6:1	17	35	7	6	20	85	Also BaSO4 10 per cent.

†For smelting purposes ore constituents may be classified as: Bases (Iron, lime, copper, MnO, ZnO, MgO. BaO, KaO, NaO, Al2O3). Protecting agents (S, As, Sb, Te). Reducing agents (coke, sulphur). Acids (SiO_2. Al2, O3). Al2O3 is basic in the presence of a large excess of SiO_2. Under other conditions it may be neutral or acid.

The above proportions can be considerably varied, especially in the relative proportions of iron and lime, which in non-zinciferous ores may replace each other to a large extent. It should be remembered that lime must vary inversely with iron, and directly with silica; alumina, directly with lime and inversely with silica and iron; and zinc oxide, directly with iron, and inversely with silica and lime.

In his paper on "The Development of Silver Smelting in Mexico," recently read before the Institute of Mining and Metallurgy, Mr. O. H. Hahn gives the following as a slag formulæ ordinarily used: 34 SiO^2 +34 FeO+17 CaO+15 RO. This slag was selected on account of its easy fusibility at a low blast, and because there was an abundance of ferruginous ores in hand. When siliceous ores were scarce the following type was used 32 SiO^2+48 FeO+12 CaO+8 RO. Under RO are comprised alumina, baryta, zinc oxide, and other bases, having no particular bearing on the character of the slag. Magnesia is figured as calcium oxide in the ratio of molecular weights. Sulphate of baryta is treated as RO, and left out of the calculation. Mr. Hahn considers it wrong to calculate any part of zinc oxide as lime, as it is carried off by the slag mechanically, and not in chemical combination. When the lead ores are comparatively low in zinc and alumina, so that the total of ZnO, Al^2O^3,PbO, in the slag make only about 10 per cent. of it; 5 per cent. of silica, that is an amount of silica equal to one-half of the quantity of these bases, may be added for them.

THE HEARTH SMELTING OF LEAD ORES.

I.—HEARTH SMELTING.

As previously explained, reverberatory smelting of lead ore consists of a combined roasting and reaction process, in which the two operations are repeated one after the other. In hearth smelting, on the contrary, these two operations, which also constitute the process, are not consecutive but simultaneous, roasting and reduction going on at the same time. Again, in the reverberatory furnace lead is reduced from the ore by the interaction of the unaltered galena, that is the sulphide, with the sulphate and oxide, whereas in the hearth furnace there is additional reduction from the lead oxide by carbon. The reberberatory is worked without a blast, the hearth with one. In the latter furnace the ore and fuel do not rest on a solid bed, but on a bath of molten lead. The charge in the hearth furnace is never fused; but at intervals the blast is stopped, a portion of the charge removed, the poor slag separated from it, and after cooling and an admixture of lime to stiffen it, the charge portion is returned to the furnace.

II.—TYPES OF HEARTH FURNACES.

In outline, the hearth furnace consists of a rectangular smelting cavity, with cast iron bottom and sides, blast arrangement, and the usual chimney. The chief types of hearth furnaces are:—The Scotch, which, on account of over-heating the hearth, cannot be worked continuously. The American Water-Back, provided with a cooling arrangement for continuous work. Lastly, the Jumbo or Moffat; this furnace is fitted with air and water boxes for cooling, also with a hot blast to increase the output; and, also the lead fumes, in cases where there is a market for this product.

III—ADVANTAGES AND DISADVANTAGES OF THE HEARTH PROCESS.

Compared with the reverberatory, the hearth method has these advantages: The fuel consumption is lower, and the furnace can be quietly started and stopped without much loss of fuel or serious racking of the structure. Against these may be enumerated as defects: that power is needed for the blast; that the lead and silver volatilization losses are heavier; that the furnace fumes are more injurious to the workmen; that the ore must be even of a purer and higher grade than that required for the reverberatory; and that owing to the blast, ore in fine powder cannot be treated without previous agglomeration.

Hearth smelting, therefore, is chiefly suitable for intermittent work on small quantities of pure high-grade non-argentiferous lead ores. When there is a good market for lead fumes, as paint pigment, these may purposely be increased by using a hot blast and collecting the fumes by the Lewis-Bartlett Bag process or similar devices.

IV.—THE PRODUCTS OF HEARTH SMELTING.

Both products and treatment are the same as in the case of reverberatory smelting. There is, however, an intermediary product consisting of ore, slag, and fuel, termed "browse." This is roasted and re-smelted with subsequent charges.

VERBATIM EVIDENCE IN THE IRON MASK-CENTRE STAR LITIGATION.

(Mr. Clarence King's Evidence Continued from Last Month.)

Q. And you were here in February for about a week, you say, in connection with that case? A. With this case, yes, sir.

Q. And you have been here in connection with this case since when, the present time? A. Since the 5th of April.

Q. And how much of your time have you devoted or have you devoted it at all, to an examination of the property in dispute in this action? A. Well, I have been underground almost every day, and have devoted a good part of the rest of the time to the study of the questions involved.

Q. So that your examination of the ground in dispute has covered between three and four weeks? A. Yes.

Q. Now, perhaps as explanatory of the evidence you will give later on, Mr. King, it might be well for you to give a brief geological sketch of the conditions that you find in this camp, and the relationship they bear to the general conditions elsewhere? A. The district immediately about Rossland is, as is commonly known, a part of a very great whole, which whole is the mountain that borders the Pacific from Cape Horn to the Arctic Sea. It is a system thus covering an arc of nearly half the great circle of the globe and has its widest expansion about the latitude of San Francisco where it is 1,200 or 1,400 miles wide. That mountain system ranks next in physical importance to that of the east and west system which traverses Asia and Europe, but unlike that system it is an empire of mines; and its geology beside having a high abstract interest, lies at the basis of the knowledge of mining for this immense area. The quantities involved in this system of the Cordilleras are great

almost beyond belief. They involve the superposition of strata amounting to over 120,000 feet in actual measured thickness; they involve a history from very near the dawn of geological history—absolutely until to-day, of enormous dynamic action and effect. And this dynamic action has consisted in the upheaval, in the crushing and folding together, and in the dislocation of enormous blocks of this great territory. This sedimentary series which I have said amount to over 100,000 feet, are derived from the older rocks in their immediate neighbourhood. So far as we have been able to see, those sediments have never travelled to very great distances. Sometimes a series of strata amounting in all to 40,000 feet have been piled up consecutively and continuously, and without break; but all these series of various episodes of sedimentation have ended in a destructive dynamic period, and they have been crushed, upheaved or depressed, and then the process of sedimentation has begun under new terms. These dynamic events which punctuate, as it were, the history of the whole of these Cordilleras, are due undoubtedly to the unbalancing of the forces of gravitation and of equilibrium. It is very well known to geology that if you load any area with a heavy mass of sediment, that area subsides; that if you unload any area, that area will rise. Consequently, whenever an area rises near an area which is stable or is sinking, there is a dynamic strain, and if that strain passes cohesion, passes the point of the elastic limit of the rocks, or the cohesive limit, they are ruptured by these tremendous strains and the action usually ends in the eruption and the readjustment of the equilibrium—and the eruption of melted matter from the subjacent area. It is in these periods of stress and strain to which the rocks and whole distances and whole enormous areas and ranges, and whole mountain ranges, have been subjected that the crushing and straining and fracturing and fissuring takes place, which is the birth of a mining district.

I do not mean to indicate that every crushed area, or every fissure or block of country is the birth of a mining district because mineral veins owe their origin to two processes; one is the fissuring of the rocks, or the solution of soluble rocks on lines of fissures, and the second process is the filling or deposition of mineral matter on, in, along and near these fissures. So that a mining district requires the two periods of action; I mean a block of country requires the two classes and periods of action to bring it from an amorphous mountain mass into a mineral district. These periods of crushing have never occupied a very great part of the geological history; they are sudden, convulsive episodes which follow periods of accumulation of strata, periods of upheaval and periods of depression, but short as they are they have ended in deluging enormous tracts of this Cordilleras system with eruptive rocks, molten when they come out, and which have cooled under or upon the surface. There are fields of these eruptive rocks which cover many thousands of square miles; there are other fields which are extremely small. and, as I say, these periods began in the earliest geological ages, and have gone on practically to the present.

The study of thes rocks which have been erupted in these various periods has resulted in a fine classification as to species, and in a certain measure as to origin, and also to a rougher classification in time; that is to say, the rocks which we know to be earlier than the dawn of life, which we will put at the base of the Cambrian, are of a different class from those which are erupted now from present volcanos. They have shades of difference in texture and in composition, and in the relative proportions of their different elements; but, chiefly, their distinction is one of decompositions; that is to say, it is very rarely we get from the earliest period any form of a lava which is as fresh and as new as those which are being erupted now. They have undergone chemical decomposition more or less.

So that, in a general, rough sort of way, the occular examination of a district of erupted rocks usually gives rise to a fairish judgment of about when that district was built.

Now, the rough examination whch I have made of the geology of this immediate region when here four or five years ago leads me to compare it as fairly near—the many deposits which have come to the surface—the many outflows which have come to the surface to what is called middle geological time, say the Jura-Trias, or the beginning of the Cretaceous. They bear a certain textural resemblance to the rocks of that period. They may be later or they may be earlier; so far the data are wanting for the exact position, but from all practical purposes they may be assigned to a middle geological period. We are here, as is properly known, I believe, on the vent of an extinct volcano, one which undoubtedly reared its head high above the present surface, and one which went through various episodes of eruptions. Those episodes are recorded here, first, in a complex mass which represents the base and centre of a volcano; and, secondly, by a later and overlying eruption of fragmentary rocks which were undoubtedly associated with the extrusion and ejection of water, so that to a very large extent they show the effects of water. They are often muds, and they are all to be classed under the head of tuffs, volcanic tuffs. They surround the region in a ring; you can see them half way from here to Trail Creek; you can see them between here and where the Red Mountain Railroad descends towards Sheep Creek; they are on the top of Red Mountain, and they are on the other side of the valley to the southwards, forming in general a ring, leaving this central axial part of a volcano an isolated mass of dark, usually fine-grained rocks, having a width of about a mile or a mile and a-half north and south, and perhaps, five miles east and west.

The rocks of that central mass are those which enclose the veins of the district, and they are the rocks which are of interest to the miners here. They have been more or less studied by the Canadian Geological Survey, and they have been compared by Mr. Ferrier with the standard types from other localities. I have myself had the opportunity of going over with him the thin slides or thin microscopical sections of these rocks and comparing them with the Pearsons types, and ships in small pieces, but enough to make comparison from a similar district to the east of here. The rocks as you walk over the surface show three easily, reasonably well-defined types: one is the rock which we see here in the cut before us. I have not examined the cut particularly, but I have seen enough to realize that the bulk of it is of a type of rock which forms the hills directly in front of us and which is the country rock of these immediate neighbouring mines. That rock has a dark, greenish-gray colour, usually of fine grain, sometimes coarses grained rock, which is very tough, breaks difficultly under the hammer, is difficult to scratch, and under the microscope, as well as

in plain vision, is often seen to be pyrrhotite, and in places the original structure has been more or less obliterated by compression and subsequent chemical action. The microscope shows this rock is an augite rock, formed of augite and triclinic feldspar; and a considerable and varying proportion of monoclinic feldspar. To the east of here and in the nighbourhood of the Iron Horse claim there appears a darker, much closer grained series of rocks formed like these of augites and triclinic feldspars, but with less or none of the monoclinic feldspar, and each following very near the type known as gabbro. At the extreme west of the body where the Josie ravine comes down towards Sheep Creek and meets the road from here to the mines, there outcrops a considerable area of a third variety of eruptive rocks of the same general family, which consist of hornblende, monoclinic feldspar and orthoclase. These three types are undoubtedly local variations of the same general melted mass. Every one who has studied volcanoes, or volcanic districts must realize—must know—that one of the peculiarities of the average volcano the world over is that it erupts at one period one type of rocks, and another at another. But on examination, these rocks are all found to possess certain family characteristics, and are from a peterological view so related to one another that it is seen quite clearly that they are differentiated from one great melted magma. The manner of this differentiation is somewhat of an enigma, but it is perhaps explicable on the basis of separation by specific gravity of the crystals developed in this magma. Be that as it may, here these three differentiations from one magma have come to the surface successively, and, perhaps, alternatingly, and together form this central mass which is the green dark, heavy country rock of the immediate neighbourhood.

We therefore find that there are, since other periods have overlapped to a certain extent, alterations of the three types of rock in the mass. Subsequently to this there has been a strain from north to south which has opened up nearly vertically and often parallel a system of fissures through this mass which have been filled immediately by intrusive dykes, and that is the rock which is the basis of this district.

Q. You may just explain, Mr. King, what a dyke is. A. A dyke is originally a fissure extending through the course of the rock to the deep until it intersects some pool or body of molten matter, which ascends in and fills the the crack, and the filled matter in this crack consists of the dyke, is the dyke.

Q. The filling, then, would be foreign? A. Intrusive.

Q. Foreign to the rocks surrounding it? A. Foreign, intrusive from below.

Q. Are they limited to any particular size, or do they vary? A. They vary to a very large size.

Q. From what? A. I have seen them from an inch to 100 feet, we will say, and probably much more.

Q. From your examination of the ground in dispute of the Rossland camp, what conclusion have you come to as to the character and structure of the veins here, the causes which have produced them, and their points of resemblance and of difference from the veins you have found in other places. You might just go into that pretty fully, Mr. King. It has an important bearing here. A. I should say that all of the larger veins, as least, and perhaps the smaller ones also, belong to a single type. They are distinctly and predominantly, fissure veins. It is clear that through such a mass of rock as this, chemical solutions could not penetrate without the avenue of cracks and interstices; and, therefore, wherever any mineral foreign to the rock itself may be found, it can be easily classed, either as intrusive dyke, or as mineral matter which has come along fissures, however, large and in whatever directions. The mineral-bearing veins here are well-characterized fissure-veins; and certainly some of the larger ones, and perhaps many of them, are what are known as shear zone fissures. That type is not, perhaps, so well and so widely known as the simple fissure, but it is recognized and does exist over a very wide range of territory. I have seen it in Mexico, I am working a mine of that type now in Colorado, have seen it in Nevada, and I know it when I see it here. Shear zone differs from the single fissure in an important particular. While a single fissure may result from a vertical action, or even be the resultant of two horizontal compressions, through compressing forces, the shear zone is always made under very high compression,—compression which holds the rock tightly together, which prevents a wide opening of fissures, and that shear zone is always the result, or almost always the result of a disturbance of opposing couples, of what are technically called "couples" of pressure—the disturbance of that couple by a vertical complement of a vertical force; while the plain, open fissure may result from a direct upward thrust, the shear zone is always the result of a very powerful compression; and since that compression is very great, and almost equals the disturbing force, whatever it is, that produces the fissure, it is apt to break, and always does practically break, in more or less parallel seams or fissures; thus making a family whose exterior boundary is always assignable, if you cross-cut or find the surface well exposed, and study the ground. Instead of being an indefinite amount of parallel fissures extending into a country an undiscoverable distance, it is always a discoverable and limitable collection or family of more or less parallel fissures. Since those forces are never mathematically adjusted to each other to be in exact opposition, the resulting fractures are not absolutely parallel. In the case, for instance, of a slight torsion of a body there might be a family arrangement of the fissures, a slight family; but in general and practically for a miner's purpose, they are a series of parallel plating of rock. Now these platings may or may not have slipped at all; that is to say, a movement on any one plane may have been infinitesimally small, may have been less than a hundredth of an inch. When these veins are thus fissures—which is always the beginning point—if they are fissures so deep that they offer avenue for the deep-seated thermal waters, there is immediately an action of ascension and the deposition of chemicals contained in the deep solution, also a decomposition of the minerals along the lines of these minute fissures, until in some instances the whole matter between two fissures will be all eaten out and replaced by the chemical elements brought in solution by the percolating waters. It is very well known that all deep-seated springs are mineral springs. Practically none of the deeply reached water of the globe is free from mineral solution. Those solutions being hot at great depth and under pressure at great depths, have their solvent power enormously increased, and their

function is indeed to discover and find their way up through any avenues they can, and according to their chemical nature, to dissolve or replace or deposit their load of dissolved matter. It is a peculiarity of those veins of Rossland—but it is a peculiarity of this class of veins, that their mineral deposits within the general limits of the exterior fissures of this shattered and plated zone may be deposited on any one plane, or they may eat up all the rock between two planes and deposit another matter in its place, or they may occupy the whole zone, or they may mineralize one particular fissure and go through a small crack into another fissure and travel upon that and so on. According to the accidence of the structure and movement; they may mineralize upon one or all of the planes. These veins are of enormous extent in some places. They are well known to reach 100 or 200 feet in extent; that is, the shattered plated series. I am myself mining to-day a vein which is 150 feet thick with six or seven of these well marked divisions.

Now, the veins of this camp, so far as I have seen them—that is to say, such as I have recently studied, and I feel very sure from what I saw before that, the Le Roi is in the same category—are shear zone veins; that is to say, they occupy this plating due to parallel fissures. They are fissure veins essentially; in particular, they are shear zone veins; that the peculiar mineral combination which here forms the ore, and which is a part of these veins which occupies the the greatest interest, is a mixture of pyrrhotite and chalcopyrite and copper pyrites, and it is seen over the neighbourhood of these veins and in portions of these veins, that, atom by atom the crystals which made up this original rock have been replaced by those mineral solutions; in other words, that they have made a pseudomorph, or taken a cast, you may say, or filled up the whole form and now occupy the area or bulk, the cubical contents, of what was formerly the crystalline ingredients of these rocks. Particularly near the Iron Horse you can see large diallages or large augites lying in the neighbourhood of that vein, making as it were, a kind of porphyry of which the crystals were already passed over into ore minerals, and the surrounding country was only partially transformed. It seems to be quite clear that here, as in so many other place, the process known as replacement, is the origin of the sheets and bodies of ore which occupy and which are made originally in contact with those fissures. A vein of that sort may be made along a single fissure, in which case the percolating solutions would fill the fissure and replace upon each side of it, obliterating the fissure, and all you would have would be a plate of metallic minerals, fading gradually into the country on each side, which for the distance it existed as a solid body would entirely have destroyed the plane itself which gave it birth. You see that, in a small way, all through the neighbourhood of these veins. I think that expresses about the ideas I have formed of the general origin of these veins.

Q. Where else have you seen veins which are exactly the same as we have here? A. I have never seen exactly the same, but the principle is precisely the same in a mine, for instance, that I am working in Colorado, the Nellie. It is a mine like this, situated in eruptive rocks, but of a much later date, in which the shear-zone is, I say, about 140 feet wide, and in which the mineralization is distinctly by replacement, as it is here. It is a different mineralization, but the principle is exactly the same.

Q. In the veins of which you have just given a description of shear-zone veins—replacement veins, —what have you to say respecting walls? A. In a vein which may be, we will say, 140 feet wide, like the Nellie, one never knows where his ultimate wall is until he has cross-cut both ways and developed the fact that he has passed the exterior limit of the fractured zone. Anywhere within that any plane appearing is simply an anterior member of the system.

Q. Will the mineralization always proceed to the exterior walls? A. Very frequently not.

Q. Will it always procced on the one point? A. The Nellie mine which I speak of has jumped across from plane to plane four times. In one instance the first jump it made it came up to a certain point and jumped, but its mineralization followed the original plane about 80 feet beyond, and then stopped for some probable want of access of the fluids, but it made a right angled jump of something like 40 feet to the next plane and then went on, on that.

Q. You have spoken of veins of this kind of very great width, 100 to 140 feet. Is it at all necessary that veins of this kind should be so broad? A. Not at all.

Q. That is, is it usually or necessarily the case that they are so broad? A. Not at all, not at all. These veins are fissure veins, and if they develop one fissure, that is the width of them; if they develop 40 that is the width of them.

Q. And I suppose there is no law governing the width or the distance at least between the adjoining walls, parallel planes? A. No, they may be very close or——

Q. Very far apart? A. Or very far apart.

Q. By the way, Mr. King, I forgot to ask you: I believe you are a member of the American National Academy of Science? A. I am.

Q. What is that body? A. It is a body incorporated in 1863 by the United States Government, and is self-perpetuating as to its membership, but exists for the purpose of the formation and maintenance of a body of scientific knowledge on which the government can draw at any time for any scientific problem which it desires to have solved for its own benefit.

Q. Is there any body in England it corresponds to? A. Not exactly; it would perhaps be nearer to the Royal Society.

Q. Is it limited in numbers? A. It has been practically limited to one hundred.

Q. Are there any other mining men in that body besides yourself? A. There are a few; Mr. Emmons, of the Geological Survey, is a member. I do not remember any others.

Q. You have examined the point, station 66, where four carloads of ore were taken away from as shown in the evidence? A. I have.

Q. And I believe you came to the conclusion that that ore which has been taken out properly belonged to the Iron Mask people—the Iron Mask vein? A. It belonged to a vein which is at that point and has its apex in Iron Mask ground.

The Court: What is the cause of this molten material? Is it chemical action? A. No, sir; the earth would be fluid at a certain depth but for the pressure of the superincumbent mass which prevents it expanding to the volume which fluid requires, and presses it into a solid. The relief of pressure allows that thing to expand and become liquid, and it is already above the temperature of fusion, but is unable

to fuse because of pressure. When that pressure is removed it expands into fusion.

The Court: It is in a liquid state, then, literally, all of it? A. The interior of the earth is mostly a solid. Up to within 30 or 40 miles of the surface it is undoubtedly solid. That has been proved by Lord Kelvin with very great ability.

The Court: Let me ask, Mr. King: this has nothing to do with the case, of course, but I have often been astonished at it. The centre of the earth is solid, Lord Kelvin says? A. Yes; in fact, the earth is all solid with small reservoirs.

The Court: There is a certain amount of liquid matter? A. Locally developed.

The Court: Around the solid body? A. Not in the shape of a complete shell, but only local pools.

The Court: Of course, of vast extent in some cases? A. Of vast extent in some cases.

The Court: How does it become heated? A. From the initial heat of the earth. The earth was hot to begin with, and has not cooled off yet; it is very slow about it.

The Court: I know the main divisions beginning with the lowest ones, the Azoic, the Palæozoic, the Mesozoic, the Myocene and Tertiary. A. Yes, sir.

The Court: What caused the heated matter? A. The heat is residual heat from the original heated condition of the earth.

The Court: That is the explanation of a volcano? A. Entirely.

Thereupon the Court adjourned until to-morrow, April 25th, 1899, at 11 o'clock a.m.

Clarence King—A witness for the Defendants on the stand.

Direct examination resumed.

By Mr. Davis—

Q. You know the incline shaft, No. 3 shaft, Mr. King, do you? A. I do.

Q. Have you made a thorough examination of that? A. I have.

Q. Just explain how thorough? A. I have visited the shaft and passed up and down it about a half dozen times, always looking at the ore, and one occasion chipped the surface of the ore which defines the centre of the vein from top to bottom, and found that there were no intervals; that it was absolutely continuous ore from top to bottom.

The Court: You found there were no intervals? A. It was absolutely continuous ore from top to bottom with the exception of the sump.

Q. From top to bottom with the exception of where the mud-seam fracture is? A. There is in the bottom of the shaft an opening which is in the nature of a sump on the bottom of that chamber, which I exclude from that general statement.

Q. That is, that 8 or 10 feet at the bottom? A. Yes, sir.

Q. So we will take it down to that sump at the present time. Do you find any vein in that shaft? A. I find a clear fissure vein from the top of the point indicated at the head of the tunnel.

Q. You say you found continuous ore. What was the nature of that ore, what kind of ore was it? A. That ore, the bulk of it, was pyrrhotite, but throughout, almost every hand-specimen taken, chalcopyrite and iron sulphide could be seen.

Q. You may say just what chalcopyrite is and pyrrhotite is and what iron pyrites is? A. Pyrrhotite is a very basic sulphide of iron; chalcopyrite is a double sulphide of copper and iron, of which the normal proportions are 30 per cent. iron, 30 per cent. silver and 30 per cent. copper, but it is an extremely varying mineral in its copper percentage, and has often been, and in fact, is generally, considered to be a more or less mechanical mixture of the two chrystals of pyrite and chalcopyrite, for its composition varies from 30 copper down to only 3 or 4 copper, and even a trace of copper.

Q. What is iron pyrites? A. Iron pyrites is the bi-sulphide of iron.

Q. You say that was a fissure vein you found in the No. 3 shaft. What particular kind of a fissure vein would you call it? A. Taken alone and without relating it to other parts of what I believe to be the Centre Star vein, I should say it was a fissure vein with accompanying exterior walls; that there was a main fissure which defined the limits of the ore above and below, or two main fissures, as the case may be, and over it a supplementary, parallel and correlative fissure, which constitutes an upper wall about two feet above the upper limit of the ore.

Q. You find then, walls in that shaft, do you? A. I find walls continuous, enclosing the ore.

Q. Enclosing the ore? A. I find the correlative wall about two feet above and lying parallel.

Q. What about below? A. Below where, sir.

Q. Below the ore? A. The workings do not go into the foot country enough to define any walls, other than the one which is the downward limit of the ore; that is to say, there are no cross-cuts back into the foot country by which you can see correlative walls.

Q. Did I understand you to say you found any fissures there? A. The ore is enclosed by fissure walls.

Q. And it is difficult to trace these fissures you have just referred to, the fissure walls? A. The upper limiting fissure of the ore is very easy to trace; the lower one is sometimes obscured and sometimes visible by the distance at which the cut enters the foot wall, or ends at the edge of the ore, and that plane is more chemically destroyed than the upper one. The upper one is a very well-marked fissure, but the other one is sufficiently in view to be sure of it from place to place.

Q. By the way, speaking generally of the veins in which disputed ground, is it easy or difficult to follow the line of ore and the line of country rock, or whatever you may call it? A. In some places it is easy, and in some places it is difficult. Not always easy, not always difficult, often very simple.

Q. What is the colour of the country rock? A. A dark greenish-gray.

Q. What is the nature of the vein filling, as you term it? A. The vein filling is of two kinds. Do you mean as regards shaft No. 3?

Q. Well, in the Centre Star vein, we will say first, where it appears in different places? A. Within what I believe to be the limiting planes, that is, the extreme walls of the Centre Star vein, there is a mineralization which, to a certain extent, defines the whole zone, included from the exterior country; but the influences which have changed the inside have, to a certain extent, and to a limited extent, changed the outside. Usually it is not impossible and not difficult to define the limits by inspection, and it would certainly always be possible by analysis.

Q. (By the Court.) That is to say, the walls have disappeared in some cases? A. Not quite disappeared, sir, but the chemical influences of the solutions which have come by exterior cracks have not only mineralized that which was within, to a certain extent, but to a lesser extent, that which is without.

Q. What do the vein fillings in that vein chiefly consist of?

Mr. Bodwell: What vein do you refer to?

Q. Centre Star No. 2 vein. A. It is largely of this altered country rock, very largely of altered country rock, and in places it consists of plates and bands and some irregular patches of metallic minerals, that is to say, of pyrrhotite or chalcopyrite and iron pyrites; the main mineral of the metallic passages of the vein is pyrrhotite; the chalcopyrite in the vein is always in much less quantities, and the pyrite is more evenly distributed, and does not seem to me to be an essential, although it is usually present.

Q. Do you find any special difference between the constituents of the Iron Mask vein and the Centre Star No. 2 vein, both as to ore, I mean, and also as to vein matter apart from ore? A. Where I have seen the Iron Mask vein its fissures were never very far apart, and the vein filling which I have seen has been always of ore, except a little country material towards the edges of their body. Whereas, the Centre Star vein, in my belief, is a much wider vein enclosed within shear planes, which are not less than at the extreme of 20 feet, and the bulk of the vein included between those is country rock, as I have said before more or less altered. That constitutes the difference, as I have seen, between the two veins.

The Court: You say the walls are about 20 feet apart? A. I should say, about that, the ultimate walls. And probably in some places are much less, as I will afterwards show.

The Court: I understand.

Q. Which vein are you speaking of now? A. Centre Star No. 2.

Q. Now, that you are speaking of the width of the Centre Star No. 2 vein, will you tell me, Mr. King, if the width of the veins is a uniform thing at all? A. Not at all. I have spent a great deal of time in the study of one vein that was over 500 feet,—in the Comstock.

Q. And did it remain of a uniform width? A. It was a closed fissure, a mere crack for thousands of feet.

Q. And how did you find the veins in this camp in that respect? A. As to their uniform width?

Q. As to their uniform width or the opposite? I have seen in the Le Roi not less than 40 feet of solid vein matter. That was at a time when the development had not proceeded very far, and as to the later widths, which I am told is very much greater, I am not able to testify personally.

Q. Well, was the width in the Le Roi vein uniform? You say you saw 40 feet of a width. Was it any narrower at other places? A. It certainly narrowed westward as far as the workings went, rather rapidly, but I am not familiar with the later developments at all.

Q. Well, speaking of the veins in the camp that you are familiar with are they as a rule of uniform width, or do they vary in width, and if so, give us an approximate idea? A. They vary very widely in width, and each vein is apt to vary in width.

Q. I am speaking, Mr. King, not altogether of the comparative width of the different veins, but I am speaking of the uniformity or non-uniformity of any particular individual vein. A. I am about to illustrate that. There may be some geological question as to whether the stopes upon the Iron Mask, east and west, are upon the same vein. In my belief they are upon the same vein, and the eastern edge of the western stope, where it comes in very close to the dyke, which will perhaps later be described, which cuts through this country to the north and south, is perhaps 6 or 7 fet wide; at other places I have seen it down to a mere fissure. So that that vein itself varies from an extremely narrow seam to 6 or 7 feet.

Q. What is the dip of the Centre Star No. 2 vein in the incline shaft? Take first the average dip, we will say, from the top of the point you mentioned before? A. About 45 degrees.

Q. Does the dip of that vein vary? A. Very little. It has a slight variation, but very little.

Q. That is, in the shaft? A. In the shaft it is steeper at the top, perhaps 6 or 8 degrees.

Q. Now, do veins as a rule maintain a uniform dip, or do they vary A. They vary enormously. I have seen veins in their dip describe a curve that amounted to almost a right angle. The ore-bearing part of the Comstock, which is a very constant example among miners, the eastern walls dip west for a considerable distance, finally swing into the perpendicular and then dip east. Another very well known vein is the Tomboy, which is now a very important mine belonging to the Rothschild Syndicate, in Telluride, Colorado. It started with one dip, made a curve, and assumed another. It is not an uncommon thing that their dip or strike be seriously changed.

Q. About what is the strike of the Centre Star No. 2 vein at the incline shaft? A. It is a little east, a little north of east, about north 86 east.

The Court: You mean as between these two shafts

The Witness: No, I mean right at this point, in this region here. (Indicating on model.) As between the two, that has not been asked me. I can figure that out.

Q. Yes, you might give it us, Mr. King.

The Court: I think I misunderstood your question probably.

Mr. Davis: The question was as to the strike of the vein in the incline shaft.

The Witness: The strike of the whole vein between No. 2 and No. 3 closely approximate to east and west, at this level (indicating), the level indicated.

Q. At which level? A. The level indicated, about 100 feet above the bottom of the shaft.

The Court: The strike, as I undertand (of course, subject to correction), the strike ordinarily, for instance, of that incline, would be taken on the top of it if you did not know there was another shaft here? A. Yes, sir; if you had no other guide to go by it would be.

The Court: That is the reason I asked you if it was between the two shafts. A. I was asked that and was answering as to one shaft only.

The Court: And you say north 86 degrees east. A. Yes, sir. at this point. But taking the wider range of the vein it would be about east and west, and the course of the outcrop, which defines the vein upon the surface, would be quite different, because this is lower than that, and the true strike would be from the top of this to that produced at an equal level.

Q. Do you find the vein in the No. 3 shaft narrower or wider or of the same width that the shaft itself is? A. The ore bearing part of the vein is narrower than the shaft. It lies near the foot of the shaft and there was over it from two to four feet according to the breaking of the shaft——

Q. Can you tell—— A. May I finish this answer? Will you kindly read that to me again. (Last question and answer read.)

A. (Continued.) Before reaching the last seen hanging wall, which hanging wall is not continuous, but is sometimes broken into by the mining operations and for considerable spaces obliterated.

Q. Can you tell from an examination of No. 3 shaft, as it is at present, what is the width of the vein at that place? A. I cannot. I simply see that a little above, 2 or 3 feet above, the upper boundary plane of the ore is another parallel plane, which is undoubtedly in my mind, a part of the shearing system of the whole. But no works give me access to planes; if they exist, below the lower level of the ore; and I do not believe that I saw the upper planes of the veins; the ultimate plane of the vein, anywhere in this shaft. My reason for that is, that a few feet to the east, at the east end of this brown drift, which is the south drift from the Iron Mask stope, what I believe to be, from its position and character, an eastward projection of the ore body of this shaft.

Q. That is No. 3 shaft? A. No. 3 shaft—is accompanied by two superior parallel walls, at distances of from 4 to 5 feet in actual cross section. The lower one of these I believe to be the one which exactly geometrically fits it and which is the one which is the wall I have spoken of as overlying the ore of this shaft, but we have never cut high enough in No. 3 to get at the upper of those walls, and we have never cut below to get at the lower walls.

Q. From the explanation you have given, I understand this is what you described yesterday as the shear zone vein? A. Yes, sir, the shear zone vein.

Q. Now, you spoke a moment ago of the hanging wall disappearing. What hanging wall were you referring to? A. The lowest plane seen above in the No. 3 shaft.

Q. And what is the cause, if you know it, of its disappearing? A. I explained that, that it was due to cutting in by the miners, but they had never broken accurately to the planes; that they had sometimes left some material below it, and for large distance they cut into it.

Q. And had not gone far enough back to cut the wall? A. Any correlative planes that might be there.

Q. In the case of a vein that you have described, what would be the only possible way of accurately and mathematically demonstrating where the two ultimate walls of the vein were? A. By a thorough cross-cutting into the hanging and foot walls.

The Court: In the present shaft? A. In any case; in this case exactly the same cut.

The Court: And cutting out any particular place? A. Yes, sir.

DIRECT EXAMINATION

Mr. Davis: I may be a little long over this No. 3, but that is the shaft so much fighting is about.

The Court: I want all the information possible.

Q Now, Mr. King, will you kindly come around here and point the ore in this Exhibit No. 90 out to the Judge and explain the different ores as you find them. This is a sample from near the top of No. 3 shaft. I suppose that will explain the oxidation? A. Yes.

Mr. Davis: All of this evidence is being given with reference to the pieces of ore in Exhibit.

The Witness (Proceeding to illustrate to the Court from Exhibit No. 90): This is the type of the metallic mineral of the No. 3 shaft and of the vein at large. It is taken from near the surface, and this dull bronze lustre is a characteristic of the ore and of the copper—which is much more easily decomposed than the pyrrhotite, more soluble, appears only scattered. There (illustrating), for instance, is a little yellowish spot, which is the copper. Here is a sample which contains but little of the pyrrhotite or the metallic mineral, and is chiefly of country rock. The sample, therefore, is composed of a mixture of what I should probably consider the country rock and of the metallic mineral such as you would get by breaking into a more or less decomposed and not always perfectly defined outcrop. Here, for instance, is a piece of the siliceous, and the quartzose part of the vein which is found, but not an absolutely constant accompaniment, which contains a good deal of the copper mineral chalcopyrite. Quite often, as near the surface, some of the copper has been oxidized, and has left a green stain of itself, which indicates its former presence. That is the characteristic of this pan full of ore It is made up of a mixture of broken country and ore material, with more or less silica.

Mr. Bodwell: I will put those in a piece of paper which Mr. King referred to.

The Witness: I picked that out on purpose to show the mixture.

Mr. Davis: This is more for the purpose of showing your Lordship the ore itself and having Mr. King point out the different minerals, than anything else.

Q. From what you said, Mr. King, you apparently find country rock more or less altered, and perhaps not altered at all in the vein. Is that correct? A. In parts of the vein.

Q. Here is Exhibit 91. This is the second one down in the shaft. A. (Illustrating.) I take the two top specimens, as illustrating precisely the same phases that I spoke of before. This sample is chiefly pyrrhotite, but contains a little copper mineral; this is chiefly country rock, containing a good deal of chalcopyrite and some calcite.

Q. As to Exhibit 92, first of all, Mr. King, what ore do you find in that, speaking generally? A. You mean what ore minerals?

Q. Yes. A. Pyrrhotite and chalcopyrite, with the calcite which I mentioned as accessory.

Q. You found both of those? A. If you will allow me to look at the very first specimen again. (Referring to Exhibit 90.) It has perhaps a little lime, but it is largely quartz.

The Court: Is that term "shear zone" that you mentioned yesterday and this morning a geological term? A. Yes, sir.

The Court: A very well known one? A. Yes, in modern times; it has not been very well recognized until very recent years. It appears in geological literature in a prominent way in recent times.

The Court: Owing to the new theory by compression. A. Owing to the new observations chiefly. This (referring to Exhibit 92) is again a mixture of country rock; and when I say country rock, I do not mean in this case to limit it to the country rock exter-

ior to the vein, but to the material of the country rock; and as to whether it is altered by vein influence and is within the bounding planes or exterior to it I could not say without close examination, which is impossible to make here. Outside that, the bulk of the exhibit is of pyrrhotite, with a good deal of chalcopyrite—that is in the specimen of the chalcopyrite. Here is also a considerable amount, a noticeable amount, of calcite. I should like also to say that in the first specimen (Exhibit No. 90.) there is calcite.

Q. I hand you Exhibit 93. A. Can I make what I said about country rock apply to all of the specimens later?

Q. Certainly you can if it does. A. There appears to be three types here, a country rock with very slight impregnation by metallic mineral, a pretty solid pyrrhotite ore with a little copper and the same mixture type in which there is considerable calcite, with pyrrhotite and chalcopyrite.

Q. When you speak of the country rock being altered in the veins, what is the alteration which you refer to? You might just describe it as simply as possible. A. It is a varying decomposition of the included country rock, which results prominently in the degradation of the feldspar, and in the uralization of the augites, and the development of the secondary biorite. The two former cases also proceed into the country rock, but in less degree, and the third case, that of the secondary biorite, is, so far as my examination has gone, characteristic of the included country rock, which I call vein matter.

Q. In Exhibit 94 what do you find? A. An exhaustive examination of this would take hours, of course, and perhaps days. I am only giving it in a cursory manner. This is the same mixture of country rock, containing disseminated pyrrhotite and chalcopyrite, more or less charged with calcite and solid masses of pyrrhotite. I will qualify those at the end by what my limitations are.

Q. What about Exhibit 95? A. This is a similar mixture, in which, however, the proportion of country rock is much less and the pyrrhotite and chalcopyrite much greater than in the previous sample.

Mr. Bodwell: That applies generally to the whole sample? A. That applies generally to the whole sample. That contains the two chief ore-bearing minerals and shows the country rock, (referring to one of the specimens.)

Q. What do you say about 96? A. This has more coutnry rock in it. This is a similar mixture of country rock containing more or less calcite and carrying the ore minerals pyrrhotite and chalcopyrite.

Q. And what else? You said it is a mixture of country rock carrying so and so. A. Carrying the ore minerals pyrrhotite and chalcopyrite, together with solid masses of pyrrhotite and chalcopyrite, the latter always in less proportion. Do you want me to particularize, or can I say this is similar to the previous?

Q. I want you to say whether or not it contains pyrrhotite and chalcopyrite. A. Yes.

Q. Say that definitely, and then you can generalize as much as you like. A. This is a similar mixture of country rock, impregnated with the metallic minerals and of solid masses of pyrrhotite and chalcopyrite.

Q. What do you say about 98? A. A similar mixture of coutnry rock, more or less impregnated with metallic minerals, the impregnation amounting in places to a solid mass of the two metallic minerals.

Q. That is pyrrhotite and chalcopyrite? A. Pyrrhotite and chalcopyrite.

Q. What do you say about Exhibit 99? That is taken from 102 and 107 feet down? A. It is a similar mixture of country rock, pyrrhotite and chalcopyrite and iron sulphide.

Q. That is iron pyrites? A. No, which is probably iron pyrites mixed with a little chalcopyrite.

Q. What do you say about Exhibit 100, taken 112 and 117 feet down? A. It is a similar mixture of country rock, pyrrhotite and chalcopyrite, and is in part more silicified—apparently more silicified. It contains calcite as well.

Q. What do you say about Exhibit 101, taken at 123 and 127 fet down? A. It is a similar mixture of country rock, pyrrhotite and chalcopyrite.

Q. Is it possible to form any reliable opinion from looking at those samples which is the richer in value? A. I should suppose that the higher percentage of chalcopyrite would indicate a slightly greater contents of precious metal, but so far as the bulk of the ore mineral goes, which is pyrrhotite, there can be no determination made of relative values by looking at them.

Q. By merely an examination; that is what I want to get at? A. No. Since part of the values of the ore are in copper, the higher visible proportion of chalcopyrite means a higher value; but that pyrrhotite offers no guide.

Q. Now, are the values in veins, as a rule, uniform? A. Not at all.

Q. Just describe how values are frequently or usually found in that respect? A. The distribution of the valuable minerals within the material of a vein is most capricious and most irregular, and follows a very great number of types. Sometimes the values are all in certain layers of a banded structure; sometimes they are thinly distributed through a gangue stone; sometimes they are highly concentrated in the mud-seam of ore bodies, and sometimes one wall will carry more value than another. Sometimes in a mine whose vein consists of a vein stone of metallic minerals and of an impregnated companion zone exterior to the gangue stone, the plain exterior zone which may be due to silicification or even the presence of calcite, the exterior zone may carry a higher proportion of the precious minerals than the visible metallic minerals would show. In the case of veins of replacement the values may, and usually do, depend on the perfection of the pseudomorphism or replacement by the mineral as well as the original matter of the vein, and as that is a most capricious process, both values and the carrying mineral matter may cease at any time and re-appear in the most eccentric manner, and practically not until a great vein should be entirely worked out would it be possible to map the distinction of accompanying minerals or essential minerals.

Q. So that if, in following down a vein, you come to a place where the mineral rock constituting the vein, the filling, carried only a trace, what would you say of the precious metals; would you attach any importance to that? A. Only a commercial importance.

Q. But I mean as to the vein itself, or as to what might ultimately result in that vein? A. No, not at all.

Q. What do you say as to Exhibit 102, taken at a depth of 132 and 137 feet? A. That it was a similar

mixture of country rock, pyrrhotite, chalcopyrite and a white quartzose matter, which possibly includes feldspar; that the chalcopyrite is accompanied by tarnishes which indicate local decomposition.

Q. What do you say about Exhibit No. 103, taken at a depth of 142 and 147 feet? A. A similar mixture of country rock, pyrrhotite and chalcopyrite.

Q. What do you say about 104, taken at a depth of 152 and 157 feet? A. Similar mixture of country rock, pyrrhotite and chalcopyrite.

Q. What do you say as to Exhibit No. 105, taken at a depth of 162 and 167 feet below? A. A similar mixture of country rock, pyrrhotite and chalcopyrite in which the metallic minerals are in larger proportion than in most of the preceding samples.

Q. Did you break one of those and see the chalcopyrite and pyrrhotite when it was fresh? A. (Witness breaks the rock.) This shows it pretty well, the bright, brassy yellow is chalcopyrite, and this dull metal coloured bronze is the pyrrhotite.

The Court: There are no sulphurets? A. No, they are copper-bearing sulphurets.

Q. What do you say as to Exhibit 106, taken at a depth of 172 and 177 feet? A. I should say that it was a similar mixture of country rock, pyrrhotite and chalcopyrite. To save multiplicity, of that sample, I have got both.

Q. What do you say as to Exhibit 107, taken at a depth of 182 and 187 feet? A. It is a similar mixture of country rock, with pyrrhotite and chalcopyrite.

Q. What do you say as to Exhibit 108, taken at a depth of 192 and 197 feet A. The same mixture of country rock, pyrrhotite and chalcopyrite.

Q. What do you say as to Exhibit 109, taken at a depth of 202 and 207 feet A. A similar mixture of country rock, pyrrhotite and chalcopyrite.

Q. What do you say as to Exhibit 110, taken at a depth of 212 and 217 feet A. A similar mixture of country rock, pyrrhotite and chalcopyrite.

Q. Now, Mr. King, looking at 109 and 110, which from appearance would seem to be the richer sample; which seems to show more mineral? A. (After examining.) This one (Exhibit 109).

Mr. Davis: The assayer's return show that 110 is the richer by one-half.

The Witness: It is a question of the interior of the rock, as well as the exterior.

Mr. Davis: That is what I wanted to bring out, that you can't tell by looking at the outside their values.

The Witness: What I judged by was the visible breaks, there seemed to be more chalcopyrite.

Q. What do you say as to 111? A. Mixture of country rock, pyrrhotite and chalcopyrite.

Q. What do you say as to 112, taken at a depth of 232 and 237 feet? A. This consists of a mixture of country rock, pyrrhotite, and what I take to be a mixture of pyrite with a little chalcopyrite, but that could only be determined by closer examination.

Q. What do you say as to Exhibit 113, taken at a depth of 242 and 247 feet? A. It contains country rock, pyrrhotite and pyrite, the latter apparently cuperiferous.

Q. That is, copper-bearing, is it not, Mr. King? A. Yes, copper-bearing; perhaps I had better put it in "copper-bearing.'

Q. What do you say as to Exhibit 114, taken at a depth of 252 and 257 feet? A. Mixture of country rock, pyrrhotite, some pyrite and chalcopyrite.

Q. How would you say that particular sample compares in value with the ordinary run of them, the last few you have been having, for instance? A. I don't like to answer that.

Q. I suppose what you mean is, that on a cursory examination such as this, you could not tell very much about about the difference? A. I could not tell without a very close examination; I should say it was low in value.

Mr. Davis: That is the assay which runs the highest in value. The assayer's return is $45.60.

The Court: Very few of them ran over $20.

Mr. Davis: Very few indeed.

The Witness: I had previously stated it could not be done by the eye.

Mr. Davis: I just wished to accentuate that. That is the very object of it.

Q. Exhibit No. 15, taken at a depth of 262 and 267 feet? A. Country rock, pyrrhotite and chalcopyrite and pyrites.

Q. What would you say as to Exhibit 116, depth 272 and 277 feet? A. Similar mixture of country rock, pyrrhotite and chalcopyrite.

Q. What do you say as to Exhibit 117, depth 282 and 287 feet? A. Mixture of country rock, pyrrhotite, chalcopyrite and a little pyrite.

Q. What do you say as to 118, taken at a depth of 292 and 297 feet? A. Country rock, pyrite and pyrrhotite.

Q. Now, the point where you stopped in the shaft, Mr. King, that is at the bottom of this sump, is coincident, I think, with the place where the so-called flat fault goes through, is it not? A. It is.

Q. Now, Mr. King, is there anything you want to add to what you have said individually as to these specimens? Because we have finished all the specimens in the No. 3 shaft down to the mud-seam? A. I should like to make a qualification, yes. In regard to these determinations, they were intended to cover essentially the obvious facts of the samples. They do not propose to determine obscure or difficultly visible accessory minerals. I have not always mentioned that calcite was present when it was present in some of the samples. I may say generally that there is a little calcite through the whole suite, not in every piece, but in a great number of them. That the mention of pyrite has been chiefly confined to specimens in which the mineral appears with sufficiently crystalline facets to offer easy determination. The pyrite is probably present in a very large number of cases where I have not mentioned it, and where it could not be easily differentiated from chalcopyrite.

Q. Mr. King, looking at these samples which you have examined, which came, as the evidence shows, from trenches cut across the full width of the ore every five feet down in No. 3 shaft, is it a physical possibility that there should be no vein in that shaft, in your opinion? A. In my opinion it is not. I will qualify that. From what I know of veins in general, and of the Rossland district in particular, it would be impossible to trace continuous ore upon any plane or line unless you were following a vein.

Q. You have examined, I believe, the Centre Star east drift, that is, the green drift which runs from the No. 3 shaft? A. I have.

Q. Have you made a careful examination of that? A. I have.

Q. Do you find any vein there? A. I find precisely the same vein, which I followed from the collar

of No. 3 shaft where it outcrops down to the mouth of the 59 east drift, and all through that drift I continued to follow that vein to the head of the winze. Its ore is continuous, its structure unmistakable.

Q. So that there is a lateral extent of the vein in No. 3 shaft of at least 100 feet? A. There is.

Q. You spoke of the structure of the vein in 59 east drift. Please describe that structure you found there, and why from that point of view you say there is a vein in the 59 east drift? A. Primarily because the ore lies upon the south and north sides of the drift, corresponding in position to the inclination which the ore has followed from the surface; therefore it is a part of a plane, which plane has been defined upon one side by No. 3 and upon the other side by the east drift. Also by the presence of a plane visible, frequently tapping the ore and defining it from the immediate country rock, which plane is the trace of a fissure.

Q. What about the ore? A. I should like to qualify that answer a little more, and say that that plane is not a mathematical plane in the sense of it fitting co-ordinate with absolute exactness, but it is a pure geological fissure vein.

Q. What do you say as to the ore in 59 east drift? A. It is the same mixture of predominant pyrrhotite and a little chalcopyrite.

Q. As to its continuity, what do you say? A. Absolutely continuous from the point of its divergence from shaft No. 3 to the head of the winze; and the face in that direction shews ore forthgoing.

Q. Now, I wish to have this point clear, Mr. King. When you speak of the ore being absolutely continuous, you are speaking literally. A. I am speaking in the case of No. 3 and this drift literally.

Q. You have made such an examination as enables you to say that? A. Yes, sir; it is literally continuous.

Q. What do you say as to the width of the ore and the width of the vein, if you know the width in 59 east drift? A. It varies from——

Q. Which? You see, I asked you as to the width of the ore and also of vein. A. As to the width of ore, it varies from perhaps 18 inches to about four feet on the plane of exposure. It would indicate a little less on an absolute perpendicular to the plane of the vein. As to the vein itself, I got no further light—I did not get so much light as to the general structure or rather as to the presence of overlying parallel walls as I do in the shaft itself.

Q. That is, you cannot tell the width of the vein in the 59 east drift? A. No, I am only able to follow a distinct line of unbroken continuous ore, which was a part of the sheet which I had followed down which I traced inwardly to the head of the winze.

Q. What do you say as to the walls there? A. I repeat that the only wall, clearly visible is a somewhat disturbed wall covering and limiting the ore, which wall I will describe later.

Q. Perhaps it would be as well to describe that wall now, since we are on it? A. Well, if you ask me about the winze I will do it then. It appears better in the winze.

Q. All right. I don't know whether I asked you when examining you on the No. 3 shaft about what the width of ore was in that shaft. I do not think I did. A. From about a foot to three feet and a-half in one place, I think. It is a substantially continuous zone sheet of ore.

Q. Before I ask you about the individual samples, I will ask you whether you find any similarity or any difference between the ore in the No. 3 shaft and the ore in 59 east drift? A. I see none whatever.

Q. No which? A. No difference.

Q. What do you say as to Exhibit 72, which is from 7 and 12 feet east station 59? A. It contains country rock, pyrrhotite, pyrite, and chalcopyrite.

Q. What do you say as to Exhibit 73, which is from 17 and 22 feet east of the shaft? A. They contain country rock, pyrrhotite and pyrite.

Q. What do you say as to Exhibit 74, which is from 27 and 32 feet east? A. They contain country rock, pyrrhotite and chalcopyrite.

Q. What do you say as to Exhibit 75, which is from 37 and 42 feet east? A. They contain the same country rock, chalcopyrite and pyrite.

Q. Any pyrrhotite in that? A. I meant pyrrhotite, not pyrite.

Q. Chalcopyrite and pyrrhotite? A. Yes.

Mr. Davis: I will ask your Lordship to look at these samples in Exhibit 75. This piece, which to me, at any rate, looks rather "rocky," is the highest sample in the drift.

The Court: For silver? A. For gold. There is a silicification of these ores. In answering the question as to this sample I was not aware of the value of the sample at all, which is shown to be $18.80; and I now suspect that it owes that value largely to gold accompanying a secondary silicification, which is a prominent feature in certain parts of the Rossland mines.

Q. What do you say as to Exhibit 76, which is 47 and 52 feet east of No. 3 shaft. A. That contains country rock, chalcopyrite and pyrrhotite.

Q. What do you say as to Exhibit 77, at 57 and 62 feet east of the shaft? A. I should say that it was country rock, pyrrhotite, a little chalcopyrite and pyrite.

Q. What would you say as to Exhibit 78? A. Pyrrhotite, chalcopyrite and country rock.

Mr. Davis: I ask your Lordship to look at this one specially.

Q. Would you mind pointing out to his Lordship those different pieces showing the pyrrhotite and chalcopyrite? A. That yellow going through there is chalcopyrite, a sort of brassy yellow. The bronze mineral is pyrrhotite. And that piece is a mixture of both, with some country rock.

Q. What is that which you see there in that piece? A. Pyrrhotite.

Q. What do you see there (showing another piece to the witness)? A. Pyrrhotite with a tarnish that may contain a trace of copper.

Q. What do you see there? A. Pyrrhotite.

Q. And what do you see there? A. A little chalcopyrite.

Q. What do you see in that piece? A. Pyrrhotite.

Q. What do you see there? A. Pyrrhotite, with a little chalcopyrite. There you can see the association; there is the pyrrhotite and there is the brassy chalcopyrite.

Q. There is not a piece in this sample, is there, in which you cannot find pyrrhotite and chalcopyrite? A. It would take a long time to determine it.

Mr. Davis: Now, that, my Lord, although it looks so nice, is one of the poorest assays, only $2.40.

Q. What do you say as to Exhibit 79? A. Country rock, pyrrhotite and chalcopyrite.

Q. What do you say as to Exhibit 80, 87, and 92 feet from No. 3 shaft? A. Country rock, pyrrhotite, and chalcopyrite.

Q. What do you say as to Exhibit 81, which is 97 and 102 feet east of No. 3 shaft? A. It is country rock, pyrrhotite and chalcopyrite.

Q. So that the chief ores in this vein that we are considering are clearly chalcopyrite and pyrrhotite. A. With accessory pyrite.

Q. What are the chief ores which you find in the Iron Mask vein? A. Chiefly pyrites, with mixtures of chalcopyrite.

Q. Chiefly pyrite? A. No, pyrrhotite, with a mixture of chalcopyrite.

The Court: That is, they are the same? A. Practically the same, yes.

Q. Now, Mr. King, have you anything further to say as a whole with reference to the ore in that drift? A. Only to repeat its absolute continuity, and like the vein in No. 3, shaft, so far as its metallic contents are concerned, it consists predominantly of pyrrhotite with a little chalcopyrite and occasional masses of pyrite, which seemed to me to be secondary and accessory.

Thereupon the Court adjourned until 2:30 p.m.

(To be continued.)

RECENT PUBLICATIONS.

THE Statistical Year-Book of Canada for 1899. Issued by the Department of Agriculture, Ottawa, 1900.

Section of Mineral Statistics and Mines, annual report for 1898, by E. D. Ingall, M.E., Geological Survey of Canada, 1900.

Descriptive Catalogue of a Collection of the Economic Minerals of Canada at the Paris International Exhibition. Printed by direction of the Canadian Commisisoner, 1900.

Report of the Section of Chemistry and Mineralogy, by G. Christian Hoffman, L.L.D., F.I.C., F.R.S.C., Geological Survey of Canada, 1900.

Preliminary Report on the Clays of Alabama. Bulletin No. 6, Geological Survey of Alabama, Jacksonville, Gla., 1900.

TECHNICAL PERIODICALS FOR THE MONTH.

THE JOURNAL OF GEOLOGY.

MANY factors have to be taken into consideration if the stone used for building or other purposes is to prove durable. In the issue of this periodical Mr. E. R. Buckley cites the following points as particularly worthy of notice: 1, colour; 2, composition (mineralogical chemical); 3, strength (crushing transverse); 4, hardness; 5, elasticity; 6, porosity; 7, specific gravity; 8, weight per cubic foot; 9, effect of temperature changes, (a) freezing and thawing in interstitial water, (b) effect of extreme heat; 10 effect of gases (carbonic, sulphuric); 11 quarry conditions.

The information indicated may be obtained from observation at the quarry, inspection of buildings, or other structures made out of the same stone, and from laboratory tests. At the quarry one can ascertain the quantity of stone similar in texture and uniform in colour that is available, also whether the method of quarrying is injurious to the stone.

When estimating the strength and durability of a stone on observation of buildings, one must be careful to take into account among other things: age, size, position and climatic conditions. The effect of exposure can be estimated with wonderful exactitude, from laboratory tests without the aid of the foregoing. Laboratory tests come under these principal heads: chemical, microscopical, physical. Chemical analysis determines whether a building stone contains any detrimental material such as iron or bitumen. This may also be learned, and at less expense by microscopical examination, when, at the same time texture is considered. Physical tests supply the data for 3 to 10 of the above scheme. Few experiments have as yet been made to determine the temperature which different rocks will stand without injury. In large cities the capacity to withstand extreme heat is regarded as essential to a first class building stone.

THE ENGINEERING MAGAZINE.

In the last few numbers of this magazine a discussion covering the question of iron production and supply has been accorded much prominence. The subject is further investigated and elaborated in the August issue in a paper entitled "Industrial Depressions and the Pig Iron Reserve," by Mr. George H. Hull, who has been closely identified with the iron industry of the West and South for many years. Mr. Hull's theory that industrial depression follow abnormal advances in the price of iron, is not new, but the highest commendation is his due for the mass of valuable statistical and other information which in the paper in question, he brings forward in its support. After showing that the depressions of the past in the manufacturing nations of the world have been nearly or quite contemporaneous in their occurrence, Mr. Hull points out that "before iron became of preponderating importance to the industries of nations, there were no industrial depressions except those born of causes apparent at the time, such as pestilence, famine and war. "Iron," he contiues, "is acknowledged to be the foundation on which the modern industrial system rests. If that system is disturbed it is most natural to look to the foundation for the cause of the disturbance. If we would appreciate how thoroughly the entire industrial system depends upon iron, let him imagine what the world would be to-day without it—what it would be if we depended upon wood, stone, copper and tin for our implements of agriculture, tools, machinery, vehicles of transportation on land and sea, the vast network of rails on the surface, and the pipes which carry water, gas, etc., under the surface. What proportion of these could could have existed without it? It matters little what its price is, provided that price is stable. The industries of a nation depend upon the actions of an aggregation of individuals. When the individual considers an expenditure for a permanent improvement, and finds that improvement will cost 50 per cent. too 100 per cent. more than it would have done a year before, or is likely to do a year later, he acts, and that action is almost invariably a postponement of that improvement. This in a nutshell, is the reason that industrial depressions follow an abnormal advance." And the figures Mr. Hull is able to bring forward certainly prove his conclusion true. Other interesting and timely articles are "China in Regeneration," by John Foord; "Electric Mining Machinery in the British

Collieries," by S. F. Walker, and "The Future of Power Development," by W. D. Ennis.

MINES AND MINERALS.

Among the leading articles in *Mines and Minerals* for August is an account of gold dredging in British Columbia. As this class of mining has not, with one exception, proved as yet greatly successful, the main point of interest centres in the description of the type of dredge operated at Boston Bar, with which fair results have been obtained. This appliance is of the "dipper" design, the machinery resting on two scows. On one of these is placed a 75-horsepower engine, and boiler, a pump with a discharge of 500 gallons per minute, the arm that works the dipper and the dipper itself. On the other scow, anchored alongside, is placed the grizzly, across which extends a water pipe connecting with the pump above referred to, and below the grizzly are the sluice boxes. The grizzly is composed of iron bars laid about one inch apart. Into this the dipper discharges its load, the finer material passing through the grizzly into the sluice boxes, and washed down by the water coming through the holes of the perforated water pipe. Large boulders and the heavier gravel are carefully washed by a man stationed at the grizzly, who throws the worthless material into the river. The entire string of sluice boxes is 120 feet long, the first 30 or 40 feet being three feet wide, the rest six feet wide, mercury being used in the latter. The dipper is constructed of cast iron with a steel lip protected by steel prongs necessary to penetrate the cement. It has a capacity for raising one cubic yard of gravel every minute and a-half. This dredge works to a depth of twenty-five feet.

THE ENGINEERING & MINING JOURNAL, NEW YORK.

Mr. W. M. Brewer contributes an interesting and comprehensive account of the Britannia group of mines at Howe Sound to the *Engineering and Mining Journal* of August 18th, in which he points out the similarity of the mineral zone of this locality to the extensive formations of the Lillooet district. In fact, there appears to be a series of parallel belts of an igneous rock which has become schistose from shearing, extending northerly from Howe Sound into the Upper Lillooet section. All of these belts of formation are mineralized with iron pyrites, a large proportion of which is marcasite. So far as concerns the Howe Sound belt, actual development has demonstrated that within this main zone of mineralized schist there occur smaller zones having concentrated values in gold, silver and copper, averaging approximately $10 per ton, estamating the copper values at 10 cents per pound, based on dry assay.

THE CANADIAN MINING REVIEW, OTTAWA.

The July number of the *Review* is somewhat "slacker" than usual and remarkable only for a rather unnecessarily fierce attack on the War Eagle. The strictures which our contemporary passed on this company in March last were not unjust or unwarranted, but at present there are as yet no reasonable grounds for the "deduction" that there will be "another 'rosy' manifesto when shipping recommences, with much bathos about high-grade ore and 'prodigious profits,' followed by a speedy collapse."

MODERN MACHINERY.

Two articles in *Modern Machinery* for August are particularly worthy of notice, the one entitled "Blast Furnace Gas Engine" describing a simplex engine capable of developing 1,000 horsepower with ordinary gases, now on exhibition at Paris; and the second giving an account of electric power in Cripple Creek. It is asserted that the saving effected by the use of electric power in this district, as compared with the cost of coal under the same conditions is fully 50 per cent. The cost of coal delivered to the mines of Cripple Creek is $4.75 per ton.

B. C. IN LONDON.

MR. WHITAKER WRIGHT AND THE "BEARS"—THE KLONDIKE & COLUMBIAN GOLDFIELDS DISCLOSURES.

(From Our Own Correspondent.)

THE holiday season is now on us, and business has been, and is likely to be very slack. The mining market just drags along, but it is satisfactory to note that prices remain comparatively steady. The operations in British Columbians are conspicuous by their absense, but some hope is derived from the fact that the Hall Mines Co. (the premier B. C. mining company so far as London is concerned) has just emerged triumphant from the throes of reconstruction, and proposes now to go ahead, let us hope with happier results than hitherto. So far, however, as the British Columbian market is concerned, practically all the dealings are limited to the B. A. C. group, and in this latter has taken place the chief movement of the month in so far as mining shares are concerned. I have already shown the activity displayed by Mr. Whitaker Wright and his friends in floating off their Rossland properties. Mr. Wright's methods have more thann once seemed to present splendid opportunities to "bear" operators, and the flotation of the "Le Roi No. 2" was seized upon by the market manipulators who love to sell what they haven't got speculatively in the hope of frightening out real holders at lower prices, and so secure the profit in between the top selling and lowest bringing quotations. A very large number of shares was sold at the market premium quoted for them—a part of the Whitaker Wright methods. Now it soon transpired that this premium was in no ways justified by the results of the issue of capital, and as those who were shareholders in the allied companies and had applied for allotments quickly took their profits, Mr. Whitaker Wright and his friends were masters of the situation —a very nasty situation, as the bears soon found out to their cost. The price began to move up rapidly, and directly the bears sought to buy back the shares they had recklessly sold, the screw was put on quickly by the controlling group, and it was evident that Mr. Whitaker Wright had at last an opportunity of dictating terms to those who had attacked his interests so successfully during the past twelve months. Day by day the bears found the price put against them, every effort to get back shares sending the quotation up £1 or so, until at length nearly £20 was quoted for the £5 share. I understand that terms of capitulation have at length been agreed upon, and that as a result of his actions the little man has netted a big gain, which will help to offset the heavy losses he must have incurred in defending his Westralian and British Columbian interests during the last twelve months or so. They say one big operator lost over £100,000, and I heard from the very best source that one young firm of jobbers who have associated themselves with the so-called British Columbian market were very badly hit.

It will give you some idea of the dullness of things British Columbian in London if I tell you for a fact that I know of one of the very biggest firms in London, who associated themselves from the first with the B. C. movement have just given orders to suspend the supply of all their B. C. publications, their point being that it is "no good bothering about B. C. matters for the present, and therefore they do not need any B. C. literature." Surely this is shortsighted.

The collapse of the Klondike boom was also a bad blow to many operators who thought they foresaw big things in the goldfields of the frozen North. The Canadian Pacific Railway still calls attention to the Klondike in its advertisements, but it couples with Klondike, Kootenay and Ontario, and for the moment seems to have come to the conclusion that it is no good pushing the Klondike alone. A chat I had a few days ago with the secretary of one of the very biggest Klondike companies was illustrative of the generally disappointed tone of groups here so far as the Yukon is concerned. This gentleman told me that the results were very much below their earlier expectations. You will judge the importance of this when I tell you that this group is one of the very biggest operating in connection with South Africa and the results to which I have referred will certainly restrain them from showing any immediate enthusiasm over either B. C. or the Klondike.

The disgraceful disclosures at the public examination of the directors and promoters of the Klondike & Columbian Goldfields—the group with which so unfortunately Messrs. Turner and Pooley associated themselves—deserve the fullest publicity in British Columbia. The evidence should be published in full throughout the province. From the first I exposed Mr. Morris Catton, the erstwhile War Office clerk, in your columns and deprecated the association of members of your government with him. This individual's career (Mr. Morris Catton's) reads like a romance. He seems to have worked hard and to have gone to his private office before starting for the War Office, meeting his clerks again at lunch time, and then returning after War Office hours to work on at company promoting until after 9 o'clock. He has foisted a number of disgraceful companies on to the British public; but as I have over and over again dealt with his B. C. and Klondike ventures I need not do more now than to refer readers to the back numbers of your paper for my earlier articles about the "Klondike & Columbian Goldfields," "The Dawson City Trading Co.," "The Rainy River & Ontario Co.," and "The New Golden Twins." The evidence given in court showed that the various companies had been worked as a nice little family party chiefly for the benefit apparently of Mr. Catton, and his time directors, and I shall be very much surprised indeed if the matter is allowed to rest where it is. In addition to running as War Office clerk, and promoter Mr. Catton acted as an advertising agent and received some wonderful fees for his "services" to the companies in question. The wonderful 20 per cent. dividends which I exposed long ago is now very much in evidence. Some of the directors say the solicitor sanctioned it—the latter denies this strenuously and counters by charging the board with being solely responsible. Then there are also the questions of Catton's presents of shares to the colonial directors. The whole thing is a pretty kettle of fish, and we all look for further and early sensational developments in "another court." Mr. Hess, of the London *Critic*, may yet be justified of his prediction!

THE MONTH'S MINING

HARRISON LAKE DISTRICT.

(From Our Own Correspondent.)

I AM pleased to be able to report an improvement in conditions, and numerous enquiries as to mining properties from people of means, looking for profitable investment, are being made. Probably one effect of the recent depression will be that capitalists will be able to negotiate for the purchase of properties, on much more favourable terms than formerly, as the owners now realize that this class of property is comparatively worthless, without the assistance of capital for its development. There is meanwhile very little doubt that the recent depression is in great part due to the distrust with which capital has viewed the mischievous tinkering with mineral laws, and the introduction of the ill-considered legislation in the past. I notice one point that shows up in a very comical light, as being the legislative work of such an anti-Chinese administration as the late government posed to be, and that is the repeal of the working miners' certificate. As a matter of fact all of our local white miners have, or expect to locate mineral claims of their own, consequently this legislation is no benefit to them, as they have to possess a free miners' certificate to enable them to do so, and formerly this certificate acted in the nature of a protection to them, to the extent of its value against foreign competition, in obtaining work in mines, but now the foreign element come in, work a few months, and depart with the money they have earned, without contributing to the revenue of the country. Most especially are the Chinamen pleased with this new legislation. Immediately on the close of the fishing season, when the rivers and streams fall so as to allow the gravel bars to be worked, these Orientals betake themselves in large numbers to placer mining principally by means of the rocker. They thus formerly contributed considerably to the provincial revenue by being compelled to take out free miners' certificates, but now on being approached by his old enemy, the collector, John Chinaman blandly responds "Me no got claim," and blesses the shade of his good friends, Cotton and Martin, who have enabled him to enjoy an extra $5 worth of opium in the year.

The Providence mine is again working and being rapidly developed under the able superintendence of Mr. DePencier, who is running two shifts. The work is proceeding under the immediate advice of Mr. Cirkle, M.E. I trust that in my next I will be able to record the iniation of operations by other companies in various parts of the district.

KAMLOOPS.

(From Our Own Correspondent.)

Exploratory work continues to be prosecuted steadily on Coal Hill. At the Lucky Strike ore is being taken out which would indicate that the faulted vein has been recovered. A tunnel has been started at the Python which will give a depth of 175 feet, sinking having been suspended on account of the large amount of water met in the shaft. Work has been re-commenced on the Hecla which was closed down in the spring, also on account of the large influx of water into the shaft. A pump has been installed and the vein will be cross-cut from the bottom of

the shaft. At the Truth mine some of the best bands in the ore body are being drifted on from the cross-cut at the 75-foot level. The cross-cut is in 80 feet from the shaft all in low-grade ore with some bands of high-grade ore. A drift on one of these bands, which is 12 feet wide, is now in twenty feet showing are all the way carrying six to eight per cent. of copper and $3 to $4 in gold and silver values. A very fine showing of copper ore is being opened up on the Laura group east of Jacko Lake. President and chief holders of the syndicate which recently purchased the Kimberley mine has visited the property and made arrangements for commencing work on a larger scale. Contracts are said to have been let for the erection of buildings, a quantity of steel rails, etc. The syndicate has several other properties in the camp under consideration with a view to purchasing. The Jamieson Creek dredging leases have been sold to an English-Canadian syndicate and active steps are being taken to place a dredge on the property as early as possible. A company has been registered with a capital of $100,000 in 1,000,000 shares of 10 cents each to take over the Tenderfoot mine from the syndicate which recently purchased and has been developing that property. The old syndicate takes 550,000 fully paid up shares in payment for the mine and the balance of the stock is offered to investors at par. Three men are employed at the present time sinking a winze in the tunnel and more active operations will be commenced as soon as there is sufficient money in the treasury.

SALE OF TENDERFOOT.

BOUNDARY CREEK.

(From Our Own Correspondent.)

In several respects the month of August has witnessed a decided improvement in connection with the mining and smelting industries of the district. Among the most encouraging and satisfactory experiences have been the cutting of ore bodies at the 300-foot level in the Mother Lode, Golden Crown and Winnipeg mines respectively, and at the 150-foot level of the R. Bell. Particulars of these developments are given below. Of more present importance though, from a general standpoint, is the starting of the Granby smelter at Grand Forks at which the furnace fires were lighted for the first time on the morning of Tuesday, August 21st. The event was of much significance to this district which sent over a number of visitors to the smelter on this auspicious occasion. Then the successful conclusion of negotiations for a site for the Standard Pyritic Smelting Company's projected pyritic smelter, together with the assurances given by Mr. A. Laidlaw, the company's managing director, that the smelting plant and machinery are now being manufactured at Denver, Colorado, and that within a month the work of grading the site and of erecting the necessary buildings so as to have these in readiness to receive the plant due to arrive here in October, will be in full swing, have assisted in confirming the slowly-growing impression that the district is now emerging from the period of commercial stagnation that for a time checked its advancement. Another reason for returning confidence is found in the fact that several mines have been regularly shipping ore to the smelters and by their persistence in doing so have given in a very practical manner a contradiction to rumors in circulation broadly suggesting that the ores of the district would not return a profit above cost of mining, freight and treatment. True the aggregate tonnage sent to the smelters is not yet large, but then this is still the day of small things in the Boundary in this direction. But a beginning has been fairly made, as the following approximate statement of shipments to date will show:

IMPORTANT DEVELOPMENTS

A GROWING PRODUCTION.

	Tons.
B. C.	8,000
Old Ironsides and Knob Hill	6,000
Golden Crown	2,000
City of Paris	2,000
Winnipeg	1,000
Sundry Others	750
	19,750

Possibly September shipments will aggregate 10,000 tons and thereafter there should be a gradual increase in the output of the mines of the district until by the end of the year total shipments should be approaching 20,000 tons per month.

So extensive is the area over which the mines and prospects of the district are spread that it is difficult to supply information every month concerning each individual property worthy of notice. So it will happen that from this or other causes one or more of the most prominent of the mines must occasionally have no more than passing notice. That such must sometimes be the case, even when an endeavour has been made to obtain information, is exemplified this month by the absence of particulars relating to the B. C. mine, the temporary absence on business of the superintendent of which having prevented the obtainment of these. However, the subjoined summary is as comprehensive as it has been found practicable to make it.

Deadwood Camp is on the whole making satisfactory progress, yet there is still plenty of room for improvement, particularly in regard to sending out ore. So far shipments from this camp have been restricted to thirteen carloads, in the following proportions: Mother Lode (British Columbia Copper Company, of New York), 8; Gold Bug (Boundary Creek Mining and Milling Company), 2; Sunset (Montreal Boundary Creek Mining Company), 2; and Buckhorn (Buckhorn Gold and Copper Company), 1. With the exception of that from the Gold Bug these several small shipments were made simply for test purposes. The Mother Lode is preparing to commence and maintain a regular output of ore on a scale commensurate with the requirements of the smelter its owners are building. As will be seen below, developments in this mine are more and more indicative of permanency. Other properties in this camp that are opening up in an encouraging manner are the Crown Silver, Morrison, Greyhound and Buckhorn. Prospecting work is being done on the Gold Bug, Great Hopes, Marguerite, Tam o'Shanter and several others.

The Mother Lode.—Mention was made last month of the difficulty that was being experienced at the Mother Lode mine consequent upon a shortness of coal. During August there has been an ample supply sent forward from the Crow's Nest Pass collieries, so that this difficulty has now been removed. Good progress has been made with the several improvements above ground to which reference was also made last month. The foundations for the 35-drill compressor shortly to arrive and for the two

100-horsepower boilers recently received at the mine have been completed. The tramway from the main shaft to the ore bins has also been finished and ore is now being transferred from the dump to the ore bins. The new building to include dining room and other accommodation for the workmen, is well on the way towards completion. Underground work is being pushed at the 300-foot level. The north drift is now in nearly 200 feet and is being extended as quickly as possible with the object of cutting the big ore body encountered at the 200-foot level and believed to continue down. It is expected that this will be reached in 50 to 80 feet from the present face of the drift. A cross-cut from this drift, started at about 100 feet from the shaft, ran through a shoot of ore twenty feet wide, the lateral extensions of which have not as yet been opened up. A second cross-cut fifty feet farther ahead is now in ore. This shoot is an entirely different ore to that to reach which the drift is now being extended. The south drift has been stopped at about 140 feet in from the shaft, a short distance from which a cross-cut is being run east and west and at 100 feet in another cross-cut is going southeast. Mineral is showing in the face of the latter so an early improvement here is looked for. At the 200-foot level the ore body previously proved by cross-cuts to extend at least 350 feet was not met with in a cross-cut another 100 feet away, so as to ascertain whether it had dipped under the level at this distance a winze was sunk in this cross-cut with the result that the bottom of it is now in ore. This appears to add another 100 feet to the proved length of this big shoot of ore known to be 80 to 90 feet in width. There are 67 men all told now at work at this mine. More will be put on as soon as they can be worked to advantage after receipt and installation of the more powerful compressor and hoising engine shortly to be added to the mine equipment.

Sunset and Crown Silver.—A test carload of Sunset ore sent to the Trail smelter last month returned values practically all in gold, that are stated to have left a good margin of profit above freight and treatment charges. The exact returns have not been made public, but it is understood that they were were about $18 or $19 gross. A second carload has since been sent forward, but it is not intended to make further shipments for the present. A double-compartment vertical shaft has been sunk 150 feet on the Crown Silver, which adjoins the Mother Lode. At 87 feet it ran into ore which continued to the bottom. A cross-cut at the 150-foot level is being run all in ore which appears to be improving in value at this depth. Values are chiefly in copper, but the grade is not yet so good as that of the ore obtained in the adjoining Sunset mine, where an entirely different kind of ore occurs. During August up to 28 men were employed on these properties, which form part of the group owned by the Montreal Boundary Creek Mining Company.

No particulars of work are at present available respecting work in progress on the Morrison or Greyhound. The Buckhorn is now making a better showing, for besides meeting with ore in the south cross-cut at the 200-foot level, an open cut has disclosed the occurrence near the surface of some of the nicest looking chalcopyrite ore yet found on this promising property. A carload has been sent to Trail but values have not yet been given out.

Greenwood Camp.—No other camp in the district has yet assumed such an appearance of mining activity as Greenwood Camp notwithstanding that the Brooklyn, Stemwinder and Gold Drop are still idle. The Old Ironsides, Victoria, Knob Hill, War Eagle and Snowshoe are all at work. Of these the Old Ironsides group is working on the largest scale, finding employment for about 110 men. Not much new development work is being done at present, but the ore bunkers are being kept full from the big ore reserves in the Victoria and Knob Hill. The total number of feet of work done underground in development of these mines now approaches 10,000. The large stopes now being worked in the Victoria are a revelation to those who see them, comparatively few realizing unusual size of the ore bodies occurring there. Similar conditions prevail in the Knob Hill, where large quantities of ore are also blocked out. The two 80-horsepower boilers for the Knob Hill compressor have arrived and are being built in at the mine. A 9x12 hoisting engine has also been received, but there has been some delay at Sherbrooke, Quebec, in shipping the 10-drill air compressor which should have come in with the boilers and hoist. A new shaft and engine house 28x80 is being erected at the No. 1 shaft of the Old Ironsides and a new 9x12 hoisting engine is being put in position here. The buildings over No. 2 shaft on the line between the Old Ironsides and Victoria are shortly to be added to. A 200-light electric light plant has been installed and now mine buildings and ore bins are well lighted, as too, are the main workings of the several mines. It is hoped that next month's letter will contain additional and more interesting information respecting this important group.

OLD IRONSIDES, VICTORIA AND KNOB HILL.

The new 70-horsepower boiler has been received at the Snowshoe mine and will a few days hence be ready for use, the bricklayers having about completed their work of building it in. Two 3¼ Little Giant drills and a 3x2x3 Snow boiler feed pump were also included in the new plant lately received at the mine. Development work has been restricted to completing the raise from the 100-foot level to the surface and in extending what is known as the railway unnel. This is now in about 300 feet, the greater part of this length being in ore. A cross-cut from this tunnel is now in about 50 feet in ore all the way. Development will be resumed at the 200-foot level from the main shaft so soon as the additional power now provided for shall be available. Mr. G. S. Waterlow, of London, chairman of the British Columbia (Rossland and Slocan) Syndicate, owning this mine, and Dr. Lewis Jones, of England, also largely interested in the syndicate, are now visiting the mine for the first time. They are accompanied by Mr. A. J. McMillan, managing director, and Mr. J. W. Astley, C.E., consulting engineer to the syndicate. The pay roll of the mine numbers about 28 men.

THE SNOWSHOE AND WAR EAGLE.

The War Eagle has now made connection between its 100-foot level and the surface by an upraise from the east cross-cut started about 200 feet from the main shaft. The shaft sunk to meet the raise has part of the way in some very nice chalcopyrite ore which will be followed down on its dip. This property looks promising for early satisfactory development. It is employing 15 men at present.

In Wellington Camp, too, developments are encouraging. Mention has already been made of those in the Golden Crown and Winnipeg. The J. & R. and Hard Cash claims, which adjoin, are coming into notice, ore similar to that occurring on the Winnipeg having been cut on the line between these claims. Nothing is being done on the Hartford just now. The Athelstan is at work but the manager is reticent about what is being done and with what result. At the 300-foot level of the Winnipeg a vein with four feet of the best looking ore yet found at that depth in this mine is being opened up and a carload has been sent to the smelter to test its value. The lead known as the railway ledge, from which shipments have been made during the past two or three months, has widened to about six feet of clean shipping ore at less than 50 feet from the surface. One 20-ton carload of Winnipeg ore recently returned $375 above freight and treatment charges, but this value was exceptional, average shipments running lower.

WINNIPEG AND GOLDEN CROWN.

In the Golden Crown a strong ledge from seven to eight feet in width nearly all ore of a shipping grade, has been cut at about 175 feet from the shaft in the south-crosscut which is being extended still farther. Shipments from the mine are being maintained. Fuller notice of this property, together with others not mentioned above, must be deferred until next month.

ROSSLAND.

(From Our Own Correspondent.)

Through the courtesy of Mr. Bernard McDonald, general manager of the Le Roi mine, and with the aid of his efficient assistant, Mr. John M. Long, I was recently permitted to investigate the interior of this great mine. Entering via the Black Bear tunnel and accompanied by Mr. Long, I went through the well-lighted and thoroughly ventilated passage which is stoutly timbered and having traversed this for a distance of about 400 feet arrived at a point where there is installed a 150 h.p electric hoist plant, manufactured in Denver Col. A few feet from this plant is the double compartment shaft. The level of the tunnel is anywhere from 250 to 300 feet from the collar of the new shaft, for there is a new double compartment shaft as well as an old one and both are within a few hundred feet of each other, but the new shaft is now doing most of the work. This electric plant is doing good service. The engineer in charge was a young man, evidently of the new school of electric engineers who has been trained to his occupation. Descending in one of the cages with Mr. Long we reached the 500-foot level and stood on the drift along the main Le Roi vein. This drift extends the entire length of the claim, 1,500 feet, and eight months ago it was supposed that all the ore on this level had been stoped out by the previous owners, but Mr. McDonald and his superintendent, with a keen eye for discovery and development, soon ascertained that in many places the stoping which was only 10 or 12 feet wide, had been cut out to only about one-third of the ore contents. This discovery was an important one, and part of the large ore reserve which was thus recovered has been stoped and sent to the smelter, but this reserve is still a commercial factor in the life of that level. When, however, it is remembered that the discovery not only applies to the level but goes up to the surface and down to the lower levels cut out, and to come with all the ramifications the importance of this discovery is not to be regarded lightly. The main drift and some of the cross-cuts on this level were followed their entire length and much was thus ascertained to convince us that the Le Roi is all that its name implies. At the extreme west end of the drift on Black Bear ground a dyke which is known as the Josie dyke, disputes the further progress, but seemingly at this point on this level, at least, the ore vein cuts the dyke though somewhat narrowed, instead of the dyke cutting off the ore.

A VISIT TO LE ROI.

Mr. Long has identified this intrusion, and he stated that on Josie ground it has been cut through and ore found on the west side and a repetition of this is expected on Le Roi ground. The dyke is composed of an altered granite and in some places it is estimated to be from 90 to 100 feet wide.

In company with Mr. Long I also descended to the 600 and 700-foot levels, both of which are more or less counterparts of the ore above. They extend the same distance as the drift on the 500-foot level and in most respects correspond with that ore. The ore reserve on these levels is a cumulative asset notwithstanding that the management is shipping from 4,000 to 5,000 tons weekly. I did not descend to the 800 or the 900-foot levels, as these are at present only in an incipient state of development, but enough was seen in the levels visited, and on the surface to convince the most skeptical mind that the Le Roi is a wonderful mine and its management experienced and capable men. Three of four of the stope expansions are regular chambers all in ore, and I was informed that it is the intention of the management to stope large quantities of the ore in bins below ground. This ore will be sent to the surface from time to time and shipped as facilities permit.

Much has certainly been done by Mr. McDonald and his assistant, Mr. Long, to place this mine in its present good condition and much remains to be done and will be done to improve the condition, for the general manager believes that there are positive, comparative and superlative degrees, and that the last is attainable. The old double compartment shaft was being worked. The mine, however, is now principally worked by means of the Black Bear tunnel and the new shaft. The ventilation here is excellent. There is, I am informed, an eastern outlet by way of the Centre Star and Iron Mask.

After returning to the surface feeling very much pleased at what I had seen below, a turn was taken through the company's saw mill, blacksmith, and carpenters' shops as well as the compressor buildings, where are located two of the largest compressors on the continent. The saw mill itself must save the company a large amount of money, for here the timber for the mine, etc., is dressed and prepared upon a large scale and with great rapidity, and economy.

The new bunkers which are now nearly finished and which are erected near the big compressor house on the line of the Great Northern will have a capacity of 1,000 tons. Shipments of ore for the Northport smelter will be made from these bunkers which can be filled by a tram running from the mouth of the Black Bear tunnel and another tram from the new

shaft house on the surface, and most of the surface workings will be discarded.

From 4,000 to 5,000 tons of ore have been and are being continuously shipped while these preparations and improvements have been in progress. The amount is exclusive of the 140 tons daily shipment from the old dump to the Trail smelter.

One has only to take the sound of the camp to note the marked progress that has been made on Red Mountain since my last report. The shipment of ore to date 105,790 tons is made up as follows: Le Roi, 85,270 tons; War Eagle, 10,600; Centre Star, 7,017; Iron Mask, 1,435; Le Roi No. 2 (Josie), 360; Evening Star, 351; I. X. L., 342; Monte Christo, 273; Iron Colt, 80; Grant, 42; Spitzee, 20. Le Roi shipments of ore from mine average 4,600 tons, and from dump to Trail smelter, 980 tons. War Eagle shaft has reached the 800-foot level. Drifting on the north vein at the seventh level continues. In the south vein the working is limited to find the new vein encountered in the other level.

Centre Star.—The management has estimated that shipments of ore will be commenced early next month. From 8,000 to 10,000 tons of ore have accumulated on the dump.

Josie.—The management has shipped three carloads of ore to the Northport smelter, and regular shipments will hereafter be made.

I. X. L.—Stoping is going on in the second level.

California.—The 200-foot level in the shaft has been reached, and the management is exploring in No. 2 tunnel.

Le Roi No. 3, Nickel, Etc.—The British America Corporation recently contracted with the Rand Drill Company for a Rand Corliss 40-drill up-to-date air compressor at a cost of $25,000. The machine is adaptable to electricity as well as steam. It is to be manufactured at Sherbrook, Quebec. All the necessary accessories to this machine are also to be furnished.

Messrs. E. B. Kirby, of the War Eagle, and Bernard McDonald, of the Le Roi, publish a joint letter stating that they fail to see any profitable reasons for increasing the wage worker from $2.50 a day to $3, as asked for by the miners' union. The public will in all probability not hear any more upon the subject for some time to come.

Kootenay Land and Exploration Co.—This company recently received from the Provincial Government the deed to the tract of land comprising its townsite, thus enabling the company to give a complete title to all lots. Recently the government dredges greatly improved the facilities for landing freight at Peterborough, and have made a grant of public money in aid of the Peterborough school. According to the statement of Mr. F. W. Hendsdale, of Rossland, the company's timber limits near and around Peterborough comprise about ten million feet of serviceable timber.

SLOCAN.

(From Our Own Correspondent.)

The recent increase in the mineral tax from one to two per cent. on mines producing over two carloads of ore a month is not appreciated by the mine owners of this section or of any other for that matter, as indeed was to be anticipated from its very nature. There are, however, good points to be noticed, the tendency being to favour the small property and those struggling in the initial stage of development at the expense of those better able to contribute to the treasury. Some definition will doubtless be required to determine exactly what a carload comprises, the term being somewhat elastic though usually applied to consignments of twenty tons of ore. In the case of narrow gauge railways, however, this is considerably more than a car will hold. Whatever arrangement is made on this point notwithstanding, the calculation being on a basis of minimum tonnage and not of value, advantage must rest with the higher grade districts, this being counteracted in some degree by the certainty that in poorer regions a mine capable of producing two cars a month will in all probability be able to ship a great many more than this number, whereas in the Slocan very many properties will be compelled to pay the tax on an output but little above that required to bring them within the operation of the Act. I remarked last month on the amount of enthusiasm displayed around Sandon, and I am equally pleased to be able to record now a further continuation of good times. Not only Sandon, but Whitewater and other places contiguous are sharing in the season of prosperity, the general opinion expressed being that never before did the mines look better or the outlook so encouraging as at present, despite the misfortunes of the earlier part of the year. Reports of extraordinary finds, by no means visionary, from the Payne and the Slocan Star—in the case of the latter the ore being better and of higher grade than any previously encountered—in conjunction with a great increase in output from the Whitewater and Idaho mines, coupled with the present and prospective operation of the Ivanhoe mine and concentrator, conspire to give an air of hopeful expectancy to the inhabitants of the mountain towns. The same stimulating influences are not unfortunately at work in the lake region, the depression arising from even a temporary cessation of activity at what is regarded as one of our main props so to speak, namely, the Wakefield mine, being hard to dispel. That operations will be resumed again before many weeks on a scale fully commensurate with the importance of the undertaking nobody appears to doubt, but in the meantime a feeling of dismay and unrest has been engendered which is difficult to allay. We are gratified to know that in the estimates of public expenditure for the ensuing year the claims of the Slocan have been pretty well recognized, and more particularly of interest to us at this juncture, to find that the pressing needs of Silver Mountain so often urged in this respect have not been entirely overlooked. Some three thousand dollars have been appropriated for the purpose of assisting in the building of a waggon road to the properties there situated and it is safe to assert that if all the roads which are constructed by the government gave equal promise of so speedily requiting the outlay, the public treasury would not lack for funds. Difficulties in connection with both the Marion and Hartney deals have been satisfactorily adjusted and everything now points to a continued operation and development of both properties.

GOOD TIMES AT SANDON.

The spasmodic occurrence of the ore bodies is one of the most interesting features of mining in the Slocan from a theoretical standpoint, being calculated at times to drive the best of mine managers insane; but when as frequently happens an unexpected discovery of high grade ore is made, the other extreme

is reached, only to be followed in time by a corresponding reaction when the ore as suddenly disappears. These are the discouragements incident to mining of the character here met with, the test of a really good mine manager being often found in the equanimity and unconcern with which he views the ups and downs of his professional career as reflected in the varying fortunes of the particular mine with which he happens to be connected. Apropos of this, surface operations at the Corinth, situated a little above the Idaho have disclosed a new vein carrying very fine ore and developments will be proceeded with as speedily as possible. Success to all enterprises in which the element of perseverance is so conspicuous! May it never go unrewarded.

YMIR.

(From Our Own Correspondent.)

Since last month Ymir has been very nearly destroyed by fire, and if it had not been for the herculean efforts of the residents this catastrophe would have certainly occurred. The fire commenced about half a mile south of the town and was caused by men setting fire to the bush for the purpose of clearing land. I regret to state that the flames destroyed both the Dundee mill and the tramway, but the buildings at the mine were fortunately saved. For a time it was feared that the conflagration which stretched over five miles of country would reach Wild Horse Creek and in that case the Ymir mill would have been in grave danger. The company had, however, made every preparation to fight the fire had it come. Fortunately two days' heavy rain set in and saved the situation.

I am pleased to state that much assessment work is being done in this camp this year, and that as a result some very promising looking indications are being shown up. There is a good demand for property in this camp and we are all confident that Ymir district will come to the front once more, as it is certainly entitled to rank as one of the best sections in the Kootenays.

Our principal property, the Ymir, is running 80 stamps and treating 200 tons of ore every twenty-four hours. The average values are $10, so that the returns from one mine every day is in the neighbourhood of some $2,000. This property is doing more to advertise the resources of our camp in London than any quantity of descriptive writing.

The Tamarac Company has an engineering force here surveying out a mill site and making all the needed preparations for the installation of a mill. The company has been re-organized and the stock assessed at 10 cents per share. The property is looked upon as one of merit, and when it is properly worked there is every reason to believe that it will be a big producer.

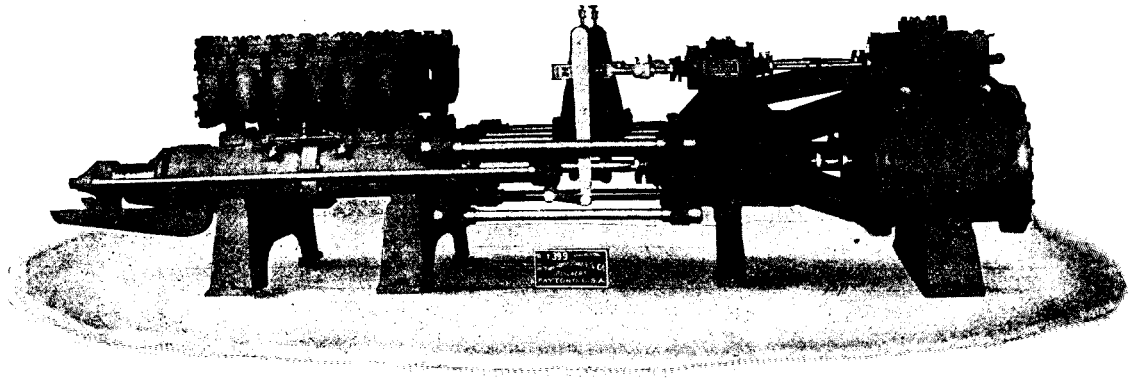
Mr. Stephen Bywater, president of the Wolcox Company, was here during the first part of the month for the purpose of consulting with the mine officials regarding the installing of a mill, and it is believed ere long a mill will be erected at the property.

The Arlington mine management are erecting large boarding and bunk houses and intend to keep a large force of men at work this winter. The Yellowstone mine is working steadily, and the results are very satisfactory.

FERNIE.

(From Our Own Correspondent.)

The Crow's Nest Coal Company have just closed a contract with the James Cooper Manufacturing Company, for a complete coal mining plant, consisting of an Ingersoll-Sergeant straight-line air compressor, steam cylinder 24" diameter by 30" stroke, air cylinder 26¼" diameter by 30" stroke, which is the largest machine of this type that is built in Canada. The contract also includes ten of the latest model Sergeant coal-cutters, with all accessories.



Compound Duplex Pressure Pump.

A NEW DESIGN FOR A COMPOUND PRESSURE PUMP.

THE illustration given herewith shows a compound duplex pressure pump designed to develop a maximum pressure of 700 pounds per square inch.

The liquid end is of the termination packed trombone style; the cylinders being made of special metal, mounted upon which are separate chambers for the location of the valves; chambers are also constructed of special metal and designed with a view of facilitating quick access for the inspection of the valves.

The valves are of the hydraulic pattern, made of steel, and guided from below. An extension piece is provided for supporting the water plunger, and an approved adjustment device provided therefor.

The water end is mounted on heavy supporting columns. An engine of the transported cylinder type is furnished, giving free access to all steam pistons without dismantling the pump.

The outside valve adjustment is a feature of this design. Further particulars regarding this style of pump can be obtained from the manufacturers, the Stilwell-Bierce & Smith-Vaile Co., 293 Lehman St., Dayton, Ohio, U.S.A.

THE CANADIAN EXHIBIT AT PARIS.

TO THE EDITOR:—It may interest your reads to learn the impressions of a British Columbian visitor to the Canadian exhibition at Paris. I visited the exhibition for the first time on the 17th of June and was very disagreeably surprised to notice a state of great disorder and chaos in the mining department. I found everything topsy turvy. Specimens were arranged regardless of order and system, and I actually saw a mixed pyramid of galena and copper ores, the whole being labelled "galena." I was rather astonished to find Mr. A. K. Stuart, the B. C. representative in the agricultural department working like a beaver (by superior order). On my second visit, however, on July 26th, a change decidedly for the better had taken place. I was given to understand that after much wire-pulling and kicking Mr. Stuart had been placed in the position he should have occupied from the first, *i.e.*, in the mineral section and in charge of the British Columbia exhibits for which purpose he was sent to Paris. Meanwhile the whole exhibit had been re-arranged by Mr. A. P. Low, of the Geological Survey, assisted by Mr. Stuart. Each specimen was labeled and classified and the whole presented a most creditable appearance. The great fault, however, to be found with our mineral exhibit is that it resembles too closely a collection of mineral specimens—a very excellent arrangement no doubt from the point of view of students of geology, but not attractive as an advertisement when compared with the exhibits from West Australia, Transvaal, Siberia, etc. The public cannot realize that each small sample represents a large mine. In an interview I had on the subject with Mr. Hume, Minister of Mines in 1899 I pointed out that the British Columbia government should purchase a carload of galena and sulphide ores which would make a most attractive feature of our exhibit of minerals from B. C. This of course in addition to collections of samples from principal mines. While our exhibit is creditable there is not enough of it for a display demonstrating the wealth of the country.

Canadian furs have taken the highest award and we have actually beaten Russia. Unfortunately the specimens are scattered all over the building. In forestry and lumber British Columbia and the other provinces have beaten the whole world and received the highest award, but poor judgment was shown in the failure to purchase adequate space. The exhibit is therefore piled against the wall occupying a space of about 25 feet by 25 feet. In front are two large show cases, containing the exhibit of an English cartridge factory. I am told that additional space was offered to the Canadian government, but not accepted. The Canadian building itself is very poor, while the exhibits are exceptionally good. Our representative, Mr. Stuart, is doing excellent work and has proved himself most highly qualified for the post.

In conclusion I will add that but for British Columbia's exhibits Canada would have come off badly in the mineral and forestry sections. The Paris exposition is much too large, the buildings are marvellous, but the undertaking itself is a financial failure.

MAURICE GINTZBURGER.

PRODUCING MINES.

SLOCAN.

THE total shipments for the six months ending July, 1900, aggregate 8,794½ tons. The following table shows the production for July:

	Tons.
Payne	1,090
Whitewater	505
Idaho Mines	499
Last Chance	231
Wakefield	220
Slocan Star	120
Queen Bess	108
Ruth	101
Enterprise	100
Rambler	85
Bosun	60
Vancouver	60
Hewett	40
American Boy	40
Soho	22
Vulture	21
Wilson	7
Hampton	3
Hillside	3
Total tons	3,315

ROSSLAND.

Our Rossland correspondent telegraphs: "The ore shipments for eight months ending August 31st amount to 114,000 tons, valued at $1,800,000. As compared with the corresponding period of 1899 an increase in production is shown of 6,000 tons, or 56,000 tons over the corresponding period of 1898.

BOUNDARY CREEK.

During the month of July two hundred and forty-two carloads of ore were sent out from this district for smelter treatment.

NELSON.

The returns from the Athabasca mine for July were:

Period of run, 27 days 23 hours.
(Shut down two and a-half days during celebration.
Tons or ore crushed, 400.

Value of bullion recovered	$13,530 00
Value of concentrates recovered	3,591 32
Total values recovered	$17,121 32
Values recovered per ton of ore crushed	$42 80

EAST KOOTENAY.

The St. Eugene mine shipped 2,396 tons of high-grade ore as a result of operations in July. The North Star mine at Fort Steele is producing at the rate of 100 tons daily and the Sullivan group 25 tons.

In the annexed table from the B. C. Review are compiled the returns to date of those companies whose crushings in ore shipments are available. Owing to the irregularity with which some of these returns are published the list is necessarily incomplete.

NAME.	March.	April.	May.	June.	July.
Alaska Mexican	$19,384	$24,481	$ 24,922	$23,000	—
Alaska Treadwell	$36,242	$63,533	$130,373	$79,265	$67,100
Alaska United	$50,869	$39,567	$ 51,329	$46,575	—
Athabasca	$10,674	$ 9,385	$ 18,500	$27,400	$17,100
Bosun (B.C.)	$ 4,896	—	$ 4 966	$ 5,592	—
Granite	$10,500	$ 7,100	$ 11,250	$ 7,600	$ 9,550
Hall Mines	—	—	—	—	—
Klondike Govt. Concs.	—	—	1,400 ozs.	1,838 oz.	—
Le Roi	—	$119.000	$219,000	$227,500	$248,000
Mikado	918 oz	894 oz.	875 oz.	944 ozs.	92,102 oz.
McDonald's	—	—	—	—	—
Queen Bess	$10,100	$ 6,600	$ 2,60	$ 5,900	$ 6,700
Whitewater	$ 9,500	$13,500	$ 4 750	$ 9,250	—
Ymir	‡$16,081	$25,000	$ 21,431	†$10,700	$25,000
Yukon Goldfields	$16,500	$27,375	$ 22,517	$20,572	—

* To date, £31,251. † Mill idle 21 days.
‡ These figures represent profit, not gross values.

COAL EXPORTATIONS.

THE exportations of the coal from the Vancouver Island collieries for the month of July were as follows:

	Tons.
New Vancouver Coal Co.	37,571
Ladysmith (Extension and Wellington)	18,982
Union	8,497
Total	65 050

For the three weeks ending August 20th the New Vancouver Coal Co. shipped:—

Date. Vessel and destination.	Tons.
1—SS. Titania, San Francisco	5,847
4—SS. R. Adamson, San Francisco	4,435
5—SS. Vigilant, Seattle	11
7—SS. Mineola, Port Los Angeles	3,424
10—SS. San Mateo, San Francisco	4,416
13—SS. Wanderer, Port Townsend	51
16—SS.Titania, San Francisco	5,842
16—SS. Ruth, Seattle	22
Total	24,048

THE METAL MARKET—AUGUST.

[Compiled from special telegraphic quotations to the B. C. MINING RECORD from the *Engineering & Mining Journal*, New York.]

SILVER.

NO new feature has developed in this market, which continues very steady, sales being so distributed as not tending to disturb prices. The latest quotations have ranged from 60⅞ to 61⅛. The average price last month was 61.25, which is the highest for over a year past.

COPPER.

Copper continues firm with an excellent demand both in New York and abroad for cable, electrical and ammunition purposes. Spot is very scarce and most of the large refineries have recently experienced some difficulty in meeting the urgent market requirements. Lake copper is quoted at 16½@16⅝; electrolytic in cakes, wire bars and ingots, at 16⅜@16½; in cathodes, at 16⅛@16¼; and casting copper nominal at 16⅜.

LEAD.

The market has been quiet but steady with no special features, prices remaining unchanged at 4.20 @4.25, New York; 4.15@4.20, St. Louis.

SPELTER.

Spelter has been dull and business limited, prices having again fallen to 4.15, New York; 4, St. Louis.

MACHINERY CATALOGUES.

WE shall be pleased to mail catalogues of any of the undermentioned firms to our readers free of charge, on application.

Ainsworth & Sons., Wm., fine balances; Armstrong & Morrison, riveted steel pipe ore cars, etc.; B. C. Assay & Chemical Supply Co., assayers' supplies; Braun & Co., T., assayers' supplies; Beatty & Sons, M., cables and tramways, dredges, pumps, etc.; Bennett & Co., Wm., fuse safety couplers, etc.; California Wire Works, cables and tramways; Canadian Rand Drill Co., drills and compressors; Canadian General Electric Co., electrical plants; Cooper Mfg. Co., The James, compressors, power and hand drills; Denver Fire Clay Co., assayers' furnaces, etc.; Fraser & Chalmers, mills, pumps, hoists, engines, etc.; Fairbanks, Morse & Co., steam and gas engines, compressors, etc.; Gates Iron Works, engines, boilers, crushers, etc.; Hamilton Mfg. Co., The Wm., crushers, mills, hoists, etc.; Hendy Iron Works, Johsua, modern mining machinery; Hinton & Co., Geo. C., electrical supplies and machinery; Hearn & Harrison, engineering, mining and surveying instruments; Hamilton Powder Co., explosives; Howells Mining Drill Co., drills, all kinds; Jeffrey Mfg. Co., elevating machinery; Jenckes Machine Co., hoisting and milling machinery, Krupp, Fried, Grusonwerk, mills, engines, pumps, etc.; Lexow, Theo., carbons; Link Belt Machinery Co., conveyors, elevators, etc.; McLennan, McFeeley & Co., belting, etc.; Mitchell, Lewis & Staver, compressors, drills, hoists, etc.; Perrin & Co., Wm., filter presses; Royal Electric Co., electric power, all kinds; Robertson & Co.,James,wrought iron pipe, paints, etc.; Sturtevant Mill Co., ore breakers and mills; Stilwell—Bierce & Smith-Vaile Co., water wheels; Taylor & Co., John, assayers' supplies; Trenton Iron Co., cables and tramways; Taylor Air Compressor Co., drills,

compressors, etc.; Union Gas Engine Co., gas engines, hoists, etc.; Whitstock, P. & R., mining engineering and surveying instruments; Wilfley Ore Concentrator Co., Ltd., concentrators.