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CIRCULATION.

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CONTENTS.

THE NAVY

Rarely is it our duty to touch upon controversial political subjects, and it is with some diffidence that we approach the topic of the Canadian navy. While it is by no means our intention to discuss the merits or demerits of the lately introduced Naval Bill, yet there is one passage in the Rt. Hon. Mr. Borden's pregnant speech that demands comment.

In expressing so positively his opinion that Canada could not prepare herself for the construction of a navy within a quarter or even half a century, we are profoundly convinced that the Premier erred. And we shall proceed to give our reasons for this conviction.

Within the past two decades Canada has built up a strong, modern, and well organized iron and steel industry. In Nova Scotia the Dominion Steel Corporation has an enormous plant. The Nova Scotia Steel and Coal Company possesses at Trenton, near New Glasgow, a steel forging plant that represents the last word in modern practice. Raw material there is in plenty. Labour is obtainable as needed. The splendid harbours of Sydney and Halifax are commodious enough for any purpose.

On the Pacific coast, whilst the necessary industries have not been established, there are abundant sources of fuel, flux, and ore. In short, Canada possesses every natural facility for establishing shipbuilding industries on any desired scale.

As for the length of time in which such industries could be established, it is our opinion that, with suitable direction, not more than five, or at most, ten years would be consumed in preliminary work. There is no hidden mystery in shipbuilding. English and Scotch engineers could be engaged to direct the work. The fact that for some years the cost of construction would be higher here than in Great Britain is of no importance whatsoever. The gain to Canada would be immeasurably greater than any added expenditure in building. Employment would be given to thousands of men, new communities would spring up, the Maritime Provinces would be incalculably benefitted, and the whole industrial life of the nation would be strengthened.

Canada does not and will not for a moment regret the contribution of $35,000,000 to the British navy. This is but one meagre step in the right direction. But it is wrong to postulate as a reason for this contribution our inability to build our own ships. We have the ability, though we have not now the equipment. Problems as large as this have been solved in Canada by Canadians. The building of the Canadian Pacific Railway was, in many senses, a more arduous task. The construction of the Grand Trunk Pacific was probably more costly. The

proposed harbour improvements on the ocean seaboards and on our inland waterways will be still more costly. To stop short at this conjuncture, to refrain from completing the industrial cycle, is not the path of wisdom.

Another vital consideration is the fact that Canada possesses the only important coal deposits on tidewater in the whole hemisphere. These are situated, respectively, in Nova Scotia and in British Columbia. At present we have absolutely no means of protecting these in case of war. They would be absolutely at the mercy of a hostile fleet. In itself this is a serious enough fact to demand instant attention.

We hope, therefore, that the policy of the Dominion Government will be so modified as to encourage specifically the establishment of Canadian shipbuilding. Canada is ready and willing to help the Mother Country in any and all emergencies. Canada owes it to herself to make ready for the building of her own mercantile and war marine. This is doubly true if the Premier's opinion is correct. Fortunately, we believe that he has been quite misled.

SYSTEM OF MINE TAXATION

At the October meeting of the New York Section of the Mining and Metallurgical Society of America, the subject selected for debate was that of Systems of Mine Taxation. The discussion was opened by Mr. J. R. Finlay, who referred to four methods of taxing mining property of which he had knowledge, namely: (1) The plan in force in Michigan and Minnesota, of taxing on an ad valorem basis; (2) that followed in Colorado, Montana, Idaho, and Nevada, of taxing each year's net income over expenditures; (3) the United States government plan of taxing the net "profits" of corporations; and (4) that largely applied throughout the British Empire of placing a fixed royalty on output. Commenting on these several systems, Mr. Finlay remarked that while the difficulties in the application of the ad valorem method were considerable, they were not insuperable. What is needed in this case is a central authority ready and able to apply some well defined rules. In a mining community, taxes should be levied on a minimum valuation of land holdings and on all buildings and tangible assets, whether profitable or not, in some proportion to their cost. These taxes should be fundamental and could be made to cover local expenses. The mines themselves can be valued intelligently only after they have reached the profit earning stage. They can then be valued with fair accuracy, but should be re-assessed each year. This is not so considerable a task as would at first appear, for the number of profitable mines in each district which can be appraised for the value of their mining business *per se* is never very great. The work could be systemized by means of periodic reports, and by the inspection of maps and new developments. The other systems of taxation are at first glance somewhat more attractive on account of their greater apparent fairness. The weakness is, however, that taxes must be levied on property before it has become remunerative, taxes on profits alone can never be sufficient and can only supplement local ad valorem taxes of some description. On the theory that the business of a mining company, in contradistinction to its mere possessions, has value only if it is profitable, the system of taxing yearly revenue can be made absolutely fair; and the advantage of taxing net income is that it involves no necessity for making a valuation of the business. The recommendation in favour of royalty or "tonnage tax" is chiefly in the fact that it is broader in its scope than an income tax and that it is a harder tax to dodge.

Mr. H. C. Hoover remarked that taxation of mines in the British Empire rests upon an entirely different basis than that in the United States, and, moreover, it varies greatly in different portions of the Empire. In America the mining laws were formulated at the apogee of the economic theory of *laissez faire;* as a result, the minerals were freely alienated to the individual, and thus, under the economic sentiment of that period, the state or community reserved scarcely any right in the minerals. Hence, the object of taxation is purely for the necessary state revenue. In the British Empire the mining laws are to some extent either a survival of the period when the state or crown claimed an interest in all minerals, or have been formulated during these latter days when that claim has been revived. Moreover, the general basis of taxation throughout most of the British Empire is upon income and not upon capital. The tendency, therefore, is to employ taxation on minerals as a means to allow participation by the community in the minerals won, as well as to procure revenue. In some states, such as West Australia and the Transvaal, for example, taxation takes the form of rents on mineral land, fees for various state services, and so on, which at least partially support the local government; but, in addition, there is a heavy tax on profits, varying from 5 to 10 per cent. In some Indian states a gross royalty is demanded on minerals won, the origin of this system being mainly the conception that mineral ownership rests in the local prince, or the state, and that the working of mines pays tribute to the owner. Mr. Hoover's own view of a basis of taxation is that the right of the community to an interest in its minerals should be recognized. In the United States (and this also applies to Canada) in view of the alienation of the minerals, this right can be secured to the state only through some form of taxation; further, the miner should contribute his share to the cost of local government like all other members of the community. Respecting the form of taxation, he was of the opinion that any system based upon the capital value of mines is open to the strongest objection, because it throws upon the local, perhaps, unskilled official the highly technical work of mine valuation. A gross royalty on minerals won, although easiest of

assessment, is open also to objection, because it would bear with great inequality upon different mines. For example, a royalty of 20 cents per ton on a gold ore averaging $4 per ton might mean 30 per cent. of the profit won, while the same royalty on ore worth $50 might mean less than 1 per cent., and it is also probable that more capital pro rata would be employed in the first case than in the second. Furthermore, a gross royalty would in many cases be a tax on unprofitable mining and would handicap the industry. A tax on profit, with due allowance for depreciation, is, he considered, the fairest basis, and assessment becomes a matter of accountancy, which is within the skill of local officials. A small additional tax on improvements, for purposes of purely local government, would also be a necessity.

MINING ACCIDENTS IN ONTARIO

Bulletin No. 12, Mining Accidents in Ontario for July, August and September, 1912, has just been issued by the Ontario Bureau of Mines. Mr. E. T. Corkill, Chief Inspector of Mines, reports for the first nine months of the current year, fifteen fatalities below ground, and eleven above. These are distributed between mines, metallurgical works and quarries. It is gratifying to record that the present figures are much lower than those for the corresponding part of last year, when there were twenty-two underground fatalities and twelve above ground.

During the three months more particularly covered by the report, there occurred seven fatalities in mines, two at metallurgical works, and one in a quarry.

No less than 110 non-fatal accidents are reported for the third quarter of the year. This is much in excess of the third quarter of 1911, largely for the reason that a change in the Mining Act now requires that all accidents that incapacitate a man for seven days or more must be reported.

None of the fatalities in mines was due to the careless handling of explosives. One was due to electric shock.

In the main, the situation as regards accidents is improving. The policy of prompt official publicity is warmly to be commended.

A CORRECTION

A fortnight ago there appeared in the *Canadian Mining Journal* the statement that at the Jupiter mine, Porcupine, only one drill was working. The paragraph read as follows: "The Jupiter is now working with one drill, deeming it best to feel its way very carefully around the intricate fault, etc., etc." We have been advised authoritatively that this statement is incorrect. Drifting has been carried on to a point several hundred feet beyond the slight fault that was encountered some time ago. No intricate fault exists so far as is known, and the management has every reason to be satisfied with the results of work to date.

CHILIAN MILLS

In a very instinctive discussion of the Chilian mill, published in the latest bulletin of the Mexican Institute of Mining and Metallurgy, Mr. G. A. Denny and others express their opinions as to its efficiency. According to figures quoted by Mr. Denny, one slow-speed Chilian, with a daily output of 16 tons, showed 50 per cent. mechanical efficiency; whilst a mill running 14 per cent. faster develops an efficiency of 66 per cent., and outputs 26 tons daily. The discharge of the former was, however, in a finer state of comminution than that of the latter. Incidentally, the fact is brought out that the Chilian does far better work on a coarse feed than on fine. And, further, there is no advantage in slow speed, the high speed mill being demonstratably more economical and efficient.

Chilian mills, as compared with combined stamps and tube mills, have much to recommend them,—according to Mr. Denny. In initial cost, in output of fine material, in running expenses, and in cost of maintenance, the Chilian has everything in its favour.

Replying to Mr. Denny's criticisms, Mr. J. B. Empson, whose original paper is the basis of the discussion, concurs in the view that the stamp is not a grinder, but a fine breaker. He takes exception to the statement that, for Mexican ores in any case, the slow speed Chilian is less efficient than the high speed. The latter, he claims, is constantly getting out of repair. In fact, he looks upon the whole problem as not yet susceptible of solution.

EDITORIAL NOTES

At the Knights Deep mine, South Africa, all the newly installed crushers will be of the jaw type. Hammer drills are being used exclusively in the stopes.

Statistics published by the United States Bureau of Mines show that during the first eight months of 1912, 1,453 men were killed in and about coal mines in the States. In March the largest number of fatalaties per month occurred, there being 351 lives lost. April had the lowest figure, 73. Unless disasters of unusual magnitude occur between now and the end of the year, these figures signify that the death rate will be substantially lower this year than ever before. Last year the number of deaths was 2,719.

Of the total coal consumed in Alaska in 1911, which amounted to 122,000 short tons, 88,573 tons came from British Columbia, less than 1,000 tons being produced in Alaska. The remainder was shipped from the State of Washington.

It has been the boast of the American Institute of Mining Engineers that it was an international society, representing not only the mining profession of the United States, but also that of Canada and of Mexico. In view of this claim some surprise is expressed that contrary to

custom in the past no provision has been made of late for a Canadian representative on the Council of this society.

The Alberta authorities propose adopting the broad-minded and sensible course of permitting men who hold either British or Canadian (Nova Scotia and British Columbia) certificates of competency to become mine managers or hold other positions of responsibility in the mines of the province, without passing the local examinations. This departure is to be entirely commended.

CORRESPONDENCE

THE MONOPOLY OF COAL

The Editor of The Canadian Mining Journal:

Sir,—My attention has been cald to your editorial comment of Nov. 15 on an address of mine which obviously you can not have red. You quote correctly enough a few words utterd by me, but, as you miss their intention, I will therefore leave unacknowledged the interesting series of left-handed compliments you pay me. Let me only say that to the average Nova Scotian it is amusing rather than offensiv to be dubd by a Toronto journalist "an uninformd and casual observer" of the affairs of his own province. Not that Toronto journalists make a practis of writing thus. On the contrary, but rarely.

The remarks to which you object is this: "We have pawnd our coal-mines to monopolists who take hevy toll."

Well, have we not? I ask. Indeed, you make no attempt to dispute either the pawn or the toll. Relativ to the latter, you are doutless aware that the Nova Scotian consumer has long been paying for coal at the mine a far higher price than that for which the same commodity is deliverd to the railway companies at St. Lawrence ports. You have fresh in mind, too, the fact of a recent advance of about sixty cents a ton to the Nova Scotian middleman, the only explanation tenderd the public being that there is a shortage in the United States, and, therefore, no danger, temporarily, at least, of American competition. These little incidents you would have us treat as merry jests, I suppose, harbingers of a merry Christmas—to the Toronto and Montreal coal-barons.

Next, as to the naked circumstances of our having deliverd our public proprietorship of the mines into the hands of working companies, no one has any fault to find with this. Our coal mines doutless are, as you are, competently workt. No other plan for their effectiv working could be suggested quite so convenient as the one we adopted many years ago.

But that is not the point of my observation. The whole tenor of my reflections was that at the different times when we were cald upon to effect leases of our mines our government was so starvd for revenue and our general economic condition so deprest that we were compeld for the sake of the stipulated royalties to make an arrangement with the prospetiv operations which faild to safegard our own people against just such extortion as I mention in a preceding paragraf. Any complaint I had to make was not of the method of operation of our mines or of the conduct of our local legislature, but of the policy of the federal government which goes on to this day taxing these provinces to such a limit as forbids us obtaining more than a pittance of revenue for our educational and other provincial servises—a policy that had all to do with forcing upon us a very defectiv contract with the coal companies.

I am, sir, respectfully yours,

DAVID SOLOAN,
Truro, N.S.

COMPANY NOTES

HUDSON BAY DIVIDEND.

The Hudson Bay dividend of 300 per cent. was the eighth for the current year, bringing its payments for 1912 up to 2,400 per cent., and for the life of the mine to 22,000 per cent. It is a remarkable fact that all the dividends for the current year since the declaration of March 19th have been paid from the production of the dumps at the No. 1 camp. The work underground has been limited to a vigorous policy of development, and little stoping has been attempted. The Hudson Bay still has a large reserve of milling rock on its dumps.

THE COBALT LAKE CIRCULAR.

December 9th, 1912.

Dear Sir or Madam,—

I have been approached by a responsible English syndicate with a proposition that the shareholders of the Cobalt Lake Mining Company, Limited, should enter into an optional agreement for the sale of their shares.

The syndicate's offer, which is made to all the shareholders of the company alike, is to pay for 20 per cent. of each share holding in cash, the remaining proportion of the shares to be optioned at different prices as set out in an agreement, a copy of which is lodged with the British and Colonial Land and Securities Company, Traders Bank Building, Toronto, as trustees, where it can be seen by any registered shareholder.

I cannot give the option prices, because it is not usual or fair to do so in the case of an optional agreement, but full particulars will be given privately to any shareholders, verbally or by letter, on application, or at the meeting of shareholders to be held on the 20th December instant, of which notice has already been given.

I have carefully considered the present position of the property, and the conditions existing in the Cobalt stock market in Canada; I have estimated the physical condition of various Cobalt properties, as shown by their reports, and the stock quotations for the same, and have arrived at the conclusion that the prices and the terms and conditions contained in the syndicate's proposal are fair and reasonable and advantageous to the shareholders of this company.

I have accordingly agreed to enter into the agreement as far as I am concerned, and have deposited one million shares held by me with the Trust Company, and I have no hesitation in advising all the shareholders of the company to join in the agreement.

It must be understood that the Cobalt Lake Mining Company is not going out of business; the effect of the agreement is only to give the control of the company to the English syndicate, and an English company which will be incorporated by them; any shareholder who is not satisfied with the terms may retain his shares in the original company.

A meeting of the shareholders of the company, as above mentioned, is to be held on the 20th December instant, pursuant to notice already given, and all matters requiring explanation can be brought up and dealt with then; shareholders wishing to avail themselves of the syndicate's offer must send in their shares before January 10th, 1913.

Yours truly,

HENRY M. PELLATT,
President.

LITERATURE AND MINING

By J. C. Murray ,B.A., B.Sc.*

(*Concluded*)

Samuel Pepys was an official in the Navy Department in the reigns of Charles II. and James II. He was, also, an amazingly candid diarist. His diary, obviously never intended for publication, was written in a shorthand of Pepy's own devising. It covered the period 1660-1669. By accident it was not destroyed and it was included in the gift of books that Pepys bequeathed to Magdalene College, Oxford. Not until early last century was the shorthand deciphered.

Frequent illuminating allusions to mining matters occur in the diary. Nova Scotia figures in several of these. In an entry for May 13th, 1667, we find this: "This morning comes Sir H. Cholmly to me for a tally or two; and tells me that he hears that we are by agreement to give the King of France Nova Scotia, which he do not like; but I do not know the importance of it." A few months later, however, Pepys received more light, for he complains of the matter again, and characterizes as shameful the giving away of Nova Scotia, "which hath a river 300 miles up the country, with copper mines more than Swedeland, and Newcastle coales, the only place in America that hath coales that we know of." A river 300 miles long would, if crowded into Nova Scotia, assume roughly the shape of a closely coiled serpent. Also rumours of coal have come from other parts of the continent; but Mr. Pepys was not a stickler for trifles.

During the year of the great fire of London, 1666, Pepys notes the extraordinarily high price of coal in the city. The price per chaldron (25½ hundredweight) was £3 3s., and it must be remembered that the purchasing power of money was thrice as great then as it is now. But early in 1667 worse befell. Pepys, in the act of purchasing some newsbooks at Westminster Hall "did hear everybody complain of the dearness of coals, being at £4 per chaldron, the weather, too, being most bitter cold, the King saying to-day, that it was the coldest day he ever knew in England." The next day, sad to relate, was still colder. "This day," groans the excellent Samuel, "was reckoned by all people the coldest day that ever was remembered in England; and God knows! coal's at a very great price!" Harried as the coastwise colliers were by the Dutch fleet, it is not surprising to read that coal went up to £5 10s. in the following June.

A few sentences from his description of the methods used at the Royal Mint, and we shall have done with Mr. Pepys.

On the morning of May 19th, 1663, Pepys, to use his own good phrase, was "up pretty betimes." With a few friends he was shown over the Mint by the controller, and he takes pains to set down his impressions. He tells, among other things, how he "saw the manner of assaying of gold and silver, and how silver melted down with gold do part, just being put into aqua-fortis, the silver turning into water, and the gold lying whole in the very form it was put in . . . . which is a miracle; and to see no silver at all, but turned into water, which they can bring again into itself out of the water." Discussing all these things afterwards at dinner, the controller told his guests of one dishonest laborer who clipped coins and swallowed the clippings "down into his belly, and so they could not find him out." The thief was later induced to confess. His thievings amounted to £7. Another artisan made dies that produced facsimiles of old, worn corns, and thus gained 50 per cent. on his investment.

It is not inappropriated here to glance forf a moment at Lord Macaulay's vivid description of the condition of the mineral industry of England just about the period to which we have been referring. Tin was one of the most valuable products of the mine, the output from Cornwall being about 1,600 tons annually. Copper, however, was altogether neglected. Rock salt was not worked. "The salt which was obtained by a rude process from brine pits was held in no high estimation. The pans in which the manufacture was carried on exhaled a sulphurous stench." In fact, the residue was hardly fit for human consumption, and, as it was supposed to induce scorbutic maladies, it was used only by those who could not afford to buy the more expensive French product.

Since the manufacture of iron implied the wholesale destruction of forests wherefrom to obtain the necessary charcoal, the industry was no tencouraged. In fact, nearly all the iron used was imported, not more than ten thousand tons being made in Great Britain annually, a quantity equal to the output of one large modern furnace in less than a month. The art of using coal or coke had not, of course, been thought of.

Coal, the most important of all minerals, was very little used in manufacture. Few mines were worked that were not easily accessible by water, and London, so Lord Macaulay believes, consumed at least half of all the coal mined. As the capital is credited with requiring about 350,000 tons annually in the reign of Charles II. (and this quantity was thought to be fabulously large) one can compute the total without a ready reckoner.

It would be pleasant, of course, to continue multiplying such citations and quotations. Standard English literature, both prose and poetry, abounds in facts, fancies, and metaphors drawn from mining and metallurgy. Our vocabulary has drawn many cogent phrases and words from the mine. The whole course of history has been colored by man's desire for the products of the mine. The arts and the industries are based upon the miner's labor. Our remotest ancestors, shortly after they outgrew their tails, took to smiting each other with roughly smelted weapons of iron and copper. At the same time—I have to ask you to take my word for this—the female of the species recognized the decorative value of polished metals. And I doubt if this made for peace.

It is, I take it, quite superfluous to quote from Holy Writ. You all know of that first artificer, Tubalcain, of the metallic embelishments of the Temple; of that oft-misquoted and magnificent chapter in the Book of Job; and last, of the specifically mineralogical terms in which both places of future abode are described in the last book of the accepted canon.

All this, I doubt not, would be a work of supererogation. It will suffice for me to assure you that there are equally available and more modern works that can be used with profit. The essays of T. Sterry Hunt, the volumes of Sir William Dawson, many of the pamph-

*Editor of "*The Canadian Mining Journal*," in an address to the Engineering Society, the first part of which appeared in "Canadian Mining Journal" for Nov. 1st

lets of Dr. Henry Youle Hind, not to mention other noted Canadian scientists are pre-eminently worth while to the mining man. Moreover, when he wishes other stimulation, he can turn with profits to the pages of Parkman, who is to my mind the best of historians; or to Prescott, who deals with more southerly latitudes. In both, particularly in the latter, he will find that the romance of mining plays a considerable part.

The broad truth that I wish to impress upon you is that general reading is vitally necessary through all stages of our mental development. I fear that I have succeeded in submerging this truth in a flood of extraneous matter. Nevertheless it is a truth that cannot be ignored. The mining man who reads wisely and well is a better citizen than the mere technologist. He is also the better technologist.

THE SILVER HOARD CAVE

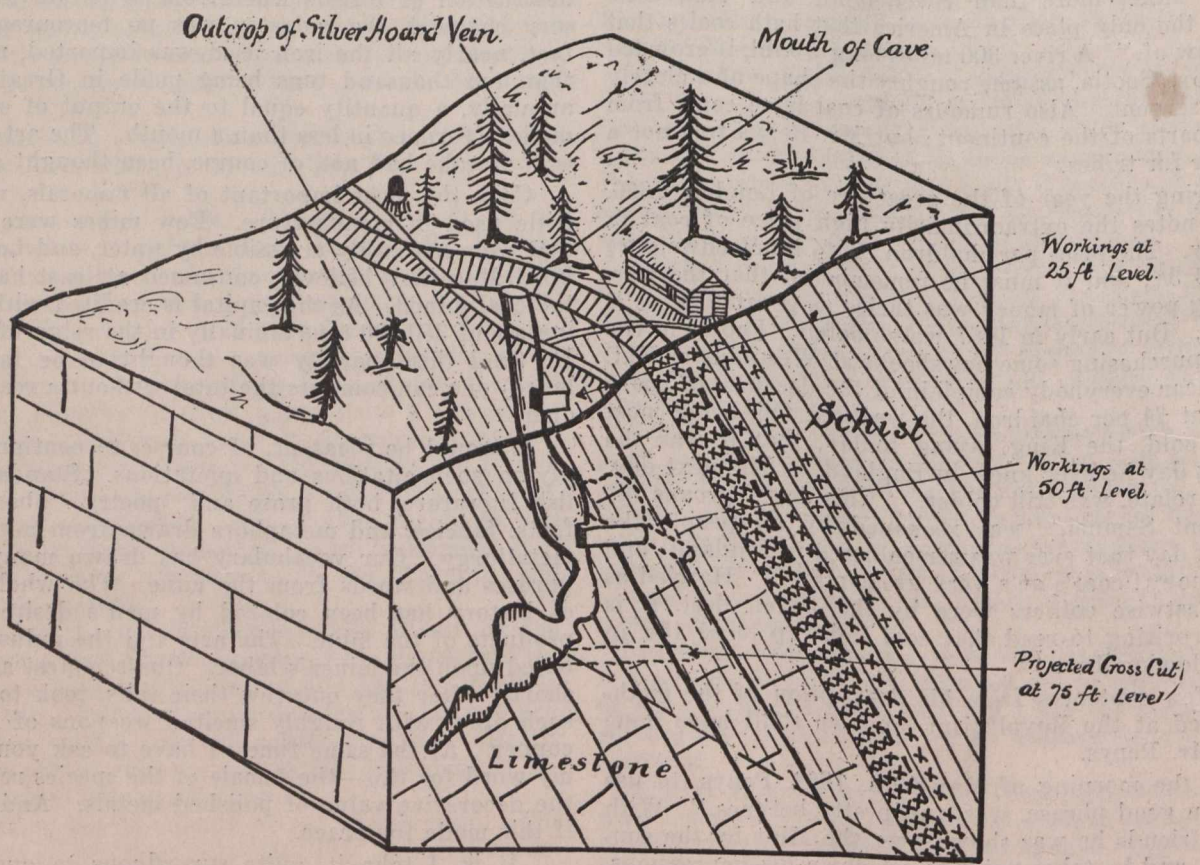
By Francis A Thomson, head of Department of Mining Engineering, State College of Washington, U.S.A.

The Silver Hoard Mines Company, operating a group of claims, situated about three miles from the old camp at Ainsworth, on the western shore of Kootenay lake, B.C., has recently uncovered a subterranean passage, which, in the relation it bears to the orebody adjacent to it, is probably unique in the annals of mining.

The relative positions of the cave and the vein are shown in Fig. 1, from which it will be seen that, for a considerable distance, the cave is practically a prospect-shaft in the footwall.

The vein is apparently a contact-fissure following the bedding plane between a belt of crystalline limestone and one of graphitic schist. At various points the orebody replaces the limestone footwall, and at others forms outliers along shear zones in the schist hanging-wall. The cave is confined entirely to the limestone and its mouth is practically in the outcrop of the vein.

The discovery of the cave makes a rather interesting story. Two of the principal owners of the property, Dr. E. R. Northrup and Mr. W. S. Hawley, both of Spokane, Washington, had come to look over the ground, and were examining a recent strike at the south end of the Dellie claim from which about ten tons of "carbonate" ore assaying several hundred ounces of silver per ton, had recently been taken. One of the miners—a Dutchman with an unpronounceable name—was hammering away at the face with a pick, anxious to make an impression by his diligence; suddenly the



Stereogram of Silver Hoard Cave
Ainsworth. B.C.

face fell inwards, the pick disappeared and the Dutchman barely regained his balance in time to avoid following it. As soon as he could get his breath he let a howl out of him and started for the bunk-house. On his way there he met the superintendent, Mr. E. E. Ward, to whom he announced: "By kolly, Mister Vahrd, we're up ajinst it." (At the Silver Hoard, "up ajint it" has since become a household joke). A rope was speedily secured and an exploration made, with the result that it was only a short time until the new "shaft" was equipped with skids and a whip, and a crosscut at the 50-foot level was being driven to catch the vein, which was intersected 15 ft. S. from the cave.

During a recent examination of the property by the writer, the cave was surveyed, using a Verschoyle pocket transit, and from the survey notes taken at that time the stereogram Fig. I was prepared.

The cave itself is evidently the result of solution of the limestone caused by surface waters seeping down fissures and joint planes. It is, of course, irregular in outline, following roughly the line of the joint planes. In some places it contracts to a narrow passage through which an average man can only pass with difficulty, and in others opens out to lofty chambers which, with their stalactite-covered ceilings are extremely impressive.

The stalactites themselves are interesting and unique, the usual tapering forms are, of course, abundant, but the occurrence of cylindrical tubes of calcite often 18 to 24 in. long with an external diameter of 3/16 in. and an internal diameter of 3/32 to 1/8 in. were entirely new to me. The miners call them "camaronis," which is rather apt, except that I have never seen macaroni as straight as these calcite tubes. Occasionally these tubes have sprouts or branches on them, due apparently to a stoppage of the tube and the leaking out of lime-laden water through the interstices between the radial crystals forming the tube-wall. A few of these sprouts were seen which had developed ridiculous-looking bulbous excrescences out of all proportion to the size of the parent stem.

It is evident that there have been several alternating periods of solution and deposition, possibly corresponding to some extent with seasonal fluctations of water-flow. Thus, in some parts the cave is almost impassable from the amount of stalactitic material; in other places the walls of the opening are evidently not those of the original cave, but are made up of the remnants of the stumps and other portions of partly dissolved stalactites, showing the re-opening by further solution of a passage blocked by stalactites.

Branches, both horizontal and vertical, are common and from the air currents it is evident that many of these reach the surface. There is at all times a considerable stream of water running on the floor of the cave and this can be heard continuing on its course beyond the present accessible limits of the chamber.

Skeletons of small rodents, driftwood, and other surface debris are frequently found among the boulders along the floor. At one point there is a deposit of soft oxidized material similar to the carbonates at the surface. An assay shows that this material contains about 30 ozs. silver to the ton. It may possibly, like the sticks and the rat's bones, have been washed in from the surface, but it looks in places more like a feeder from the main vein and a microscopic examination of the sample taken tends rather to confirm this view.

As an assistance in exploring the vein at this point, the cave is available as far as known at present to a depth of 75 ft. on the slope, or considerably more than this on the vertical, since it pitches into the hill, which is here quite steep. Below the 75-ft. point it swings to the eastward in a roughly helical form and departs from the vein too rapidly to make its use desirable. I believe, however, that it will continue to drain any workings which may be driven on a continuation of the present shaft (which is being enlarged to a two-compartment opening) to at least 100 ft. depth.

It is probable that below the limits of present accessibility the cave has other large chambers, and it may continue its present helical course until it again approaches close to the footwall; if such is the case it would, of course, make it of value for drainage purposes to still greater depth.

Although only in operation about one month the "cave-shaft" has already served for the extraction of between $5,000 and $10,000 worth of ore.

ELECTRIC SMELTING OF TIN IN ENGLAND

(From a London Correspondent.)

London, November 22, 1912.

The electric furnace generally is only making slow progress in the United Kingdom, although there are signs that that progress will be expedited in the near future. Perhaps the big obstacle to its development has been the comparative expensiveness of power in this country and this is a matter which the future may improve. As a matter of fact there are now many generating houses that can offer power, with a high consistent load factor, at a rate as low as 0.6c. per kw. hour. Within the last year or two some interesting developments in the way of electric smelting have made their appearance in Cornwall, and one trial smelting plant has been erected in that tin mining county of England for the reduction of tin ores on a scale not usual for this class of work in this country. At the first it might be supposed that the electric smelting of tin would have little or no chance as compared with the old established Cornish tin smelting; but the results of the trials suggest that this is not so. Metallic tin, and, consequently, also its ores, have such a high commercial value that every wastage is a serious loss. Now the losses in the ordinary coal-fired reverberatory furnace are considerable, and this is the case to an even greater extent in the shaft or blast furnace sometimes used in other countries. In a treatise by a German authority, Dr. Menicke, it is stated that the losses of metal in the slags and by volatization very often amount to as much as 8 or 9 per cent. The slags require, as a rule,a second treatment, but in spite of this losses amounting to 7 or 8 per cent. are not uncommon. The condensation of the flue dust is also complicated and costly and forms a constant source of trouble to the tin smelter. Another drawback to the use of the reverberatory furnace which is the one generally adopted in this country is the necessity for intermittent operation; loss in efficiency of the plant is thereby caused since the furnaces of necessity must stand idle

between the charges. Also the formation of "hard-head" or impure alloys of tin, through imperfect refining, is considerable.

Most of these disadvantages, it is claimed, can be overcome by electric smelting methods. The plant erected in Cornwall consisted of a specially designed electric furnace capable of dealing with about two tons (one ton equals 2,240 pounds) of ore a day, a suitable transformer, and appliances for the final purification of the tin. The power supply was three-phase current, produced by oil engines for mining purposes, and although the costs of the power thus obtained were by no means so low as they would be for production by means of coal in other districts, they were not prohibitive. The furnace was designed for about 200 kw. or about 260 h.p., but only 90 to 110 kw. were available, else the daily output would have been considerably increased. The working of the furnace was absolutely steady, so that electric light could be operated off the same line without showing any flickering. As no combustion takes place in the electric furnace, only the theoretical amount of coal necessary for the reduction had to be added, or about 14 per cent., instead of the 22 or 25 per cent. (with Bolivian ore even more) required by the reverberatory process. The furnace being practically closed, losses from volatization were practically eliminated. In fact, tests made over a week with a temporarily arranged condensing tube proved that less than 1 per cent. escaped in this way.

The tin contained in the slags could be made to vary at will; in some cases slags from the "first melt" were produced, containing only 0.25 per cent. of metallic tin. But it was found that the output of the furnace was somewhat reduced when such slags were produced. It appeared better to work two furnaces in series, the first or primary furnace being charged with ore direct and operated so as to give a large output, thereby producing a slag containing up to 15 or 18 per cent. of tin, which was subsequently treated when still hot in a second furnace, where the tin contained in the slag was reduced to only 1¼ or 2 per cent. This procedure has also the advantage that, the total amount of slag being comparatively small, the second furnace could be made of smaller capacity and worked with a reduced output. If necessary, the slags can be worked together with lead ore or galena in this furnace for the production of tin solder, and in this case it is quite possible to extract practically all the tin present. As fumes are almost absent the process can be carried out in places where, for sanitary reasons, such operations are now forbidden. Another item of great importance is that very few repairs to the furnace are required. The brickwork in the trial furnace mentioned was intact at the end of the trial, after running day and night for many weeks, with various severe tests under difficult conditions; in fact, the bricks could be utilized as building material after the trial was concluded.

Altogether about 20 tons of metallic tin of a purity of 99.5 per cent. (hence even purer than ordinary tin on the market) were produced during the trials. The average power consumption was about 2,000 kw. hours per ton of tin, btu many runs were made with only 1,500 kw. hours per ton. In a larger plant, running regularly as a working concern, the power consumption may be expected to be so low as 1,400 kw. hours per ton of tin. Calculated at a price of 0.3 pence (06 cents) a unit, the power cost would thus be one pound fifteen shilling ($8.75). The labour cost is also reduced as three men and a boy can easily handle a furnace turning out ten tons of tin a day if suitable appliances for handling the ore and the metal are provided. This, of course, refers to the smelting furnace proper, and does not include the men necessary for the subsequent handling of the metal. Actual figures of the smelting costs of the present system with the reverberatory furnace naturally vary considerably, according to the size of the plant, location, etc., but the figures given above suggest that a decided saving may be secured by the electric process. In addition to this, the electric smelting plant works under more efficient conditions, seeing that the process is absolutely continuous day and night for months, whereas the ordinary furnace has to be shut down after each melt for recharging and repairs.

CHILIAN MILLS*

By G. A. Denny.

My first Chilian mill experience was, whilst still a student, in 1885, on a plant in South Australia, in which my father was using Chilian mills for grinding, followed by grinding pans, of his own design, which are still largely the vogue in Australiasia.

In 1905 I prepared provisional plans for a Chilian mill plant for one of the principal deep level mines of the Rand, but these, however, owing to the dislike on that field for so-called "experiments," were not adopted. In the same year I prepared for the first meeting of the Mines Trials Committee what I termed an "Ideal" plant for the treatment of Rand ores. In this plant Chilian mills were substituted for stamps. Drawings of both these schemes are submitted herewith. Seeing, therefore, I am very much interested in the Chilian mill, I am very glad to respond to Mr. Empson's invitation to take part in a discussion on his paper.

Although Mr. Empson deals specifically with the slow speed Chilian mill throughout his paper, I cannot find any but passing reference, as to the reason why a slow speed machine should be better adapted for Mexican practice, than one of moderately high speed. Neither have I been able to find in Mr. Bayldon's paper, from which Mr. Empson so copiously quotes, any evidence that the slow speed mill has any advantages over one of higher speed. Mr. Bayldon plainly says, that if the speed of his mill had been increased by 43 per cent., its output would have increased in almost exact ratio, namely by 47.5 per cent. He also shows that by increasing one of two mills of the old slow speed type, by 14 per cent. in the number of revolutions ,he increased its capacity by 62 per cent., the main reason for the increase he thought, being the more violent agitation of the pulp in the pan.

I have calculated the mechanical efficiency of these two mills from Mr. Bayldon's figures, and find that if we take 8 h.p. for the slow speed mill, which is just above his limit for power absorbed, and 9.5 h.p. for the faster mill, the relative mech. effs. work out as under.

* Extract of discussion in Bulletin of Mexican Institute of Mining and Metallurgy.

No. 1 mill, slow speed. Mechanical efficiency 50 per cent. Output 16 tons daily.

No. 2 mill, 14 per cent. faster speed. Mechanical efficiency 66 per cent. Output 26 tons daily.

The respective mechanical energy units represented by the discharge of the two mills, after allowing for the value of the feed, are:

No 1 mill.....25.16 Energy units.
No. 2 mill.....24.33 Energy units.

An examination of the discharges of the two mills, shows, however, that the slow speed mill was making a slightly finer product than No. 2 mill, but at the cost of a greatly reduced output. There is, therefore, a critical limit somewhere between the smaller tonnage output of fine material, and a larger tonnage output of coarser material, at which the mill works most advantageously, if not most efficiently. Unquestionably a very important factor, given other favourable conditions, is the size of the feed to the mills. It is a very current, but wholly mistaken idea, that a Chilian mill has a larger output if fed with fine material, than with coarse. Contrariwise, it has a considerably higher output on ore fed direct from breakers set at say 1.5 inch, than on a pulp discharged from a 3-mash screen, and probably four times the efficiency on the coarse feed cited, than on ordinary middlings or tailings. Imagining for the moment all other things, such as speed of runners, their weight and shape, the screen in use, the form of pan, and the height of discharge, to be all correctly combined for the best results; the critical limit we are discussing in the instance of the two mills referred to above, lies according to the available evidence, more on the side of the higher, than of the lower speed mill, for the reason largely that the finer material interferes with the action of the runners, directly, in the grinding process and indirectly, in reducing the agitation in the pan, and, therefore, lessening the chances of quick discharge, for which reason the work put into the runners secures an inadequate corresponding result in tons of output.

The percentage of pulp that will pass through the finest mesh in use in any given plant, is generally taken to be the criterion of the relative efficiencies of the machines in use. Whilst this is a very useful approximate guide to efficiencies, it does not give any credit for the work represented by the reduction of the ore to finenesses above the minimum as in some cases there may be very little work left in the plus 200 pulp, to reduce it to the grade necessary to pass a 200-mash. This may be illustrated by reference to the gradings of the two mills in question. In the analysis of the gradings of the discharge of No. 2 mill, 36.94 per cent. of the pulp, remained on a 100-mash screen. The units of energy represented by this percentage are 7.97, and to grind it fine enough to pass 100-mesh would only need the expenditure of 1.26 additional energy units. In other words, although the gradings of Nos. 1 and 2 mills show approximately 20 per cent. more pulp through 100-mash from the former, the comparison of the energy units represented by the respective pulps, shows that the No. 2 mill has only just missed the realization of an equal number of energy units, as the No. 1 mill, and since it has treated 62 per cent. more tonnage, its tonnage energy units are vastly greater than those of the No. 1 mill.

If we had the problem of providing 16 tons of minus 100 material each day and the choice of the No. 1 slow speed mill, with its apparently better output of fine product; or the No. 2 mill, which would we choose?

With the No. 1 mill we could only treat 16 tons of ore all told, of which 13.23 tons would pass 100-mash, leavinfi 2.77 tons which would have to be stored for subsequent treatment. In the course of six days, the plus 100 pulp would have accumulated to say 16 tons, or one day's run of the mill working on coarse ore. The capacity of the mill, however, on the stored pulp, of which practically all passes 30-mash, and 85 per cent. passes 100-mesh screen, would be very different to that secured, when crushing the mixed grindings of the original feed from the breakers, a fact which is not sufficiently realized.

To illustrate this difference, let us calculate the respective efficiencies of the Evans-Waddell Chilian mills, grinding fine material at the Guerrero mill, Pachuca, from the figures supplied by Mr. Sherod in his paper to this Institution; and the figures given by Mr. Eaton of an Akron high speed Chilian mill, running on ore discharged from a stamp battery, fitted with 1.25-inch screens. As these mills are both of the high speed type, and very similar in construction, they give an excellent basis for comparison. Mr. Sherod in his tests, apparently only varied the feed to the mills, leaving all other conditions unchanged. For our purpose we will take the highest and lowest rate of feed used in his tests. The gradings of these No. 1 and No. 5 tests respectively, can be seen by reference to Mr. Sherod's paper. The relative mechanical efficiencies work out as under:

No. 1 Test. Feed 24 Kgs. dry ore per minute. Mechanical efficiency, 8.10 per cent.

No. 5 Test. Feed 70 Kgs. dry ore per minute. Mechanical efficiency, 17.00 per cent.

Or an increase of 110 per cent. in efficiency for the higher feed.

The foregoing result is roughly checked by taking as the standard of efficiency the Kgs. of ore ground to pass 200-mesh per h.p. per minute, as under:

Test No. 1 through 200-mash per h.p. per min. 0.19 Ggs.
Test No. 2 through 200-mash per h.p. per min. 0.42 Kgs.

Or an increase of 121 per cent. for No. 5 test.

The figures given by Mr. Eaton represent the average of one year's regular milling work on Rhodesian gold ore with high speed Chilian mill. The daily tonnage dealt with by the Chilian mill was 118.48, and the average power consumed 25 h.p. running 43 revs. per minute.

The average gradings of the feed were as follows:

On 1.25-inch mash	10.37%
On 0.75-inch mesh	16.25
On 8-mesh	29.30
On 20-mash	20.71
On 30-mash	5.10
Through 30-mesh	18.27

The analyses of the Chilian mill discharge, using 30-mash screen were as under:

	New die ring.	Worn die ring.
On 40-mash	1.50%	3.45%
On 60-mesh	13.50	12.26
On 90-mash	21.00	35.35
On 150-mash	15.20	10.45
— 150-mesh	48.80	38.40

The cost per ton for shells and dies, screens and all spares was 13 cvs. Mex. per ton. Chrome steel spares costing 24 cvs. per lb.

The average mechanical efficiency, worked out from the two analyses given is 60 per cent. The quantity ground through 150-mash per day was 57.8 tons, which is equal to 3.2 lbs. per h.p. per minute.

Referring now to our choice of the No. 1 or the No. 2 mill for the grinding of 16 tons per day, through 200-mesh. It will be realized from the comparative statements given above, how seriously the efficiency of No. 1 mill would fall, when put to work on material of which 85 per cent. passes 100-mesh. It is extremely probable that it would fall, from its normal 57 per cent. on the coarse feed, to under 10 per cent on the fine material. Therefore, in order to grind the whole of the stored material fine enough to pass a 200-mesh, we would either have to return the oversize as it is made, and thus reduce the capacity of the machine, or would have to use up several days grinding the stored material to pass 200-mesh, during which time we would be running all behind on the daily tonnage required.

The No. 2 mill, on the other hand, has a daily capacity of 26 tons, due to its faster speed, and of this 16 tons passes through 200-mesh. The plus 200 pulp, would be continuously returned to the mill, mixed with the coarse feed, and subjected to reduction in the mill, under the most favourable conditions, and would be reground to pass 200-mesh proportionately to its percentage of the total mill feed. Of the two machines we would unquestionably, therefore, choose the No. 2 higher speed mill.

The lengthy digression in the preceding paragraphs, has arisen from a desire to illustrate by examples from practice, that not only is there no apparent advantage in the slow speed mill, but that there are serious economic disadvantages when the mill is used intentionally for fine grinding, inasmuch as the working results from Chilian mill practice definitely point to the superiority of the higher speed mill, a fact which as before pointed out, was fully recognized by Mr. Bayldon.

In order to form any adequate conception of the respective merits of Chilian mills versus stamps and tube mills in combination, it is necessary, I think, to examine much farther into the subject than Mr. Empson has gone. I propose, therefore, to contribute my quota to that further enquiry, trusting to other members to do likewise.

If we compare Chilian mills to stamps, it must be clearly defined on what basis the comparison is made. The modern stamp mill has been relegated to a place which is more efficiently and legitimately filled by machines of other types, e.g., breakers and rolls. It is now essentially regarded as a machine for fine breaking, as distinct from grinding.

The form of the Chilian mill is such, that as a purely ore breaking machine it cannot compete with breakers in their own province, nor with the heavy stamp when it invades the province of the breaker, if for no other reason, because of the difficulty of clearing the broken ore. Its value consists in the fact that it combines in one machine, a breaking and crushing action, which is tantamount to the functions performed by the stamp-tube mill in combination. The field for comparison is, therefore, to be found on the finished products preparatory to cyanidation.

Mr. Empson says: "Much can be written in favour of stamps as applied to ores which do not call for reduction to slime, but on which leaching of sand is possible; under these conditions where ore is to be crushed to quarter-inch mesh in stamps, and reduced to 30 to 40-mesh in tube mills, the slow speed Chilian does not compete."

This statement cannot, I think, convey what Mr. Empson means that it should. To begin with, a 1,500-lb. stamp crushing very hard and silicious ores, through a quarter-mesh screen, would produce a pulp containing about 60 per cent. of material which would pass a 30-mesh screen, and if this were run to a tube mill working at very high tonnage capacity, the product would nearly all pass a 60-mesh screen. It would be infinitely better to throw out the tube mills, and put finer mesh screen on the stamps, if the pulp were only required of a fineness of 30 to 40-mesh, as the stamp mill would do that work at about say 30 to 40 per cent. efficiency, against the tube mill working at say 15 per cent. Apart from that, however, I know of no tube mill work designed to produce a pulp that will only pass 30 or 40-cash screen, nor do I know of any cyaniding ores which would give a high rate of extraction on such a coarse product.

In the paragraph following that from which I have just quoted, Mr. Empson estimates that a 1,250-lb. stamp, when crushing 10 tons per day (he does not say through what mesh screen) will only make 0.10 of a ton slime. I would estimate the slime from such a stamp as at least 0.30 of a ton per day. It has been proved by test with 1,900-lb. stamps crushing Rand ore through a screen with a width of aperture of 0.205 in., and length of aperture of 0.536 in., that between 20 and 25 per cent. of the pulp passes a 200-mesh screen. Undoubtedly a small percentage of the fines in both cases, is contained in the ore when it is delivered to the mill, so that the sliming is not all to the credit of the stamps, but failing a preliminary separation of the slimes, it must be taken as a credit. Seeing that the slime would be so much greater than Mr. Empson has calculated, I cannot agree with the tonnage he gives to the tube mills, as in practice it would be much less, and for this reason, the value of the comparison made with Chilian mills is greatly prejudiced.

I regret that I have no complete figures from Mexican practice, of stamp-tube mill combination for comparison with those submitted above, I have, however, gradings of both stamp mills and tube mills separately, obtained from Mexican practice, from which indications may be obtained.

The efficiency of Mexican stamp milling practice appears to be between 40 and 50 per cent., but the tube mill efficiency, from the figures at my command, does not exceed an average of 5 per cent. The indications are, therefore, that the combined efficiency of the plant would not seriously challenge the U. S. instance quoted above.

The relative mechanical efficiency of the slow speed mills, of the Pachuca type, quoted by Mr. Empson from "Urbiter," are not confirmed by other available information relating to similar mills running in the Pachuca district. The particulars are as under:

	Feed.		Discharge.	
	"A"	"B"	"A"	"B"
On 1.00 in.		30.57		
.75 in.	22.00	8.52		
.50 in.	17.00	15.50		
.25 in.	21.00	15.35		
6 mesh	9.00			
8 mesh		10.50		3.42
12 mesh	13.00	4.35		1.82
20 mesh	6.00	6.20		5.50
30 mesh		3.15		5.57
40 mesh	8.00		13.50	
50 mesh		2.30		7.92
60 mesh	0.40		7.00	
80 mesh	1.30		16.00	13.00
100 mesh	0.30		2.50	3.37
120 mesh		1.02		13.77
150 mesh	0.50		15.00	4.50
200 mesh	0.30	0.50	7.00	3.25
—200 mesh	1.20	1.07	39.00	32.50

"A" mill grinds 18 tons per day, and absorbs 11 h.p. 12 revs. per min. 15 screen.

"B" mill grinds 22.5 tons per day, and absorbs 17 h.p. 15 revs. per min. The screen is made of round bars spaced horizontally at 1.5 inch centres.

The feed to both mills is the regular ore of the Pachuca camp.

It will be noticed that I have omitted the fast speed Chilian mill quoted by Mr. Empson. On referring to Urbiter's paper I found that the figures given are the result of crushing in a combination of rolls and Chilian mills, and, therefore, they can only be used for representing such a combination.

There are very large differences, it will be seen, in the table above in the efficiencies of the mills I have worked out, and those which Mr. Empson uses in support of his conclusions regarding the high efficiencies of slow speed mills. I have no explanation to offer of the differences. Mr. Empson, in his reply to this discussion, may be able to reconcile them.

The data I have on the performance of high speed Chilian mills running on coarse feeds are not suitable, in the main, for the purposes of close comparison. The indications from the analysis, and a combination of the available particulars, show that these mills have an efficiency of from 50 to 70 per cent. on coarse feeds, and up to 3 lbs. per h.p. per minute of 200 material in the pulp discharged.

For the performance of these high speed mills on fine feeds the paper read by Mr. Sherod before this Institution, to which I have already referred, supplies a great deal of interesting information.

Returning now to the comparative efficiencies of the stamp tube mill combination, versus the Chilian mill, it is seen that on coarse feed the Chilian mill finished product shows a far higher mechanical efficiency for that mill, than does the product of a stamp tube mill combination show for the combination.

In addition to this advantage, the Chilian mill plant for equivalent output of fine material, when compared with the stamp tube mill combination would cost less than the stamps alone.

The comparative cost of running a stamp tube mill combination as against that of Chilian mills, is altogether in favour of the latter.

Indeed the cost for maintenance is considerably below that of the stamps, exclusive of the tube mills. The following costs, given by Mr. Hutchinson as those at the Goldfield Consolidated mill in Nevada, for stamps, tube mills, and Chilian mills, are especially interesting, because all three forms of mill are working in the same plant simultaneously.

	Labor per ton cents U.S.	Supplies repairs upkeep per ton cents U.S.	Power per ton cents U.S.	Total cost per ton cents U.S.	%of tim lost owing to machine
Stamps, crushing through 4 mesh	3.9	4.1	5.4	13.40	0.46
Tube mills.....	1.4	6.5	8.7	16.60	
Chillian mills on fine feed.....	1.8	4.1	4.7	10.60	0.17

With regard to the design of mill submitted for criticism and suggestion by Mr. Empson, I have the following remarks to make, prefacing them by saying that although in his design, there are unquestionably many features of improvement over the mills of the Pachuca type now extant, in none do I find any improvements over many good types of fast running Chilian mills on the market. Briefly, my criticisms and suggestions are as under:

1. The centrifugal tendency of such massive runners as are proposed for this mill, should be utilized by trunnioning them below the centre of the axle.

2. In order to take full advantage of the pivotal action in runners of such width, the face of the runner should be divided into two separate discs, the one on the inner, and the other on the outer side of the runner face, leaving a central space of perhaps one-third of the face out of contact with the die. Thus the pressure per square inch on the grinding surfaces would be greatly increased, and on those portions of the face which through their backward and forward sliding movements, are the real grinding sections of the face. In consequence the grinding efficiency of the machine would be improved very considerably.

3. The thrust which the Mantsey offset will give to the runner, should be provided for by thrust rings turned on the axles. There is nothing to show that the angle of offset proposed, for the mill, is the critical one for the speed. If it is not, it will result in great friction, and wear for which there will be no compensation.

4. The shape of the pan, in my opinion, can be improved upon. The runners, to do efficient grinding and discharging, should work in as narrow and vertical a pan, as is practicable with clearance, and such a pan should be provided, and fitted with screens both on the inner and outer periphery.

5. Portion of the pan should be made to open out for the easy removal of runners.

6. The main driving boss should be made adjustable vertically, otherwise as the rings and dies wear, the output of the machine will be seriously reduced.

7. An arrangement should be provided fitted to the driving arms, for carrying weights for compensating for the weight lost by the runners as they wear, thus keeping the machine up to maximum crushing capacity all the time.

8. A light housing, at least axle high would be advantageous.

9. A three runner machine, instead of two, and a speed of 20 to 25 revs. would in my opinion greatly improve the capacity and efficiency of the mill.

10. Firm foundations are of the utmost importance for any grinding machinery. This mill should be set upon a block of reinforced concrete, to get the maximum effect.

If my written argument in this discussion conveys my meaning, it will be understood that I entirely support Mr. Empson in principle, on his advocacy of the excellent qualities of the Chilian mill, but I differ from his view, that the slow speed mill is the one especially adapted to the requirements of Mexican practice, for the reasons I have advanced.

In the course of the discussion arising out of Mr. Empson's advocacy I have the hope that a supporter of the Ball mill will appear, a machine which is dry crushing an average of 63,000 tons per month on the Kalgoorlie goldfield.

Also the interest of someone may be aroused who will oppose the use of the tube mill, with the natural adjunct of the Chilian mill, namely, the grinding pan.

TECHNICAL LITERATURE

The Effect of Explosives Used in Mining.—Writing in the Colliery Guardian on the harmful effects of explosives upon coal miners, Sir Thomas Oliver is disposed to attribute these rather to carbon monoxide and not to nitrogen oxides. In the United States the subject has been studied by Dr. Thomas Darlington, whose experience is based upon 1,300 cases of partial asphyxia, and of poisoning caused by explosions of dynamite during the construction of the new Croton Aqueduct, New York. There are two types of poisoning, the acute and the chronic. When only a small amount of dynamite has exploded, or where the workman have been immediately removed to the fresh air by their comrades, the trembling, flushing, or pallor of the face, nausea, vomiting, throbing of the temples, rapid heart beat and sense of fulness of the head, usually disappear within 24 hours. Even where the workmen have been brought in contact with large quantities of the products, and have become giddy, unconscious, and asphyxiated, the coma usually passes away, and most of the patients recover. In some instances, however, death has come from respiratory failure. The symptoms are considered by Darlington to be due to volatilization of nitro-gycerine, but there is equally a close and similar resemblance between poisoning by carbon monoxide and nitroglycerine.

The Illumination of the Coal Mine.—Commenting editorially on ex-papers recently read by Drs. J. S. Haldane and T. L. Llewellyn at the annual meeting of the South Staffordshire and Warwickshire Institute of Mining Engineers, describing experiments conducted by the authors to determine the effect of the composition of the mine air upon the amount of light which a safety lamp is capable of giving, the Colliery Guardian remarks that the diminuation of oxygen in mine air can take place in several ways. An addition of 1 per cent. of moisture diminishes the true oxygen percentage in pure air by 021. Thus as the percentage of moisture increases, the illuminating power of the lamp diminishes. The effect of moisture on the light given by a safety lamp has not apparently been previously investigated experimentally, although its effect upon protometric determinations is known. Thus it has been found that for every increase of 1 per cent. in the moisture percentage of the air the illumination of the standard pentane lamp and also of the Hefner amyl-acetate lamp falls off by 5 per cent. The effect would probably be not less in the case of an ordinary safety lamp, and certainly the experiments of Messrs. Haldane and Llewellyn bear this out, since the variation in moisture content in mine air is as much as, and often greater than, was the case in the experimental chamber employed by them. As regards the influence of carbon dioxide, the authors call attention to the confusion that has arisen through attributing to this gas the premier role in producing dimness of illumination. In their view it is only the variation in true oxygen percentage that matters in a practical sense, and how this percentage is diminished is of small importance, although it is true that added carbon dioxide does produce rather more effect than added nitrogen.

Mineral Resources of the Kenai Peninsula.—Mr. W. M. Brewer contributes a short descriptive article to the Mining and Scientific Press, of November 23rd, on this gold-bearing area, north of Seward, in Alaska. Placer gold was discovered along the south shore of Turnagain Arm as early as 1896, but it was not until 1905 that quartz discoveries were made. The country rock throughout the area is slate and greywacke, with many intrusive dikes, composed of a much altered quartzose material which so far has not been classified. The ore occurs in fissures, many of which have their lines of strike crossing the bedding planes of the country rock nearly at right angles. The fissures are apparently deep seated. Other instances occur where the fissures cross the bedding planes of the country rock nearly at various angles, from 10 to 30 or 40 degrees, and, in some cases, the orebodies occur lying conformably with the stratification of the slates, resembling gash veins. The values appear to be exceptionally high, the ore milled to date having yielded from $50 to $60 to the ton. Mr. Brewer is apparently very favourably impressed with the possibilities in this field.

The Nature of Metasomatism or Mineral Replacement.—Mr. Waldemar Lindgren contributes an article on this subject to the last issue of Economic Geology. His conclusions are as follows: The transformation of one mineral into another of different chemical composition, effected by practically simultaneous solution and precipitation, is called replacement or metasomatism. It is necessary to distinguish between (1) ret actions in open space, where no restraining influences oppose a change of volume or where the force of crystallization can easily overcome the restraining pressure, and (2) reacitons in rigid rocks where the new mineral is forced to make room for itself by solution of the host mineral; in this case the volume of the replacing mineral equals that of the mineral replaced; the force of crystallization is of little or no direct influence, but the pressure exerted probably promotes solution. The chemical equations written to express such replaoements are of little value, because they give relations by weight instead of relations by volume. Such replacements proceeds independently of molecular weight, molecular volume, and specific gravity. It does not take place "molecule for molecule," nor by a given proportion between the molesules dissolved and precipitated. At the same time it is molecular, or, at least, sub-microscopic in the sense that complex chemical reactions constantly take place in the contact films of solutions; the process goes on in one operation, solution and precipitation following so closely that no spaces of solution are visible under the microscope. Structure and texture are often faithfully preserved. If replacement proceeds from an extremely large number of points in a mineral, with the development of fine-grained substance, increased porosity may result from the aggregate of minute solution ducts. Replacement by equal volume takes place in most perfect form when the rock is permeated by stagnant or slowly moving solutions. Re placements in mineral deposits are sometimes caused by raipdly moving solutions and then the equilibrium may be disturbed; solution may be more active than deposition; drusy structures may then result by local deficiency of the solutions in the substances precipitated.

Mr. Alfred C. Garde, formerly of Nelson, B.C., has, in partnership with Mr. W. J. Kennaugh, established himself in consulting practice at Prince Rupert. The firm will be known as Garde & Kennaugh, civil and mining engineers.

BRIEF REVIEW OF MINING IN BRITISH COLUMBIA

In responding for British Columbia at the opening session of the American Mining Congress, held in Spokane, Washington, on November 25-29, Mr. E. Jacobs, of Victoria, B.C., Secretary of the Western Branch of the Canadian Mining Institute, after having first expressed appreciation of the cordial welcome extended to British Columbians present, said:

"Of the 382,000 square miles of territory in British Columbia, approximately 300,000 square miles is known to be extensively mineralized, and to-day most of this remains a virgin field for the prospector and the investor in undeveloped prospects.

"British Columbia is a part of the great Cordilleran belt which, in South America, Mexico, and the western United States, is recognized as one of the greatest mining regions of the world, noted principally for its wealth in gold, silver, copper, and lead—unparalleled for continuity, extent, and variety of its mineral resources. In Canada and Alaska this belt maintains its reputation, though for the greater part unprospected. In Canada, where it also has enormous resources of coal of excellent quality, it has a length of 1,300 and a width of 400 miles. It is pre-eminently a great mining region.

"Ten years ago Mr. Bernard MacDonald, for several years managing mines at Rossland, B.C., read before the Canadian iMning Institute a paper on 'Mining Possibilities of the Canadian Rockies,' and in that he showed that in Mexico the Rocky mountains had yielded of the previous metals alone a production of $5,500,000,000 over a length of 1,700 miles, or an average of $3,124,857 a mile; in the United States, $4,500,000,000, or $3,461,538 a mile along a length of 1,300 miles; while in Canada the total had reached only $166,000,000, or $103,759 a mile for 1,700 miles. Later, Mr. MacDonald remarked: 'It is fair to assume that the Rockies in Canada will yield a quantity of the precious metals equal to that produced by them in American or Mexican territory—mile for mile of their length—when equally developed.' (The value of gold and silver produced in British Columbia in nine years since Mr. MacDonald spoke is about $60,000,000.) It should be noted that much of the Cordilleran belt in Canada is in British Columbia.

"Let me add, in passing, that the area and probable coal content of the coalfields of western Canada have been placed by Mr. D. B. Dowling, of Geological Survey of Canada, at 37,000 square miles and 169,000 million tons of coal (or 97 per cent. of that of the whole of Canada), as against 432 square miles, and only 5,212 million tons for Nova Scotia and New Brunswick, which provinces have long been the chief producers of coal in Canada. The estimate for British Columbia is 1,351 square miles, and 40,225 million tons of mineable coal.

HISTORICAL.

"The first known discovery of mineral in British Columbia was made on Kootenay lake in 1825 by Mr. David Douglas, a Scottish botanist, who was investigating the flora and fauna of that district. Later, Hudson Bay Co. trappers made bullets from the lead ore outcropping there, and in 1864, Mr. George Heart, of California, took in a small open-hearth furnace and smelted some ore, but the low grade of the bullion, the long distance from market, ad the absence of transportation facilities discouraged him, so that he abandoned it. Late in the eighties, Dr. W. A. Hendryx and associates from Minnesota and Connecticut, who had been on Kootenay lake for sport, became interested in and acquired the property, afterward erecting a lead smeltery in the neighborhood, but they, too, gave up the venture as unprofitable. To-day a New England man Mr. S. S. Fowler, a Columbia University graduate, is operating the Blue Bell mine, as it is now called, for a French company—the New Canadian Metal Co., Ltd.

"Coal was first discovered in British Columbia in 1835, by Hudson Bay Company officials, at Fort Rupert, Vancouver island. In 1851 coal-mining operations were commenced at Nanaimo, also on that island, and, later, the chief market was found for the product in San Francisco, where much of it still goes. The Nanaimo mines are now owned by the Western Fuel Company, a San Francisco proprietary. Up to date, more than 22,000,000 long tons of coal has been produced by Vancouver island coal mines.

"In 1858 gold was found on Thompson and Fraser rivers, and in 1860-1861 the enormously rich placer-gold fields of Cariboo were opened. It is an old story how people hurried from San Francisco in thousands; how they crossed the Isthmus of Panama, or rounded Cape Horn, or plodded wearily overland from Canada and the United States. Haid the historian: 'Victoria became a city in a day, and the Mainland solitude was converted into a Crown colony in a year.' Since then those fieldfields have yielded about $50,000,000, and are still being worked profitably.

"In the late eighties the production of lode metals—silver and lead—was commenced; in 1893 gold was added, and the next following year copper was produced.

MINERAL PRODUCTION.

"The aggregate value of all minerals produced in British Columbia to the end of 1911 is on official record as $397,696,000, of which approximately $72,000,000 is for placer gold, $65,000,000 lode gold (toal gold, $137,000,000), $32,000,000 silver, $26,000,000 lead, $65,000,000 copper, $122,000,000 coal and coke, and $15,000,000 miscellaneous minerals.

"The aggregate value of the mineral production of all Canada for 36 years, to 1911, inclusive, is $1,235,525,000. Of this total, British Columbia's proportion is about $333,696,000, or between 26 and 27 per cent. It is a striking fact, indicating the great increase in recent years, that 37 per cent. of British Columbia's production was made in the last five years, while more than half—51 per cent.—was that of seven years, 1905-1911.

"A word or two as to individual properties. The Granby Co. has mined and smelted to date more than ,8000,000 tons of copper ore, from which was produced about 192,000,000 lbs. of copper, 3,000,000 ozs. of silver, leaving net earnings of $7,400,000, of which last about one-half has been distributed in dividends. To-day the company has, in its mines in Boundary district, between 6,000,000 and 7,000,000 tons of ore 'estimated in sight.' Its copper smeltery at Grand Forks is stated to be the largest in the British Empire. In 1910—later years were broken years—it mined and smelted 1,178,000 tons of ore at a cost, including converting of copper, but not marketing, of $2.50 a ton. To-day its smelting and converting costs (not mining) are about $1.20 a ton of ore. All Boundary district mines have together produced about $60,000,000 worth of ore, gross value.

"Rossland camp's production has totalled about $55,000,000. The Consolidated Mining and Smelting Company's Rossland mines have produced 3,376,000 tons of ore, with a gross value of $45,000,000, this including 1,624,000 ozs. of gold. That company's St. Eugene mine, in East Kootenay, has produced 1,015,000 tons of ore, which contained 5,319,000 ozs. of silver and 227,615,000 lbs. of lead, having together a gross value of $10,526,000. The company's smeltery at Trail has treated 3,144,000 tons of ore and concentrate, having a gross value of $52,167,000. The Betts electrolytic process for refining lead was first used on a commercial scale at Trail, under the direction of Mr. Jules Labarthe, one of the delegates here to-day from Nevada.

"In conclusion let me briefly refer to the mining laws of British Columbia. I have here a Government pamphlet, which contains a synopsis of these. It is claimed for our mining laws that they are very liberal in their nature and compare favourably with those of any other part of the world. The 'Coal Mines Regulation Act' is considered about the best in force in the British Empire—perhaps in the world. Sir Richard McBride, Premier and Minister of Mines for British Columbia, when addressing the Canadian Mining Institute a few weeks ago, said: 'We do not say that this legislation is perfect and stands for the last word in the way of mining regulation, but we do claim that it is an immeasureable advance on any legislation in a similar direction heretofore attempted in any of the provinces of Canada, and has well proved the wisdom of having it placed on the Statute books of the province.' And, what is of equal importance, the mining laws of British Columbia are enforced."

UNITED STATES DUTIES ON LEAD AND ZINC.

The following is a copy of one of the resolution passed at the meeting of the American Mining Congress, held in Spokane, Washington, last month. As it is one that affects particularly the Kootenay district of British Columbia, it will probably be of interest to Western Canada readers of the Canadian Minin Journal:

"Whereas the lead and zinc mining industries of the United States constitute a great productive industry, employing many thousands of men, and this development, in turn, has created many other industrial enterprises of vast importance to the country at large, and

"Whereas the existing tarig duties on lead and zinc ores have been demonstrated to be less than the actual difference between the cost of production here and in competing countries, and

"Whereas any reduction of the present rates of duty would result in the closing down of many mines that are now being profitably operated, thereby depressing industry, destroying values, and throwing labour out of employment, and would also discourage prospecting and retard the development of the mineral resources of the country, and

"Whereas the duties now levied upon the imported lead and zinc ores are fully justified as revenue-producing measures, and

"Whereas the lead ore in the smelting of refractory gold ores in the gold-producing states is an absolute essential, and any burden placed upon the lead industry will increase the cost of gold production, and

"Whereas the prevailing high level of production costs, including wages, mining machinery, and mining supplies is gradually increasing, while the value of gold remains stationary, and in consequence of which the production of gold from low-grade refractory ores is being greatly hampered, and

"Whereas neighbouring countries, where the cost of labour, machinery, and supplies is very much less than in the United States, are able to produce lead ores at so much less cost as to enable them to displace the use of domestic lead ores in the markets of the United States, and thereby making impossible the production of those lead ores essential to the smelting of gold ore, which, in turn, will have the necessary effect of greatly restricting the production of gold in the United States;

"Now, therefore, be it resolved: That the American Mining Congress believes that the best interests of the nation demand that the tariff on lead be not reduced, because any such reduction would diminish the production of gold, which is the basis money of this country.

"Resolved, further: That the American Mining Congress re-affirms its prior declarations favouring the retention of the present tariff duties on lead and zinc ores, and pledges its egorts to prevent any reduction thereof."

THE SAND FILLING OF STOPES.

Since the sand filling of stopes was commenced on the Witwatersrand the number of mines that have adopted this method of supporting excavations has gradually increased. Several of the largest mines on the Rand have installed plants for this purpose and others are now doing so. It is stated that no serious difficulty has been experienced in neutralizing the egect of cyanide compounds remaining in current sand. Permanganate of potash, bleaching powder or similar oxidizing agents are used to convert the dangerous salts into stable syanates, and care is taken that only neutral or alkaline water is used for flushing the sand. Many forms of pipe lining have been tried, according to the report for 1911 of the Rand Inspector of Mines, but, unfortunately, not one of them will withstand the friction of the sand in a long vertical column. Present practice points to three methods of surmounting the difficulty of excessive wear in deep vertical shafts: (a) The pipe can be broken at intervals of about 300 feet and the velocity of flow checked by baffle boxes; (b) the sand can be dropped down dry through a wooden box launder about 6 inch square section and picked up with water near the bottom of the shaft; (c) a borehole can be sunk to connect into a stope and from the bottom of it pipes or launders can be used to convey the pulp. All these processes are at present under trial. The difficulties of retaining the sand underground have been largely overcome, strong timber or waste packs faced with cement being used as barricades.

Where the process has been entered upon on a large scale the results are stated to have been very satisfactory. At the Witwatersrand Deep, for instance, a large section of the upper works has been filled and a considerable amount of valuable ore in the shape of pillars has been recovered. It is found even in the steepest workings that if the sands on being deposited are carefully drained the lower deposit quickly dries out and very little weight is thrown on the supporting barriers or stulls, which need not be nearly so strong as might be imagined if the proper conditions of draining are observed. At the same time good ventilation is provided around the free sides of these barriers and regular inspections are carried out to prevent the possibility of a breakaway. At the same mine current sands are used for filling. They are flushed from the tanks, and after being treated with permanganate of potassium to free

them of any contained cyanide, are run down to an old winze at the top of which they are dewatered in cones, the water being pumped back and the resulting sludge being led down to the workings in pipes and launders. It is hoped that all the current sands may eventually be disposed of in this manner, which, on the other hand, will result in a great saving of labour. At the Cinderella Consolidated a long series of experiments have been carried out. At first the ordinary method of taking the wet sands down in pipes was tried, with both ordinary iron pipes and wood-lined pipes. It was found, however, that a great amount of scouring took place and the pipes were continually bursting, flooding the shaft with sands and causing endless trouble and delay, so that method had to be ultimately abandoned. A wooden box was then carried down the shaft, 12 inches square in section, with bap doors about every 100 feet. Experiments were then carried out over a long period with dry and damp sands. It was eventually found that a dry sand, containing not more than 5 per cent. of moisture, could be successfully passed through, a bucket full of stones being emptied down every half-hour to clear any tendency to clog. If more than 5 per cent. moisture is present in the sands it is found that clogging takes place in the box and operations have to be stopped and the box cleared. These facts, at any rate, make it clear, the "South African Mining Journal" remarks, that the difficulties in the way of successful sand filling are being overcome.

PERSONAL AND GENERAL

Mr. Alexander Hamfield, who for the part three years has been associated with the iron mining industry of the Mesabi district, Minn., is visiting Montreal. Mr. Hamfield was for many years a resident of British Columbia and mined in the Cassiar district.

Mr. L. K. Armstrong, secretary of the Spokane local section of the American Institute of Mining Engineers, has proposed that the Western Branch of the Canadian Mining Institute and the Spokane local section of the A. I. M. E. hold a joint meeting in Kootenay district, B.C., next spring. The proposal is likely to prove acceptable to all parties concerned, and it is probable arrangements will be made to hold a joint meeting at Rossland about the middle of next May.

The story sent out from Vancouver, B.C., as a press despatch, to the effect that Mr. James Breen, a well-known metallurgist, who built the Northport smeltery, Washington, which was afterward sold to the Le Roi Mining Company, and the smeltery at Crofton, Vancouver Island, had died lately in Anaconda, Montana, has been denied in Spokane, Washington, which city, it is stated, was recently visited by Mr. Breen when on a wedding tour.

Dr. D. W. Brunton, of Denver, Colorado, who has just succeeded Mr. Samuel A. Taylor as president of the American Mining Congress, has been visiting his son at Greenwood, Boundary district of British Columbia, where the latter (a McGill graduate) is assistant to the superintendent of the British Columbia Copper Company's smeltery. Dr. Brunton is a Canadian (of Brantford, Ontario), though for many years engaged in metallurgical and associated work in the United States. Among other prominent positions he has held is that of president of the American Institute of Mining Engineers (1909).

Prof. Joseph Daniels, of the College of Mining, University of Washington, Seattle, Washington, was among the Coast visitors to Spokane, attending the American Mining Congress.

Mr. E. P. Dudley, who several years ago was engaged at the Britannia mines, near Howe Sound, B.C., is now construction engineer for the Bunker Hill and Sullivan company at Kellogg, Idaho. He is a nephew of Colonel Dudley, well known as United States consul at Vancouver, B.C.

Mr. A. F. Eastman, of Tacoma, Washington, manager of the Tacoma Steel Company's mining department, recently returned to the company's Marble Bay mine, near Van Anda, Texada Island, B.C., after having been detained two or three weeks at his home in Tacoma by sickness in his family.

Mr. Edward Fink and Mr. H. W. Seamon, both of Chicago, have been in the northwestern States in connection with interesting mining men in a lead-zinc reduction process that Mr. Fink has developed. At Spokane a number of mining men from British Columbia were shown plans of the plant and given a description of the process, which is described as being economical and effective.

Mr. R. H. Flaherty, on Messrs. Mackenzie and Mann's engineering staff, went west from Toronto late in November.

Mr. Albert I. Goodell, formerly manager of the Boundary Falls smeltery and afterwards of the Le Roi Mining Company's smelting works at Northport, Washington, was among those who welcomed the British Columbia visitors to Spokane during the meeting of the American Mining Congress.

Mr. Robert R. Hedley, of Vancouver, B.C., has been examining mining properties on one of the Queen Charlotte Islands.

Mr. E. J. Roberts, superintendent of the Corbin Coal and Coke Company, with a colliery in Southeast Kootenay and headquarters in Spokane, has returned from a holiday visit to the south.

Mr. F. A. Ross, formerly manager of the Nickel Plate gold mines and 40-stamp mill at Hedley, Similkameen, until these were sold by the executors of the Marcus Daly estate to the organizers of the Hedley Gold Mining Company, now operating them, is resident in Spokane.

Mr. R. B. Rathbun, chief electrician at the Granby Company's smelting works at Grand Forks, B.C., left that place late in November to visit the big smeltery at Garfield, Utah.

Mr. O. B. Smith, general superintendent of mines for the Granby Consolidated Company, and Mr. W. A. Williams, superintendent of the company's smelting works, have returned to Boundary district from the company's Hidden Creek mine, near Observatory Inlet, B.C. Together with Mr. F. M. Sylvester, assistant to the general manager, they are receiving and considering bids from manufacturers and others for mining and smelting plant

and machinery required for equipment of the Hidden Creek mines and the new smeltery and hydro-electric plant the company is preparing to put in at and near Granby Bay, a branch of Observatory Inlet. Mr. George W. Wooster, treasurer and director of the company, left Grand Forks for Granby Bay during November.

Mr. Thos. Wall, who is superintending the development of the Ia Franc mine, situated in the mountains east of Kootenay Lake, recently returned to the mine from a visit to Nelson, B.C. With deep snow in the country in which the mine is situated, and little or no traffic to keep the trail open, communication with outside places is cut off during several of the winter months.

Mr. Frederick R. Weekes, of New York, who has been engaged throughout the year in connection with the exploration and development of two groups of mineral claims situated a few miles from Princeton, Similkameen, B.C., that the British Columbia Copper Company has under bond, recently spent several days with the company's manager at Greenwood. The directors of the company will shortly decide whether to make a considerable payment on the larger group, known as the Voight group, or relinguish their bond and option of purchase. Part of the purchase money on the smaller group was paid two or three months ago.

Prof. Francis A. Thomson, head of the mining engineering department, State College of Washington, late in November went to Victoria, B.C., on a private visit.

Among the large number of men, more or less directly connected with the mining and metallurgical industries, who attended the American Mining Congress at Spokane, Washington, during the last week in November, were between forty and fifty from British Columbia—chieby from Kootenay district—and several from other parts of Canada. Those from British Columbia included the following: Mr. W. M. Archibald, of Trail, one of the Consolidated Mining and Smelting Company's mining engineers; Mr. A. J. Becker, of New Denver, manager of the Apex and Sunset mines, Slocan; Mr. H. B. Brown, of Hedley, Similkameen; Mr. G. F. Caldwell, of Kaslo, manager of the Utica mine, Slocan; Mr. L. A. Campbell, M.L.A., of Rossland, general manager of the West Kootenay Power and Light Company; Mr. Lyman Carter, manager of the Blue Bird mine, Rossland; Mr. E. A. Cleveland, of Vancouver, interested in the Surf Inlet Gold Mines, Limited, operating on Princess Royal Island; Mr. C. S. Cradock, of Nelson, representing Sandon, Slocan; Mr. Graham Cruickshank, of Rossland, superintendent of the Le Roi concentrating experimental plant; Mr. E. R. Davidson, manager of the Eureka mine, near Whitewater; Mr. G. B. Dean, superintendent of the Silver Ridge mine, Three Forks, Slocan; Mr. W. S. Hawley, Spokane, representing the Silver Hoard mine, Ainsworth; Mr. P. F. Horton, manager of the H. B. mine, near Salmo, Nelson mining division; Mr. E. Jacobs, of Victoria, secretary of the Western Branch of the Canadian Mining Institute; Messrs. A. G. Ladson and R. S. Lennie, of Vancouver, and Mr. W. F. McClurg, of Sandon, all representing the Slocan Star Mines, Limited, Slocan; Mr. Frank E. Pearce, of Paulson, manager of the Inland Empire mine; Mr. M. E. Purcell, of Rossland, superintendent of the Centre Star group of mines; Mr. A. E. Rand, of New Westminster, owning large mining interests in Nelson mining division; Mr. J. Rogers, of the Crow's Nest Pass Coal Company, Fernie; Mr. G. B. Webster, of New Denver; Mr. Bruce White, of the Noonday mine, near Cody, Slocan; Mr. W. C. H. Wilson, of the British Columbia Copper Company, Greenwood, Boundary district. Alberta was represented by Mr. John Brown, of Hillcrest; Mr. A. A. Millar, of Blairmore, and Mr. J. C. Reid, manager of the Chinook Coal Mining Company, Lethbridge. Mr. S. Gordon Smith registered as representing the Peninsula Mining Syndicate, Pontiac, Quebec. Others, who at one time or another have been connected with mining in British Columbia, met in Spokane by the writer of these notes, were: Mr. F. E. Cummins, who recently resigned as superintendent of the Surprise mine, Slocan; Mr. Stanley A. Easton, general manager of the Bunker Hill and Sullivan Company, with large mines and concentrating works at Kellogg, Idaho; Mr. George Watkin Evans, of Seattle, who spent last season in the Groundhog coal field, Northern Skeena district; Mr. J. Cleveland Haas, of Spokane, for years connected with mining in Boundary district; Mr. Robert Keffer, son of Mr. Frederic Keffer, acting general manager of the British Columbia Copper Company, Greenwood, Boundary district), who is now in his fourth year in mining engineering at the State College of Washington, Pullman; Mr. Jules Labarthe, formerly superintendent of the Consolidated Mining and Smelting Company's smelting works at Trail, now general manager of the Mason Valley Company, owning mines and a smeltery in Nevada; Mr. Douglas G. Livingston, formerly with the Tyee Copper Company, and now one of the professors in mining engineering, University of Idaho, Moscow, Idaho; Mr. Sidney Norman, of Spokane, in bygone years interested in mining property in Slocan district; Mr. J. V. Richards, of Spokane, who has been connected with Slocan mines; Mr. C. Rundberg, some time since superintendent of the Dominion Copper Company's mines at Phoenix, Boundary district; and others.

Mr. L. T. Rogers, late of Porcupine, has accepted a position at the Cordova mine, Eastern Ontario.

Mr. George F. McNaughton has returned to Toronto after spending several months at the St. Anthony mine in an advisory capacity.

Mr. J. W. Astley and Mr. A. B .Willmott are in New York giving evidence in the Hawthorne case.

Mr. Joseph C. Houston has accepted the position of manager of the Schumacher mine, Porcupine.

Mr. Robert Brice is in Toronto.

Mr. J. C. Murray gave an address on December 9th before the Political Science Club, Queen's University, Kingston, on "Mining and Promotion."

Mr. G. M. Colvocoresses has opened an office at 43 Exchange Place, New York.

Mr. R. J. Flaherty, who returned from Ungava some weeks ago, will remain in Port Arthur until after Christmas.

Colonel R. G. Edwards Leckie has returned to British Columbia.

Mr. W. Jacobsen, mining accountant, who has had long experience both in this country and in South Africa, has opened an office in the Confederation Life Building, Room 256, Toronto.

Hon. E. H. Armstrong, Minister of Mines from Nova Scotia, was in Toronto early in December.

Mr. W. F. Ferrier, of Toronto, and Mr. Theo. Denis, of Quebec, attended the meeting of Council of the Canadian Mining Institute, held in Montreal on the 5th inst. In the evening they were the guests of honour at a dinner given by the Montreal Branch.

Mr. Henry Hanson, of the Domes Mines, Porcupine, expects to spend the holidays in San Francisco and will leave for the West on or about the 15th of December.

Mr. J. M. Forbes, of Black Lake, Que., has returned from a visit to England.

Dr. J. F. Kemp has been retained to make a report on asbestos properties in the Eastern Townships.

Mr. John J. Penhale is engaged in a professional examination of the Jacobs asbestos mines.

Mr. Robert R. Hedley has opened an office in Vancouver, where he will engage in consulting work.

The Engineering and Mining Journal announces that Mr. Frederick K. Brunton has resigned from the testing department of the reduction works at Anaconda, Mont., to accept a position at Greenwood, B.C., as assistant superintendent of the British Columbia Copper Company's smelting works.

Mr. R. P. Cowen, of Montreal, has returned from Europe after an absence of some months.

Mr. M. J. Butler, formerly general manager of the Dominion Steel and Coal Corporation, leaves shortly on a visit to England.

Mr. W. Y. S. Ayres, consulting mining engineer, of Hazleton, Pa., who has been examining coal properties in Alberta for clients, passed through Montreal last week.

Mr. Robert Bryce, of Silverton, Col., recently visited the Cobalt district, where he was formerly manager of the Silver Queen mine.

A SYSTEM OF SAND-FILLING USED ON THE RAND*

By R. E. Sawyer, Associate.

The method of supplying dry sand to a shaft for filling purposes as here described is actually in operation, and, consequently, may be considered to have passed out of the experimental stage. It was the invention of Mr. Girdler-Brown, general manager of the Cinderella Consolidated mine, in the Transvaal, under whose direction the author installed and subsequently operated the plant. The system adopted renders the operation of sand filling at great depths, when, of course, it is most needed, a matter of comparative simplicity, though success was not achieved without considerable thought and much hard work, accompanied by many reverses. In first cost it compares favourably with any other method, no de-watering cones or neutralization process being necessary, and it shows to the greatest advantage when employed in shaft of great depth and in circumstances where continuous filling is not necessary, as interruptions are almost certain to occur from time to time in wet weather, due to an excess of moisture in the sand.

The sand used should not contain more than 5 per cent. to 6 per cent. of moisture, and should have been exposed to the sun and air for at least two days before use; it will then be practicaly free from cyanide and neutral in character. Sand in this condition may be found at the foot of any working dump during fairly dry weather. Sand taken direct from the cyanide tanks was tried, but even after it had been treated with potassium permanganate, considerable quantities of cyanogen were evolved when the sand became mixed with ordinary acid mine water. This action was, however, entirely obviated by exposing the sand to the sun and air, as already mentioned.

The plant was originally laid out with a view to adopting the usual practice in sand filling of running the sand down the shaft already mixed with water, but this idea was found to be impracticable, owing chiefly to the excessive wear of the pipes caused by the great depth through which the mixed sand fell, and the cost of pumping entailed.

When the column first installed was worn out, it was decided to replace this by a square wooden box launder down which the sand should fall unmixed with water. This launder measured 12 in. × 11 in. in cross section, inside measurement, and its cost was approximately 2s. 6d. per running foot. Observation doors were cut at distances of about 100 ft.

The piping and launder from the surface bins were replaced by a belt which conveyed the sand to the top of the box launder. It was found that sand containing no more than 4 per cent. of moisture would run freely from the bins to the belt without handling. On arriving at the head of the launder, the sand falls down the box on to a steeply-inclined iron plate on which a stream of water is made to play. The plate, by the way, should be provided with a liner of the hardest white cast iron to counteract the excessive wear at that point. On being mixed, the sand and water flow into a steeply inclined launder where they undergo further mixture before being conveyed by means of pipes or other launders to the part of the mine requiring treatment. The effective capacity of the plant is controlled by the quantity of water available, as it is found that the delivery of the sand through the vertical box is practically without limit. In the plant now installed, experience shows that the box launder has not appreciably worn, a reason for this being the conduct of the sand, which travels normally down the centre of the box, with little or no impingement on the side. This was proved by examination through the observation doors already alluded to; the sand could be seen falling in a steady stream; the bare hand could be held in the corners of the box, but it was difficult to hold an iron bar across the falling sand in the middle of the launder, and the metal was quickly polished by the rapidly-moving particles. It was noticed that the falling stream of sand created a suction of air down the launder; thus, on opening an observation door no sand escaped, but air was drawn in.

From time to time trouble was caused by the sand containing too great a percentage of moisture. This caused it to adhere to the sides of the launder in gradually increasing quantities until at last the flow was seriously impeded. Under such circumstances, the remedy was to sluice out the box with water from the surface until the adhering sand was washed away. In this connection, experiments were conducted with a view to determining the maximum percentage of moisture which would allow of the sand being run down "dry." The following were the results obtained:

From 0 to 5 per cent. of moisture allowed the sand to fall freely, leaving the sides of the box clear and dry.

*Paper read before the Institution of Mining and Metallurgy.

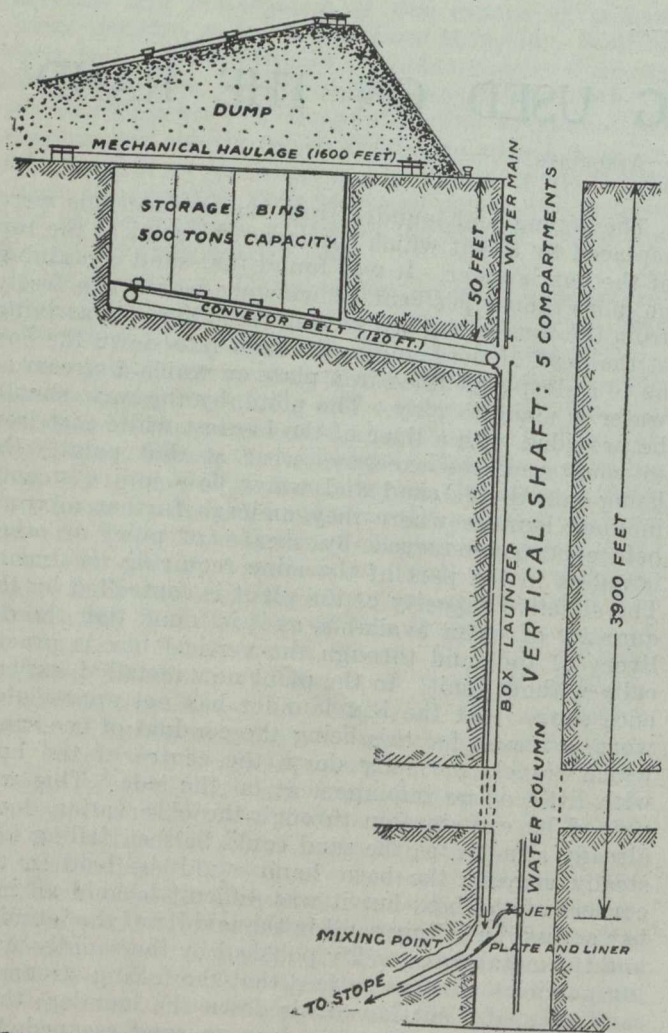
From 5 to 7 per cent. of moisture did not affect the fall, provided that the sides of the box were themselves dry.

From 7 to 9 per cent. of moisture caused the sand gradually to begin adhering to the sides of the launder, where it accumulated slowly.

From 9 per cent. upwards of moisture caused a rapid accumulation of sand along the sides of the launder.

These results were largely influenced, it was found, by the proportion of slime contained in the sand.

The liability of the sand to choke the launder under certain atmospheric conditions renders it essential to have an efficient bell-signalling service between the mining point and the surface bins, as the supply of



Diagrammatic sketch showing arrangement of plant for Sand-filling at great depths. (*Not to scale.*)

sand should be regulated in proportion to the quantity of water available for service. Thus, if the sand is supplied too quickly, it has a tendency to pile up at the bottom of the box launder and choke it, as the water is not in that case sufficient to sluice it away. On the other hand, if the sand appears to be coming down slowly, it may be that a certain proportion is sticking to the sides of the launder, on account of there being too great a percentage of moisture. When this is found to be the case, sluicing must be resorted to as mentioned previously, and must be repeated from time to time as the occasion warrants.

Determined attempts were made to use current sands, direct from the tanks, with a view to saving transport from the dump. It was found, however, that this sand, which contains from 12 to 15 per cent. of moisture, gave constant trouble by adhering to the sides of the launder and forming accumulations. These accumulations happened at various points down the launder, but principally at one point about 600 ft. down. Jets of compressed air were introduced with a view to increasing the velocity of the falling stream, and thus preventing the adhesion of the sand. The box launder was furthermore connected with the intake of a ventilating fan near the bottom, and to a Roots blower at the top, the idea being to dry the sides of the box, and thus prevent the sand from sticking. These devices undoubtedly permitted the use of damper sand than could otherwise have been employed, but they were practically of no avail when the sand contained more than 10 per cent. of moisture, and were, consequently, abandoned after prolonged trials.

Unfortunately, it was found necessary to place the box launder in the upcast side of the shaft and in the same compartment with the pump column. Consequently, the box was always wet on the outside, and the water constantly reached the interior. With sand containing no more than 4 per cent. of moisture this would not give rise to any considerable trouble, especially if the launder has its interior surface planed smooth, and the outside tarred. But in order to deal with sand containing up to a maximum of, say 8 per cent. of moisture, the launder should be placed in the driest compartment available on the downcast side.

There is actually a saving in the quantity of water requiring to be pumped out of the mine when the sand-filling plant is in operation. The sand in the stope probably retains at least 10 per cent. of moisture. The sand as sent down contains on an average 3 per cent., and it is calculated that in the course of a good day's run, the water saved from the necessity of being pumped 4,000 ft. to the surface will amount to something like 8,000 gallons.

The labour required to operate the plant is small. A learner in charge of three boys will look after the belt and surface bins, and the underground part, including the mixing point and the stope to be filled, is in charge of a timberman. The sand is brought from the dump to the surface bins by means of mechanical haulage, the actual shovelling and tipping necessary being done by unskilled labour.

Running Cost per Shift.

	s.	d.
Surface—		
25 unskilled labourers at 1s. 6d.	37	6
1 white boy	5	0
3 natives at 1s. 6d.	4	6
Underground—		
1 timberman	20	0
3 boys at 2s.	6	0
	73	0
Power for haulage, belt, pump—		
23 kilowatts per hour at 0.5617d.	13	0
	86	0

Taking an average of 400 tons per shift, the cost works out at 2.58d. per ton.

GEOLOGY OF A PORTION OF LILLOOET MINING DIVISION, B.C.

Mr. Charles Camsell's report to the Director of the Geological Survey of Canada on the "Geology of a Portion of Lillooet Mining Division, Yale District," is included in the "Summary Report" of the Geological Survey for 1911, recently published. Mr. Camsell's report, in part, follows:

"**Introductory Statements.**—Toward the close of the season a rapid reconnaisance was undertaken into the country west of the town of Lillooet and tributary to Bridge river. This recommaissance was made more to determine the needs of the district for geological work and its importance from a mining point of view, than to undertake any geological examination at the time.

"The Lillooet district lies immediately west of the Fraser river, between latitudes 50 and 51 deg. The town of Lillooet is the only place of importance in the district, and is reached in a day by stage either from Ashcroft or from Lytton, or the main line of the Canadian Pacific Railway.

"Considerable placer mining was at one time carried on in the Fraser valley and other valleys of the district, but this class of work is now almost abandoned. Quartz mining has been attempted at Cayoosh creek, and carried out to a small extent on ledges outcropping at Cadwallader creek and McGillivray creek, but the amount of gold extracted has not yet amounted to a great deal, for the reason that the owners of mines have worked with the most primitive methods and virtually without capital.

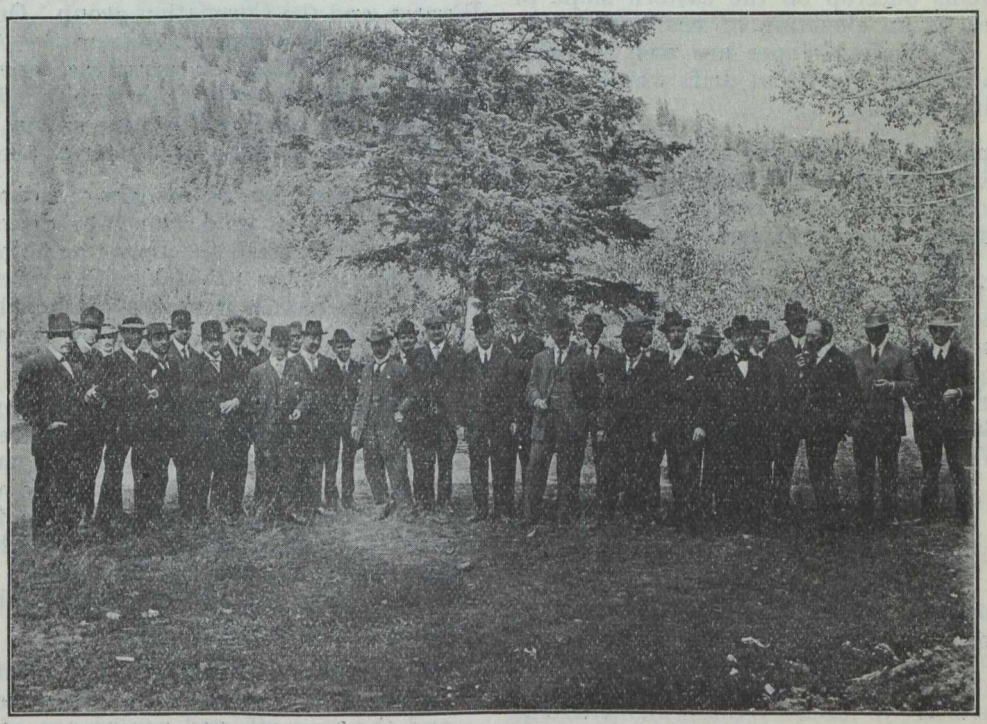
"No geological work had previously been carried out in this district by the Survey, and the only available authentic information is that obtained from the report of the Provincial Mineralogist for British Columbia, who made a brief reconnaissance of the district in the autumn of 1910.

"Eight days were spent in making a rapid reconnaissance of the district with a view to obtaining information on which to base plans for more extended geological and topographical work. The route followed from Lillooet led up Seton lake to the Mission, thence northward across the divide to Bridge river, and up that stream to Cadwallader creek. Three days were spent in an examination of the mines and region adjacent to Cadwallader creek, and the return to Lillooet was made via Cadawallader and McGillivray creeks, and Anderson and Seton lakes.

Topogrophy, etc.—The topography of the Lillooet district is mountainous and becomes increasingly so the westward. The eastern edge of the district, embracing the Fraser valley and the lower part of Bridge river, lies in the Interior Plateau region. The central and western parts lie in the Coast range. These two features merge gradually into each other, the boundary between them following a line running northwest from the town of Lilllooet. Mountain summits in the eastern portion of the district reach an elevation of a little more than 7,000 ft., giving a vertical relief of about 6,500 ft. In the western part of the district many points reach 9,000 ft. and some exceed that elevation, and the maximum vertical relief is more than 8,000 ft.

"The district enjoys a dry, pleasant climate. It does not contain much land suitable for agriculture, and all of it is confined to the bottoms of main valleys. It is a favorite hunting ground for big game parties, and there is an abundance of grizzly bears, goat, deer, and sheep."

After giving some information concerning the general geology of the district, Mr. Camsell deals with its economic geology, as follows:



Canadian Mining Institute, Western Branch Meeting

"**Economic Geology.**—So far as our present knowledge of the economic geology of the district goes, it contains two classes of ore deposits of proven value, namely, gold placer deposits and gold quartz veins.

"Placer deposits have been worked for a number of years at different localities, the most important of which are on Cayoosh creek, Cadwallader creek, Bridge river, and Fraser river. Recently, however, there has not been a great deal of activity in this class of mining, though a number of hydraulic leases and placer claims are still held with the avowed intention of working them.

"No attempt was made by the writer to examine placer deposits, and only a very cursory examination was made of some of the gold-quartz deposits, the intention being to make a fuller examination later.

"Th gold-quartz deposits examined are situated on Cadwallader creek, near its junction with the south fork of Bridge river, and about 75 miles by trail and wagon road from Lillooet. They were discovered in 1897, and since 1898 have been worked every season.

"The quartz veins outcrop on the eastern slope of Cadwallader creek at an elevation of nearly 4,000 ft. above sea-level. The valley slopes are well forested and covered with a heavy mantle of drift which makes surface prospecting difficult.

"The rock formation in which the quartz veins lie is a diorite consisting essentially of feldspar and hornblende. It has a stocklike form elongated in a northwest-southwest direction, and extends from Bridge river up to the Pioneer mine on Cadwallader creek, with a width of probably half a mile. In texture and relative proportion of its constituent minerals it is variable, and in structure massive, though traversed by a network of small quartz veinlets. The ore-bearing veins are of later formation than the veinlets and run in two well-marked directions, namely, N. 20 deg. E. and N. 80 deg. W. magnetic.

"The dioritebis intrusive on the southwest into serpentine, and on the northeast into black and grey slates and andesites, which belong to the lower Cache Creek formation. The diorite probably belongs to the same period of intrusion as the Coast Range batholith, but is older than other plutonic igneous rocks in the district.

"The ore deposits are in fissure veins, which traverse the rock in two main directions, namely, N. 20 deg. E. and N. 80 deg. W. magnetic. They range in width from a few inches up to 6 and 8 ft., and are remarkable for their regularity in dip and strike. The N. 30 deg. W. system of fissures appears much stronger than the other, and one fissure, at least, has been traced for about 1,500 ft. along the surface.

"The ore itself consists of a gangue of white quartz containing pyrite, tetrahedrite, and free gold sparingly disseminated through it. If often has a well-marked banded structure, indictating deposition in an open fissure. The walls of the veins are clean and their faces show some movement along the plane of the vein. The wall rock has been somewhat altered by vein solutions, and contains much crystalline pyrite derived from the vein.

"Free gold can be seen in many of the veins, and can be obtained by panning from almost any of the outcrops. In places the ore is exceedingly rich.

"It would be difficult to give an estimate of the average value of the ore in this camp, because of its richness in certain places and leanness in others. It is safe to say, however, that some of the oreshoots mined must have yielded $50 or more to the ton, while at the same time no parts of the veins so far mined have proved to be entirely barren of gold.

"The mineral claims on which quartz veins are known to outcrop and the number on each claim are as follows:

	Veins.
Lorne group	5
Blackbird	4
Coronation group	2
Pioneer	2
Ida May	2
Countless	2
Forty Thieves	1

"At the present time the only claims on which much development work has been done and from which gold has been extracted are: The Lorne group, the Pioneer, and the Coronation group. On all of these the gold was at first extracted from the ore by the crude method of milling in arrastras operated by water power. More recently a 5-stamp mill has been erected at the Lorne, and a 10-stamp mill at the Coronation group. Both of these use water as the motive power.

"It is stated by the owners of mines in the district that the yield in gold, since the discovery of the deposits in 1897, from the Lorne and Coronation groups alone, amounts to $155,000. The official report, however, of production from the whole Lillooet district up to 1910, is given by the Provincial Department of Mines as $137,744.

"The conclusions drawn from the brief examination made of Cadwallader creek district are that it contains some promising properties, which, if not burdened with too heavy a capitalization, could be worked so as to yield a fair margin of profit; also that further prospecting in the diorite should disclose other gold-bearing quartz veins, because all the ground likely to prove productive has not yet been thoroughly prospected on account of the covering drift.

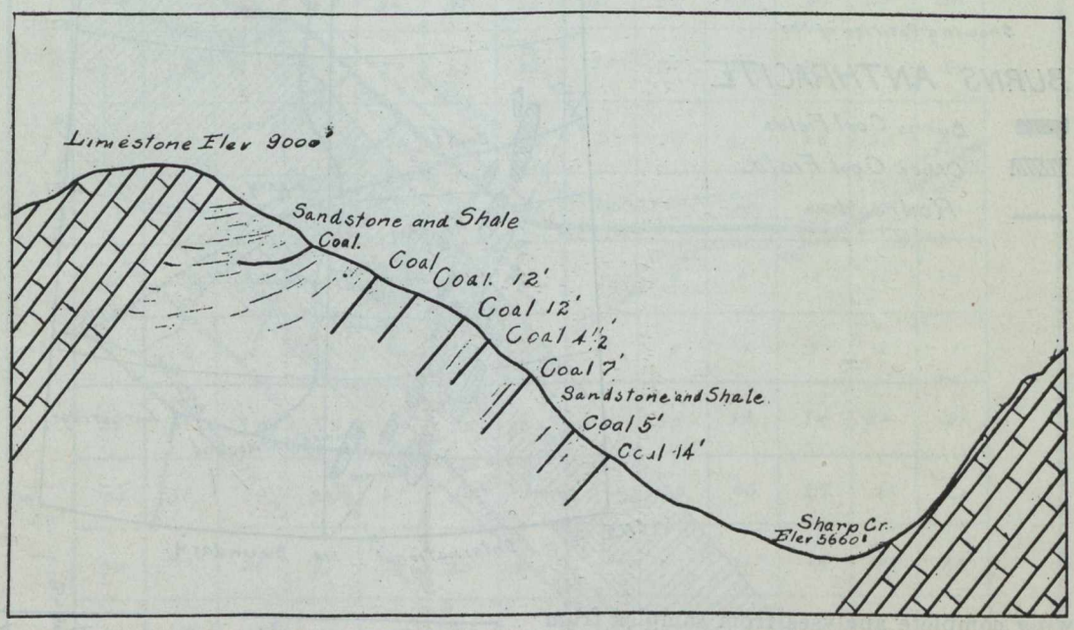
"A promising feature of the deposits is the number of known quartz veins—all of which contain some gold—and the strength and persistence of some that have been followed out. If the depth to which the veins will extend is proportional to the length of their outcrop, then there is hope that they will continue to considerable depth, since the country rock in which they occur is plutonic, and of deep-seated orgin.

"The diorite is the only formation in that district, from which gold ores have been mined, and it is stated that no workable deposits have yet been found in the slates and serpentine through which the diorite is intruded. Gold-bearing quartz veins, however, do occur in the slates, but they have not proved to be as strong and persistent as those in the diorite and are on that account less promising."

Mr. John E. Hardman left Montreal on November 27th for Mexico to examine tin properties under option to a Montreal syndicate.

THE BURNS ANTHRACITE MINES, SHEEP CREEK

The Burns Anthracite mines are among the most important properties that have been opened in the Province of Alberta within the last few years. The mines are situated near the headwaters of the south branch of Sheep Creek, Townships 18 and 19, Range 6, 7 and 8 west of the fifth meridian, the nearest railway towns being Okotoks and Calgary, each distant about 45 miles. The following information respecting the structural features and character of the coal in the area was presented in a paper read before the Western Branch of the Canadian Mining Institute, and now published with the permission of the Institute and of the author.



Section of Coal Measures at Sharp Creek

Sheep Creek is a stream of considerable size, which rises on the southern slopes of Mount Rea and Mount Tombstone. Flowing from the west and into Sheep Creek are several smaller creeks, known as Ross, Rickert, Charp, Wilson, Stewart, Burns and McKenzie Creeks, in the order named from the south. These creeks cut down into the coal formation several hundreds of feet, showing the coal measures to fine advantage. The valley of Sheep Creek is about one mile wide and six miles long where it runs through the property. It is flat-bottomed and contains some timber and a fine growth of bunch grass.

The coal measures have been placed by the Geological Survey of Canada as belonging ot the Lower Cretaceous period. (Kootenay Series). The formation comprises about 400 feet of sandstone, dark shale, conglomerates, and, near the base, some clay and ironstone. At intervals in the strata occur the coal seams and coaly shales, the whole resting on the carboniferous lime. This coal area is about eleven miles long and from one mile to three miles broad, and occurs in a depression between the first limestone range on the east, and the Mist range on the west.

The property consists of 48 coal claims of 320 acres each, in all 15,360 acres of Crown-granted land, beside an area of land leased from the Dominion Government. The measures lies in a long, narrow, synclinal trough, striking north 42 degrees west, and dipping to the westward at an angle varying from 52 to 80 degrees. The southeastern outcrops of coal upon the mountain sides, are at elevations of from 300 to 2,000 feet above the valley of Sheep Creek. But towards the north, at Burns Creek, the coal seams come down to the level of the valley and have every indication of going much deeper

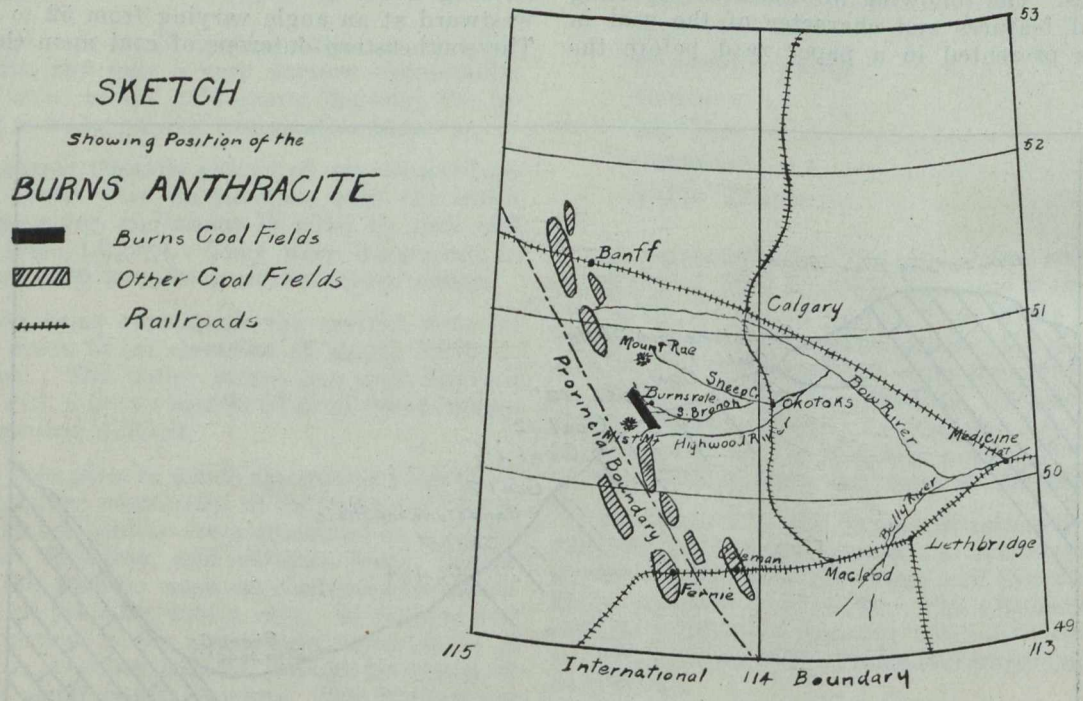
Ten or twelve seams of coal have been exposed on the several creeks and have been traced, by drifts and open cuts, for a distance of five miles. These exposures show that there is fully 100 feet of coal in the measures. The class of coal may be noted from the following analyses, sampled by the writer and assayed by J O'Sullivan of Vancouver, and A. McKillop, of Nelson, B.C. The seams sampled are from 4 ft. 6 in. to 20 feet in thickness.

	Moisture.	Volatile.	Fixed Carbon.	Ash.	Sulphur	B.T.U.
Sharp Creek	1.00	12.6	76.6	9.00	0.8	
	1.50	13.1	74.6	10.00	0.8	
	2.00	13.2	76.7	7.6	0.6	
	1.00	13.5	81.00	3.5	1.00	
	1.00	12.5	82.00	3.5	1.00	14,877
	1.00	12.5	81.5	4.00	1.00	

	Moisture.	Volatile.	Fixed Carbon.	Ash.	Sulphur.
Sharp Creek	1.00	11.1	81.1	6.00	0.8
Ross	1.50	9.6	71.1	17.00	0.8
Rickert	1.00	12.7	78.2	7.5	0.6
Burns	1.50	12.1	80.1	5.5	0.8
McKenzie	1.00	12.6	78.0	7.6	0.8
	1.00	11.65	70.65	16.0	0.7
Rickert	1.76	11.17	81.56	5.51	0.0
	1.81	11.74	82.35	4.20	0.0
	2.10	13.43	79.84	4.63	0.0

	Moisture.	Volatile.	Carbon.	Ash.	Sulphur.	B.T.U.
A.	1.27	11.98	83.22	4.76	0.57	14.877
B.	0.50	8.00	83.50	8.76	0.14	14.00
C.	8.34	5.42	81.38	4.86	0.98	13.17
D.	3.39	3.81	83.79	8.14	0.59	13.999
E.		7.495	88.16	3.099	1.247	14.884

The structure of this coal is slightly different from that of the best known anthracite. Much of it is jet black and it burns with a feeble blue flame and has great calorific values. According to Dana, good anth-



The following complete analyses from samples from a 7-ft. seam on Rickert Creek were made by A. McKillop, of Nelson, B.C.

	Water.	Carbon.	Ash.	Sulphur.	Hydrogen.	Oxygen & Nitrogen	Coke
Rickert	0.98	84.77	5.42	0.18	3.63	4.48	90.64
	1.02	87.24	5.92	0.18	2.92	3.24	92.81

It will be noticed that some of the seams may be classed as good anthracite. Many of the samples analyzed were taken from the weathered outcrop coal, somewhat robbed of its caloric qualities by long exposure to atmospheric conditions. As already noted the B. t. u. in one pound of coal are 14,877. One pound of this coal, according to tests by Mr. J. O'Sullivan evaporated 15.4 lb. of water. Compared with other coals this may be classed as one of the best in the world, as the following table will show:

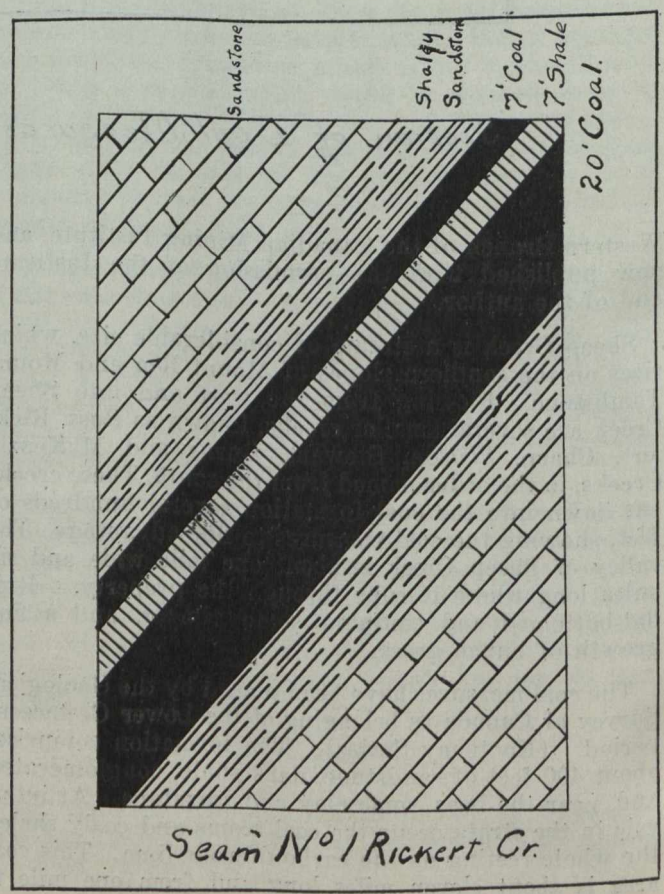
A. Burns anthracite (Alberta) six average samples. (O'Sullivan analyses).

B. Bankhead anthracite (Alberta) Gov. Report Canadian Mining 1907-1908.

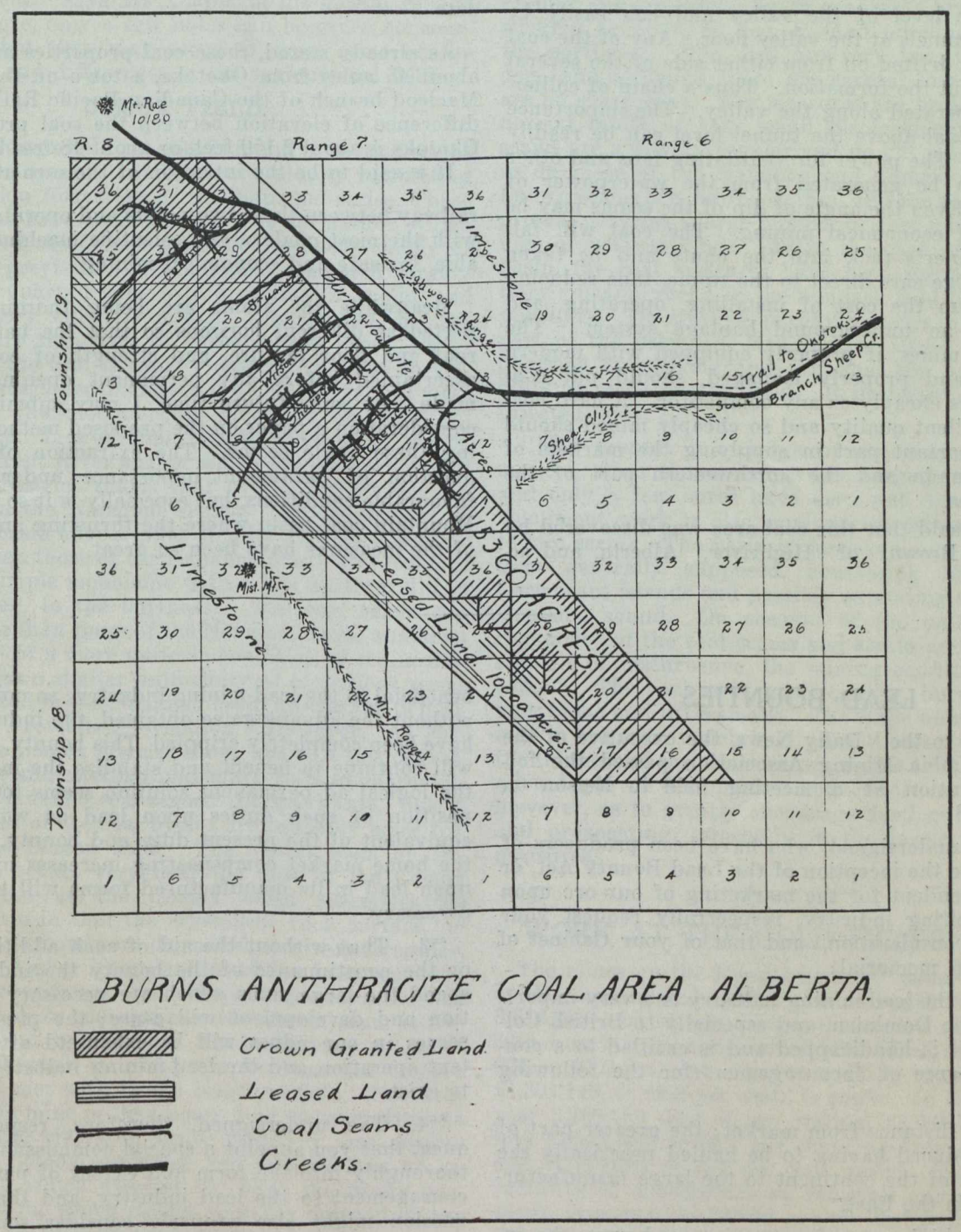
C. Bering River anthracite (U. S. Geol. Report of Controller Bay Coal '08).

D. Penna. anthracite, 9 samples, Geol. Survey Report Penna., 1885.

E. South Wales, England, 10 samples Andres Treatise Vol 1.



racite should contain from 78 to 88 per cent. fixed carbon, the average being about 83 per cent.; from 3 to 4 per cent. hydrogen; from 4 to 6 per cent. oxygen, and from 4 to 7 per cent. earthy matter, and not more than one per cent. sulphur. By comparing the statement of this authority with the analysis of coal taken from Seam No. 1 on Rickert Creek, it will be seen that in place. It is evident that the Sheep Creek anthracite coal measures are a northern extension of the same Cretaceous series as the Crow's Nest Pass coal fields; the coal having been changed from bituminous as at Fernie, to anthracite as at Sheep Creek, by the superincumbent pressure and metamorphosis, caused by the upheaval of the limestone range. It is apparent that



this coal may be classed as a good anthracite. There is no hard coal in Canada that is its superior.

The late Dr. Dawson in his report on the Crow's Nest Pass coal lands and Cascade Basin sections, mentions having been to the headwaters of Sheep Creek, during the summer of 1884 (Part B, Annual Report 1885, pp. 101 to 168 B). He remarks that loose fragments of coal found in the upper part of Sheep Creek, in the northern extremity of the Crow's Nest trough, show a tendency to become anthracite but the beds were not found

the future development of these coal areas will show the lower seams to be anthracite and the upper seams bituminous, as the pressure and heat were greater at the lower seams. The future shipments from these mines may include anthracite, steam and coking coal.

It is difficult to arrive at the amount of coal that could be extracted from this area, owing to the limited amount of work done. But it appears that the coal seams are in an unbroken condition throughout the full length of the property, a distance of 11 miles,

and outcrops from 1,000 to 2,000 feet above the level of the valley; that there is likely to be found an aggregate of 12 or 15 coal seams that will give a tonnage amounting into the hundreds of millions of tons, which would be able to maintain an output of 10,000 tons daily for many generations.

The topography of the country is all in favour of economical mining. A number of the coal seams come down to the level of the valley and can easily be reached by tunnels at the valley floor. Any of the coal seams can be drifted on from either side of the several creeks that cut the formation. Thus a chain of collieries can be operated along the valley. The importance of so much coal above the tunnel level can be readily appreciated. The power for ventilating fans and other purposes can be generated from the waterpower of the creeks. Even the angle of dip of the seams may be in favour of economical mining. The coal will fall from the miner's pick into the chute and be taken thence by large cars direct to the tipple, thus reducing to a minimum the cost of installing, operating, and maintaining an underground haulage system. The Burns' coal mines, if properly equipped with modern machinery, and properly managed, should put coal on the cars as cheaply as any competitor. A hard coal of such excellent quality and so cheaply mined should play an important part in supplying the markets of Western Canada and the northwestern part of the United States.

It may be said that this coal area was discovered by Ricker tand Brown, of Highriver, Alberta, and acquired by Patrick Burns, of Calgary, Alberta. But to the late lamented Dr. Dawson belongs the honour of being the first white man to explore the headwaters of Sheep creek. Had Dr. Dawson descended Rickert or Sharp creek instead of Burns creek, as he appears to have done, he would have seen the great thick seams of beautiful coal exposed on these creeks, and the history of Sheep creek would be written differently at this date.

As already stated, these coal properties are situated about 45 miles from Okotoks, a town on the Calgary-Macleod branch of the Canadian Pacific Railway. The difference of elevation between the coal property and Okotoks is about 2,150 feet, or about 48 feet to the mile. It is said to be the intention of the owner to build a railway between these two points and operate the mines with the most modern and scientific machinery obtainable, for safe and economical mining.

Meanwhile the seams are being thoroughly prospected at different horizons so that the nature of the roof and floor texture, and strength of coal may be ascertained before any permanent opening shall be made. At some future time, I may submit for your consideration a paper on the proposed method of working these angle seams. The extraction of coal is a question of paramount importance under the most favourable conditions, but especially is it so in a Rocky Mountain coal basin where the thrusting and uplifting of the measures have been so great.

LEAD BOUNTIES

According to the "Daily News, the executive of the British Columbia Mining Association passed the following resolution at a meeting held in Nelson on November 18:

"We, the undersigned, who have been producers of lead ore since the inception of the Lead Bounty Act, or who are dependent for the marketing of our ore upon the lead-smelting industry, respectfully request your favourable consideration, and that of your Cabinet of the following memorial:

"1. That the lead-mining industry is a very important one to the Dominion, and especially to British Columbia, but it is handicapped and is entitled to a considerable degree of encouragement for the following reasons:

"(a) The distance from market; the greater part of the lead produced having to be hauled practically the whole width of the continent to the large manufacturing centres in the East.

"(b) The high rate of wages imposed upon the industry by the scale current in similar mines in the United States, which mines by reason of the United States lead tariff obtain far higher prices for their product, the average difference during ten years ended with 1911 having been more than $20 per ton.

"(c) The tariff upon supplies and machinery used by those engaged in the industry.

"2. That the lead bounty, which will be discontinued under the present Act at June 30, 1913, as, by insuring a stable minimum price, been exceedingly beneficial to the lead-mining industry; so much so, that, without the advantage so obtained, the industry would have been completely crippled. This bounty, if renewed, will continue to benefit and stabilize the industry, but the logical ad permanent solution seems to be the imposition of such duties upon lead as would be the equivalent of the present duty and bounty. To retain the home market compensating increases in the duties upon lead in its manufactured forms will then also be necessary.

"3. That without the aid of such additional duties or the constinuance of the bounty the inducement to spend the large sums which are necessary in exploration and development will cease; the present ore reserves in our mines will be exhausetd after intermittent operation and the lead-mining industry will cease to exist.

"4. The undersigned, therefore, respectfully request that you appoint a special commission to enquire thoroughly into the form and extent of permanent encouragement to the lead industry, and that this commission might also properly consider some form of encouragement to the zinc-mining industry, zinc-mining being closely allied to lead-mining and at present is conducted in British Columbia under very great difficulties.

"5. That pending the submission to you of the report of such commission and until such time as their recommendations may be made effective by legislation, we respectfully request that the present Lead Bounty Act, expiring June 30, 1913, be extended, but only as to the then uneared balance remaining of the original amount set aside."

GEOLOGY OF COMOX AND SUQUASH COAL FIELDS, B.C.

"The Comox and Suquash coal fields, Vancouver island, were visited by Mr. Chas. H. Clapp, of the Geological Survey of Canada, in order to compare their geological conditions with those existing in the Nanaimo field," says Mr. Clapp, in his official report, and, therefore, only a few notes can be given concerning them, but they may serve to show some of the similarities and differences of the various coal fields.

COMOX FIELD.

"In the Comox field the coal is found in several seams that occur in a sandstone formation closely resembling the Protection formation of the Nanaimo series. Three of the seams have been mined. The formation, which may be called the Comox formation, consists chiefly of a white or greyish-white sandstone, composed largely of rounded quartz grains with a coating of kaolin, and with accessory chloritic micas. Interbedded in the sandstone are thin beds of carbonaceous sandy shale, with which the coal is usually associated. The formation has a maximum thickness of about 800 ft. and rests directly on the metamorphic volcanics of the Vancouver group. It is overlain by a thick group of shales, called the Trent River shales, which are very much like the Cedar District shales that overlie the Protection sandstone in the Nanaimo district. The sediments of the Comox basin have a much simpler and more regular structure than those of the Nanaimo basin, and form, in general, a simple monolcine with a low uniform dip of about 10 deg. to the northeast. The coal seams are more regular than those of the Nanaimo basin, and must be the result of a more uniform condition of sedimentation, although a similar uniformity of conditions seems to have existed in the Nanaimo basin during the deposition of the Protection formation. However, the coal seams of the Comox district show, but to a less degree, the pinching and swelling and sharp rolls so characteristic of the Nanaimo coal seams. Large 'wants,' due to a replacement of the coal by silt are probably more frequent in the Comox field. The lowest seam of the former field occurs very near the base of the Comox sandstone, and as the Comox basin resembles the Nanaimo basin in that the crystalline rock surface, on which the sediments were deposited, was very irregular, many of the higher irregularities of the base remained above the depositional level when the lowest seam was deposited, and, in consequence, the lowest seam is frequently cut out by knobs of the underlying volcanics projecting through it. There is also another feature which is not met with in the Nanaimo field. North of the producing mine in the Comox field, between Browns and Puntledge rivers, a dacite porphyry has broken through the Comox sandstone and forms a flow or intrusive sheet, which overlies it. Near the decite porphyry intrusion, which occurs near the outcrop of the lowest seam on Browns river, the coal is broken, partially coked, and rendered valueless. It is probable that the intrusion of dacite porphyry occurred in early Tertiary times and was a phase of the widespread Eocene volcanic activity.

SUQUASH FIELD.

"Conditions in the Suquash field are similar in many respects to those in the Comox field. Several seams of coal occur in a formation consisting chiefly of a grey, siliceous sandstone resembling that of the Comox and Suquash sandstone are, however, thicker, and more numerous, and the shale is finer-grained and more plastic, some of it being a clay shale apparently of excellent quality. The structure of the measures is very regular and appears to be, in general, a broad syncline, striking about N. 60 deg. E., and pitching slightly to the northeast. The dips are very low, less than 10 deg., and although there are several local rolls there are no sharp ones. The measures are broken by a few normal faults of very small displacement. The coal seams are also very regular and do not pinch and swell as do those of the Nanaimo and Comox basins. The known seams are, however, thin, and the seam mined at present contains a large number of very persistent partings of various kinds. As in the case of the Comox basin, the coal measures have been intruded by Tertiary volcanic rocks, in the Suquash field by a trachyte porphyry. The trachyte porphyry occurs in the southern part of the basin on Haddington island, where it is quarried extensively and furnishes the best grade of building stone on the coast. It probably occurs as an injected body.

"The present knowledge of the Suquash field is meagre, since the measures are largely drift-covered and only a few bores have been put down. The development work is also small in amount and confined to two seams. The basin is, however, somewhat larger than generally supposed, containing Malcolm and Cormorant islands and possibly extending southwest to Quatsino sound. On account of the uniformity and regularity of the coal seams and strata and their small amount of disturbance, the mining conditions are excellent. The coal is of good quality, burning with a long flame and little smoke. The large number of partings in the seam which is at present being worked, and the thinness of the other known seams are the chief disadvantages of the field. The conditions are much, however, as to greatly encourage further development and prospecting, especially in the lower part of the measures."

WORK AT THE GOLD FIELDS' MINES

The mines on the Rand which are under the control of the Consolidated Gold Fields of South Africa milled 3,616,330 tons of ore during the twelve months ended 30th June last for a yield of £3,975,167, of which £2,671,-024, or 67.2 per cent., went to working expenditure, and £1,304,143, or 32.8 per cent., to profit. In the preceding year 3,269,160 tons of ore realized £3,931,748, divided into £2,543,052, or 64.7 per cent., working expenditure, and £1,388,696, or 35.3 per cent., profit. Working costs, exclusive of expenditure on renewals and additions to plant, averaged 14s 9.264d per ton last year, as against the average of 19s 2.5d per ton for the 21,417,148 tons milled by the other mines of the Rand for the same period. The average value of the residues from the Gold Fields' mines has been reduced by 2.716d, equal to a total amount of £40,925, and at the same time the average metallurgical costs have been decreased by 1.923d per ton milled, equal to a total amount of £28,976. The average metallurgical costs for the past year, which include the cost of crushing, sorting and surface transport of ore, were 3s 8.264d, and the average residues 0.301 dwt. per ton milled, or a recovery of 94.569 per cent.

WHIPSAW CREEK DISTRICT, SIMILKAMEEN, B.C.

In the "Summary Report" of the Geological Survey of Canada, lately issued, Mr. Charles Camsell thus briefly describes a part of Similikameen district of British Columbia:

"Whipsaw creek is a tributary of the Similkameen river, lying to the northeast of the Skagit district. Claims were taken up at the head of this stream in 1908 and 1909, and a certain amount of prospecting and development work done on them. They lie on either side of the main Dewdney trail and are most conveniently reached from Princeton, which is distant about 20 miles.

"In this area a gneissic granodiorite is intrusive into hornblende and chlorite schists, which strike N. 20 deg. W. and dip to the west. The granodiorite has produced considerable contact metamorphism in the schists and sends many apophyses into them. Both rocks are traversed by acid dikes.

"The mineral deposits belong to one type, namely, fissure veins containing lead and zinc. The veins are found in the schists in the zone of contact metamorphism, and occupy a cognate set of fissures striking N. 2 deg. W. and N. 45 deg. W. Fissuring and ore deposition are probably both connected with the intrusion of the granodiorite.

"**Lucky Pair Group.**—The Lucky Pair group consists of three mineral claims lying on the south side of Whipsaw creek. Most of the development work on this group was concentrated in a tunnel 230 ft. in length. Owing to a miscalculation this tunnel does not cut the vein, which was afterward found by a 10-ft. crosscut 45 feet from the tunnel entry.

"The ore deposit is a well-defined fissure vein, 18 in. wide, in a zone of brecciation, cutting the schists and striking N. 45 deg. W. The veins has a banded structure, and is filled with zinc blende, galena, chalcopyrite, and pyrite, in a gangue of quartz. The whole is greatly oxidized and much of the sulphides has been leached out. The deposit is of low grade and the chief valuable metal is silver.

"**Marian Group.**—The Marian group consists of five mineral claims situated on the north side of Whipsaw creek, near its head. The country rock in these claims is granodiorite, in which are exposed three distinct veins, respectively, 36, 34, and 12 in. in width. They all contain blende, galena chalcopyrite, and pyrite, in a gangue of quartz, and are much altered by surface oxidation. Samples taken for assay show the ore to be very low grade.

"**S. and M. Group.**—The S. and M. group joins the Marian group on the east and is developed by a number of open-cuts and three short tunnels. The country rock is a schist, the surface of which is very much decomposed, and holds hard nodules of ore. None of the tunnels have penetrated into the solid rock beyond the zone of oxidation."

CHARACTERS ON THE COBALT SILVER ORES

Reginald E. Hore, Houghton, Mich.

The silver in ores of the Cobalt district occurs almost entirely as the native metal. There are numerous compounds of silver occurring in the ores, but they are present in very small quantity and are the source of a comparatively insignificant amount of the precious metal.

The silver is always found intimately associated with arsenides and cobalt and nickel. These metals are commonly present as constituents of smaltite, smaltite-chloanthite, and niccolite.

The gangue minerals are dolomite and calcite. Quartz occurs, but is an important constituent in but few of the veins.

The ore occurs chiefly in the form of very high grade, but very thin veins. The high grade ore shipped averages over 1,000 ounces per ton. For instance, that produced by the Crown Reserve mine during 1911 averaged 4,641 ounces per ton. The veins furnishing this ore are commonly only a few inches in thickness and the ore shoots are usually small.

The veins are in most cases vertical, or nearly so. The richest and most numerous veins are in Huronian sediments. A smaller number of veins in the Keewatin complex and the Keweenawan diabase have contributed to the output of the high grade ore. The veins in the Keewatin are as a rule much less regular than those in the Huronian.

On either side of many of the rich veins there are payable amounts of silver in the country rock. In some cases the wall rock is remarkably barren; but in most cases there is milling ore for a foot or two on each side of the high grade ore, and in some cases the wall rocks are being stoped for a total width of 20 feet.

The silver in the wall rock occurs almost entirely as a filling in minute crevices. It is rarely distributed through the rock, as though it had replaced the rock constituents, but is rather present as a simple deposit in small joints and fissures. In milling ore, carrying 30 or 40 ounces per ton, there is usually silver visible in the form of small flakes on the natural cleavage faces of the rock. In a few instances good assays are obtained from ore which shows no silver to the naked eye, and it is possible that this unusual ore may contain silver as a replacment of the rock constituents rather than as a simple filling.

In the milling ore in some workings there is frequently to be seen ruby silver in the form of a thin reddish film. It is in a fine state of division, and ore containing it presents the appearance of having been coated with thin red paint. This ruby silver is naturally difficult to recover, and much of it escapes in the mills. Appreciable increases in the values in slime tails are noticed when an unusually large amount of such ore is being concentrated.

In the mines it is frequently found that there are several thin veins of high grade ore spaced a few feet apart. In such cases the rock between the veins usually contains enough silver to make it workable. Many of the wide stopes show two or three veins, often less than one inch in width, separated by rock which has small amounts of visible silver on its cleavage faces.

That the silver is usually in the form of a filling rather than as replacement, is shown by the experience in treating broken rock of different sizes. It has been found in two mines that in mining low grade ore that which breaks into large blocks, because of less fissuring, contains much less silver than does the fines. One reason for this is that some fines from high grade ore is mixed with fines from the low grade; but it is also noted of ore in which no high grade is visible. In one mine the large blocks of such rock are being left in the mine, while the smaller sizes are being profitably milled. Tests at one plant in sorting the smaller sizes of low grade ore before crushing, did not give results to warrant such sorting. It was found that considerable barren rock could be picked out from the diabase ore, but not from that which was present in the Huronian or Keewatin rocks.

For some time the only silver sent out from Cobalt was in the form of high grade ore which was smelted at American furnaces. Later four plants were erected for the treatment of such ores in Canada. Some low grade ores are shipped to American smelters to be treated with other ores.

Milling at Cobalt became important in 1909, and since then a constantly increasing percentage of the shipments has been concentrates. At the cyanide plants the recovery from low grade ore has been shipped in the form of bullion. During the past year a great increase in the amount of bullion shipped has resulted from the introduction of the Nipissing's amalgamation-cyanidation method of treating high grade ore. Another, but comparatively small contribution to the bullion output, results from the recovery of metallics in Campbell and Deyell's sampling plant.

The character of the shipments for the several years since the discovery of the deposits is shown by the following table taken from the report of Thos. W. Gibson, Deputy Minister of Mines.

Contents of Ore Produced During Years 1904-1910.

Year.	Shipments ore and concentrates. Tons.	Nickel. Tons.	Nickel. Value.	Cobalt. Tons.	Cobalt. Value.	Arsenic. Tons.	Arsenic. Value.	Silver. Ounces.	Silver. Value.	Total Value.
1904	158	14	$3,467	16	$19,960	72	$903	206,875	$111,887	$136,217
1905	2,144	75	10,000	118	100,000	549	2,693	2,451,356	1,360,503	1,473,196
1906	5,335	160	....	321	80,704	1,440	15,858	5,401,766	3,667,551	3,764,113
1907	14,788	370	1,174	739	104,426	2,958	40,104	10,023,311	6,155,391	6,301,095
1908	25,624	612	....	1,224	111,118	3,672	40,373	19,437,875	9,133,378	9,284,869
1909	30,677	766	....	1,533	94,969	4,294	61,039	25,897,825	12,461,576	12,617,580
1910	34,282	604	....	1,098	54,699	4,897	70,709	30,645,181	15,478,047	15,603,455
Total	113,008	2,601	14,641	5,049	565,872	17,891	231,679	94,464,189	48,368,333	49,180,525

Note.—The production of 1910 includes 980,633 ounces bullion.

*From report of Thos. W. Gibson.

The returns for arsenic, cobalt and nickel, present in large quantity in the ores, are very small. Regarding these metals Mr. Gibson writes in his report:

"Data are not entirely wanting with regard to the arsenic contents of the low grade ores smelted in the United States. The United States Metals Refining Company of New York, whose works are at Chrome, N. J., smelted up to 31st December, 1910, 10,462 tons of Cobalt ore averaging 221.3 ounces of silver and 2.87 per cent. of arsenic. The American Smelting and Refining Company at their Denver, Col., works up to the same time smelted 28,097 tons containing an average of 184.3 ounces of silver and 4.19 per cent. of arsenic. Thus, these two companies found an average of 3.82 per cent. of arsenic in 38,559 tons of ore, whose silver contents averaged 194.4 ounces per ton. Assuming that the proportion between arsenic on the one hand, and cobalt and nickel on the other, was the same in these low grade ores as in the high grade material treated by the Ontario smelting companies, 3.82 per cent. of arsenic would imply the presence of .833 per cent. of cobalt, and .458 per cent. of nickel.

"If, then, the arsenic contents of the entire production at Cobalt were known, we could arrive at a fairly close approximation of the cobalt and nickel output; but this factor in the problem is wanting. Say, however, that of the 27,437 tons of ore shipped out in 1910, in addition to the concentrates, one-fourth was high-grade, and three-fourths low grade. This would give 6,859 tons of the former and 20.578 of the latter. Adding the concentrates, 6,845 tons, to the high grade ore, we have 13,704 tons of material containing 6.76 per cent. cobalt, 3.72 per cent. nickel, and 30 per cent. arsenic; and 20,578 tons containing, as we have assumed, .833 per cent. cobalt, .458 per cent. nickel, and 3.7 per cent. arsenic. The yield of the several substances would, therefore, be:

	Cobalt. Tons.	Nickel. Tons.	Arsenic. Tons.
High-grade ore, etc.	926.39	509.78	4,111.20
Low-grade ore, etc.	171.41	94.24	786.07
Total	1,097.80	604.02	4,897.27

or for the entire product of the mines for 1910, namely, 34,282 tons of ore and concentrates, an average of 3.20 per cent. cobalt, 1.47 per cent. nickel and 14.28 per cent. arsenic. For arsenic the figures are practically the same as were assumed in last year's report, namely

14 per cent., but are somewhat lower for cobalt and nickel, the assumed percentages being then 5 and 2½ per cent. respectively."

The following figures from the report of the La Rose mine give some idea of the character of the ore shipped and the cost of mining and marketing it:

Shipments.

	Dry Tons.	Net Value Per Ton.	Ounces Silver.	Net Value.	Per Cent. of Total Net Value.
Silver-Cobalt-Nickel Ore	1,770.995	$861.36	3,066,489.51	$1,525,455.10	75.7
Low Grade Silicious Ore	603.204	76.93	112,066.79	46,403.21	2.3
Nuggets	12.262	11,864.06	274,598.53	145,477.16	7.2
Concentrates	1,174.951	252.82	639,554.50	297,056.02	14.8
Total	3,561.412	$441.62	4,092,709.33	$2,014,391.49	100.0

Average Assay of Shipments.

	Ozs. Silver Per Ton.
Silver-Cobalt-Nickel Ore	1,731.51
Low Grade Silicious Ore	185.79
Nuggets	22,394.27
Concentrates	544.32
Average of Total	897.25

Summary of Shipments, 1911.

Dry Tons Shipped	3,561.412
Gross Ounces Silver Contained	4,092,709.33
Gross Silver Value	$2,191,524.34
Average Price Received per ounce—cents	53.55
Smelter Deduction, Freight and Treatment	177,132.85
Net Value Received from Ore Sales	$2,014,391.49

Cost of Producing Silver.

Based on 3,429.514 tons containing 3,691,797.26 ozs.

		Per Ton Shipping Ore.	Per Oz. Silver.
Mine Operation—			
Trenching	$5,717.12		
Development and Exploration	125,474.78		
Stoping	59,408.01		
Tramming	54,325.59		
Timbering	16,149.17		
Hoisting	19,715.32		
Pumping	6,887.29		
Ore Sorting and Loading	48,016.91		
Assaying and Engineering	4,783.08		
Administration and Office	28,560.17		
Boarding House Expense	13,461.66		
Insurance and Taxes	30,298.52		
General Expense	12,299.33		
	$425,096.95	$123.95	$ .1151
Concentration	109,515.65	31.93	.0297
Depreciation	13,501.82	3.94	.0037
Marketing Ore	187,815.28	54.77	.0509
Corporation and Traveling Expense	2,673.24	.78	.0007
	$738,602.94	$215.37	$ .2001
University Mine Account	437.82	.12	.0001
	$739,040.76	$215.49	$ .2002
Less Rents, Interest and Discounts	30,361.86	8.85	.0082
Total Cost of Production	$708,678.90	$206.64	$ .1920

Marketing Expense on Production.

		Per Cent. of Gross		Per Cent. of Gross
Gross Silver Value	$101,559.80	5.14		
Value of Smelter Deduction on Silver			$1,977,764.67	100.00
Treatment Charges	26,159.72	1.32		
Freight	39,575.04	2.00	167,294.56	8.46
Net Received from Ore Sales			$1,810,470.11	
Assaying, Sampling, Smelter Representatives and Ore Insurance	20,520.72	1.04		
Total Marketing Expense	$187,815.28	9.50		

The remarkable results obtained in mining the ex-ceptionally rich ore at the Crown Reserve Mine are indicated by the following tables:

Total Shipments to Date.

Year.	Dry Weight. Tons.	Gross Ounces.	Gross Value.	Net Value.
1908.....	650.78	1,798,954	$ 910,350.62	$ 854,788.89
1909.....	3,093.00	4,034,325	2,080,156.08	1,895,484.92
1910.....	2,753.00	3,248,196	1,757,824.27	1,633,716.66
1911.....	7,545.37	3,430,902	1,833,516.80	1,751,300.21
	7,545.37	12,512,377	$6,581,847.77	$6,135,290.68

Average Cost of Silver to Date.

Year.	Production. in Ounces.	Total Cost.	Price Received per Ounce.	Cost per Ounce.	Profit per Ounce.
1908.....	1,798,954	$ 135,073.56	50.64 c.	7.508 c.	43.132 c.
1909.....	4,034,325	416,140.90	51.56	10.31	41.25
1910.....	3,248,196	389,700.48	54.1	11.97	42.13
1911.....	2,430,902	366,108.53	53.46	10.671	42.79
	12,512,377	$1,307,023.47	52.603c. Aver.	10.344 c. Aver.	42.259 c. Aver.

Average Value of Ore to Date.

Year.	Ounces. Low Grade,	Ounces High Grade,	Ounces. Mill Ore,	Fineness. Bullion
1908....	4,156	231	..	...
1909....	4,784	184	..	869 Thousandths
1910....	3,611	103	..	913 "
1911....	4,641	165	24	956 "

Dividends Paid to Date.

Year.	Amount Paid.
1908.....	$ 353,762.80
1909.....	1,238,169.80
1910.....	1,061,288.40
1911.....	1,061,288.40
Total.....	$3,714,509.40

Distribution of Cost, 1911.

		Cost per Ounce.
Freight, Treatment and Smelter Deductions.....	$ 81,628.33	2.491 c.
Ore Handling.....	42,934.00	1.310
Mining Development	87,093.05	2.657
Power and Lights	26,875.76	.820
Maintenance Building, Plant and Equipment.....	15,212.98	.464
Mine, General Expenses.....	21,351.75	.651
Superintendence and Travelling	17,114.29	.522
Head Office Expenses.....	19,715.94	.601
Depreciation Building, Plant and Equipment.....	31,182.94	.952
	$343,109.04	10.468 c.
Milling.....	22,999.49	14.671
Total Ore Cost.....	$366,108.53	10.671 c.

SPECIAL CORRESPONDENCE

ONTARIO.

COBALT, SOUTH LORRAIN, GOWGANDA

Buffalo Bullion.—The Buffalo mine is this year following the example of the Crown Reserve in making a surprise distribution of profits to shareholders at Christmas. The regularly quarterly distribution from the Buffalo mine amounts to 8 per cent., so that the total for the last quarter of 1912 will amount to 16 per cent. The Buffalo rushed shipments during the past two months and its total production will be about the same as last year. The high grade mill is now ready and all concentrates and high grade will be melted down down and shipped as bullion, the process used approximating closely to that in vogue at the Nipissing high grade mill. The first "pour" was made last week.

Right of Way.—New discoveries of importance continue to be made. The Right of Way now announces that another new orebody has been cut, though its permanent importance to this mine has yet to be demonstrated. At the 80-foot level a three-inch vein of smaltite carrying 150 ounces of silver to the ton has been drifted upon as far as the Princess line, and a crosscut is now being driven to pick it up at the 140-foot level. There appears little doubt that the discovery wil be of importance to the La Rose Consolidated through their Princess property.

Mill for the Mann.—It is understood that the management of the Mann mine at Gowganda is contemplating the erection of a small concentrator as the low grade ore is piling up on the dump. Early in the year a 15-ton shipment of 3,000-ounce ore was made, and at the present time another twenty tons of a similar grade are on hand awaiting the time when the railway to Elk lake is completed. Work on the property this year was devoted entirely to the 90-foot level where three veins have been worked. The ore moved this year is

reported to amount to $100,000. The union focussed its attack upon the Hollinger mill and mine. This company had eastablished their bunk houses in the town of Timmins, about half a mile away from the mine, and the men had to go to and from work along roads which could easily be picketed. Mr. P. A. Robbins had at a few days' notice to provide sleeping quarters for the men at the time, and also feed hem, no light task, as will be readily admitted.

The situation at the Dome is different. The company has its bun houses on its property, and once they got their men back they saw that they were not molested, establishing a form of martial law on the property. In addition, it was much easier with the system of stoping ore in vogue to keep the bins at the mill full with very few drills running, and it is not likely that the production will suffer to any appreciable degree. Their only care now is to lay the pipe line from the mill to Porcupine lake, a listance of some miles. It was found last fall that the present supply of water for the mill was entirely inadequate and men were put on laying pipe to Porcupine lake at once. The strike caught them as they began to lay the pipe, and as it has been difficult to protect men at work in the trenches further linking up of the pipe has been delayed until now.

Three companies have men engaged on construction work at their new mills, namely, the McIntyre, McEaneny, and Dome lake.

The Western Federation of Miners is actively helping the men, Mr. F. J. Mahoney, the vice-president, conducting the strike in person. But wherever men can escape the attention of the pickets they are slipping back to work. In addition, they have been discouraged by the refusal of the Cobalt miners to come out in sympathy.

The Hollinger Gold Mines has issued summonses against all the men who struck, under the Lemieux Act. They claim that the men left them without giving any notice, which the Industrial Act makes an indictable offence. Dozens of cases have already risen out of the strike, and the litigation if not called off by mutual arrangement seems likely to be long and costly.

Harricana Specimens.—A number of prospectors have stampeded to the Harricana River, 140 miles east of Cochrane, on the Transcontinental Railway. The discovery is at a small lake just off the course of the Harricana and about forty miles north of the track. Some very rich specimens have been brought out of this field.

Crown Chartered Struggles.—The directors of the Crown Chartered Mining Company are making a desperate attempt to raise sufficient money to pay off the outstanding indebtedness on the Davidson claim so as to prevent it reverting to its former owners. There is yet $60,000 to raise. In order to allow them to make the attempt the sale of the plant has been again adjourned. The claims against the company can be arranged if the shareholders provide $85,000 for the purpose of paying the balance for the Davidson claim and for development and the erection of a ten-stamp mill. It is proposed to found a new company, known as the Davidson Gold Mines, Limited, and to issue new stock at the rate of one new share for two held at present. To provide the amount of $85,000, shareholders will be asked to subscribe for 350,000 shares of the treasury stock at 25 cents per share.

Mr. C. F. Dike, jr., the late manager of the property recommends the erection of a five-stamp mill, and expresses the opinion that by the operation of such a mill the property would be self-supporting.

More Mills—A contract has been let for the erection of a ten-stamp mill on the Three Nations property in Whitney township. The capacity of the mill will be about 50 tons per day. The Three Nations mine is quite out of the productive area, as it has yet been demonstrated that there is sufficient tonnage to warrant a ten-stamp mill.

Mr. R. B. Watson, general manager of the La Rose and Nipissing, has been in Porcupine to make an examination of the Foley-O'Brien for the interests in control.

In doing assessment work on a group of the Edwards claims, near the Dome lake, a big dike has been discovered. This is now being sampled by the Canadian Mining and Exploration Company. A preliminary sampling by the owners of the claim gave an average assay of $8 a ton.

The Tough Claims.—The Tough claims, in which Mr. C. A. Foster now has a controlling interest, continue to show very good results. The main vein has been opened up for 350 feet, and while the paystreak is not on the average more than five inches wide, it is so rich that the ore is worth shipping, running on an average not less than $350 to the ton. A carload of ore is now being taken out of the vein and a shipment will be made soon.

Machinery is now beginning to arrive for the Swastika mill. At the Lucky Cross, the concrete work has been finished and framing has been commenced, but it is not expected that delivery of machinery will be made till the new year.

PORCUPINE AND SWASTIKA.

Labour Troubles.—The strike in the Porcupine camp still continues to regard development; in fact there is none underground save at the Hollinger, Dome and the three companies that have yielded to the union, macher. There is no doubt now that the strike will, eventually be broken, but it will have driven many of the best men out of the camp and the labor will be of even a worse character than formerly and the camp has never been noted for the efficiency of its miners. To break the strike hundreds of men will have to be brought in, and it is not to be expected that they will be of a high-grade of efficiency.

The high-grade action of the Thiel detectives in shooting at some of the strikers is to be deplored for many reasons. In the first place, it put new enthusiasm into a waning cause and will no doubt occasion the prolongation of the strike; and, in the second place, it embittered the controversy. There is doubt that the Thiel's were needed for the protection of the mining property, but their swaggering through the public places with a chip on their shoulders invited trouble. None of the men shot were seriously hurt, and the nature of the wounds suggests that the men were careful not to shoot their opponents in any vital part. Too late in the day the Provincial Government decided to take over the situation themselves, and immediately they showed real determination to stop interference with those who desired to work, the danger of rioting was over. Previously strikers had pulled strike-breakers who were being imported from the trains, and only 18 of 138 men who were being brought in actually reached the mine. On the first occasion, when the Provincial police were in full charge of the situation, there was not the slightest trouble, and all the men won through safely.

The Ryan Discovery.—A find which promises to be of some importance has at last been made on the Gillies

Limit claims which were staked with so much farvour in August. On the Ryan claim a wide vein of cobalt and nicolite has been followed for the past month. In it has now been found good silver values.

Ore on Silver Bar.—A little high-grade ore has been found in a vein on the Silver Bar, all that is left of the Preston East Dome Mining Company. At the 50-foot level the smaltite vein which was being followed was being raised on, and almost at once four or five inches of high-grade ore was exposed. The conglomerate here is but sixty feet deep, so that it is not probable that the find is of any great importance.

Good News From Cobalt Lake.—The Cobalt Lake will make pay its first dividend on Jan. 2. The company does not commit itself to any regular disbursement of profits, but payments will be made as they accumulate. The dividend calls for $75,000, or two and a half per cent. on $3,000,000. The capital of the Cobalt Lake was originally $5,000,000, but the directors have been retiring the stock for the last two years. At the height of the Cobalt boom the company gave the Government $1,000,000 for Cobalt Lake. This was in 1906, and up to last year there appeared very little probability that the shareholders would ever profit. The necessity of proceeding with extreme caution in mining under the lake, and the expense occasioned by tapping the bottom of the lake at two different points has made the management of the property one of the most thankless in camp. The first ore was found close to the McKinley-Darragh boundary, and it was only last year that another ore body was opened up along the big fault running the length of the lake. It is probable that the bulk of the ore sold to make the first dividend came from this new ore body.

There is now a very general agitation for the repeal of royalties on claims in the Gillies Limit purchased from the Ontario Government. These are subject to a 25 per cent. gross royalty, which, in the case of a poor and struggling producer, skims all the cream off the profits. The Provincial, which has just been able to make ends meet, has already paid $9,000 to the Government, though it is now not making expenses.

STATISTICS AND RETURNS

DOMINION COAL OUTPUT

The output of the Dominion Coal Company for November was 400,000 tons. The company will have mined by the end of the year four and a half million tons.

COBALT ORE SHIPMENTS

The ore shipments for the week and year to date are as follows in tons:—

	Week Dec. 6.	Year to date.
Bailey	.....	21.57
Beaver	.....	63.75
Casey Cobalt	.....	255.15
City of Cobalt	.....	914.99
Buffalo	114.34	1,103.84
Cobalt Lake	100.15	961.03
Cobalt Townsite	.....	1,729.02
Chambers-Ferland	.....	427.83
Coniagas	123.57	1,997.90
Crown Reserve	20.02	437.84
Drummond	.....	383.05
Hudson Bay	31.65	662.85
Kerr Lake	.....	743.05
La Rose	60.00	3,291.09
Lost and Found	.....	27.80
McKinley-Darragh	.....	2,350.99
Nipissing	.....	1,735.62
Penn-Canadian	.....	97.90
O'Brien	.....	325.43
Provincial	.....	22.22
Right of Way	.....	242.82
Temiskaming	43.85	958.66
Trethewey	.....	504.89
Wettlaufer	30.25	437.21
Colonial	.....	63.14
Dom. Red. Co.	.....	56.64
Peterson Lake (Seneca Superior)	32.26	227.89
Totals	616.12	20,681.79

The bullion shipments for the week are much higher than of late, totalling 150,000 ounces from four mines. A Buffalo shipment of 33,000 ounces was made, the first run from their new high grade mill

The week's bullion record is:

	Ounces.	Value.
Nipissing	100,903.42	$64,452.00
Buffalo	33,154.00	21,000.00
Crown Reserve	14,599.90	8,500.00
Cobalt Townsite	2,300.00	1,495.00
Total	150,957.32	$95,447.00

The year's bullion shipments to date are as follows:

	Ounces.	Value.
Nipissing	3,717,029.55	$2,262,176.85
Crown Reserve	442,118.37	251,114.11
Temiskaming	38,782.00	23,165.10
O'Brien	206,792.94	124,323.61
Nova Scotia	49,010.00	31,800.00
Buffalo	115,311.00	69,914.54
McKinley-Darragh	80,327.00	6,069.37
Kerr Lake	21,463.19	13,081.95
Trethewey	20,637.08	12,416.16
City of Cobalt	5,659.94	3,133.20
Colonial	1,698.00	1,018.00
La Rose	69,849.00	41,030.88
Wettlaufer	3,280.62	2,003.14
Cobalt Lake	5,256.88	2,989.75
Right of Way	505.50	273.00
Cobalt Townsite	8,582.55	5,362.00
Drummond	3,513.54	2,169.42
Casey Cobalt	940.00	574.00
Dom. Red. Co.	75,972.46	46,760.03
Miscellaneous	16,672.56	11,050.14
Bailey	14,050.50	8,816.65
Penn-Canadian	445.00	282.69
Totals	4,887,805.33	$2,918,436.59

B. C. ORE SHIPMENTS

For the week ending November 30th the total output of the mines of the Kootenay and Boundary districts was 49,894 tons; for the year to date the total is 2,313,336 tons. Smelter receipts for the week were 43,394 tons and for the year, 2,266,211 tons. Output in detail was:

Nelson.

Mother Lode, milled	500	13,750
Queen, milled	400	13,300

Granite-Poorman, milled	250	12,850
Molly Gibson, milled	300	8,100
Second Relief	250	5,750
Yankee Girl	142	385
Other mines	...	9,943
Total	1,842	64,078

East Kootenay.

Monarch, milled	425	11,650
Sullivan	1,417	27,855
St. Eugene	31	603
Other mines	...	1,579
Total	1,873	41,687

Slocan and Ainsworth.

Zinc shipments	630	8,177
Standard, milled	400	16,800
Van-Roi, milled	1,100	53,600
Bluebell, milled	200	3,900
Silver Hoard	28	182
Ruth	38	547
Utica	40	819
Van-Roi	31	2,132
Standard	42	7,895
Other mines	...	19,410
Total	2,509	109,462

Rossland.

Le Roi No. 2, milled	300	9,200
Inland Empire, milled	90	1,980
Le Roi	494	41,947
Centre Star	2,621	145,692
Le Roi No. 2	437	23,692
Other mines	...	281
Total	3,942	222,792

Boundary.

Surprise	106	5,272
Knob Hill	105	1,981
Nickle Plate, milled	1,500	70,100
Jewel, milled	200	3,200
Mother Lode	6,692	340,153
Granby	25,153	1,160,620
Unnamed	262	10,904
Rawhide	5,009	231,623
Napoleon	543	12,070
Ben Hur	137	274
Clugston	21	21
Other mines	...	29,102
Total	39,728	1,865,317

Zinc Shipments.

Lucky Jim	120	2,267
Standard	480	3,455
Van Roi	30	2,261
Other mines	...	194
Total	630	8,177

SHARE MARKETS

TORONTO MARKETS.

Dec. 10—(Quotations from Canada Metal Co., Toronto).
Spelter, 6.35 cents per lb.
Lead, 5 cents per lb.
Tin, 52 cents per lb.
Antimony, 11 cents per lb.
Copper, casting, 18½ cents per lb.
Electrolytic, 18½ cents per lb.
Ingot brass, 11 to 15 cents per lb.
Dec. 10—Pig Iron (Qutations from Drummond, McCall & Co., Toronto).
Summerlee No. 1, $26.00 (f.o.b. Toronto).
Summerlee No. 2, $25.00 (f.o.b. Toronto).
Midland No. 1, $23.00 (f.o.b. Toronto).
Midland No. 2, $22.00 (f.o.b. Toronto).

GENERAL MARKETS.

Coal, anthracite, $5.50 to ..6.75 per ton.
Coal, bituminous, $3.50 to $4.50 for 1¼-inch lump.

Coke.

Dec. 6—Connellsville Coke (f.o.b. ovens)—
Furnace coke, prompt, $4.00 per ton.
Foundry coke, prompt, $4.00 to $4.50 per ton.
Dec. 6—Tin, Straits, 49.30 cents.
Copper, Prime Lake, 17.55 to 17.65 cents.
Electrolytic copper, 17.40 to 17.50 cents.
Copper wire, 19.00 cents.
Lead, 4.35 cents.
Spelter, 7.37½ cents.
Sheet zinc (f.o.b. smelter), 9.00 cents.
Antimony, Cookson's, 10.15 to 10.25 cents.
Aluminium, 26.25 to 26.75 cents.
Nickel, 45.00 cents.
Platinum, ordinary, $45.50 per ounce.
Platinum, hard, $48.00 per ounce.
Bismuth, $2.00 to $2.25 per pound.
Quicksilver, $41.00 per 75-lb. flask.

SILVER PRICES.

		New York cents.	London pence.
November	23	63	29⅛
"	25	63	29⅛
"	26	63	29⅛
"	27	63	29⅛
"	28	..	29⅛
"	29	63⅛	29 3/16
"	30	63½	29⅜
December	2	63⅞	29 5/16
"	3	64⅛	29 7/16
"	4	63⅝	29 9/16
"	5	64	29⅝
"	6	63⅞	29 5/16