THE CANADIAN MINING JOURNAL

VOL. XXXIII. TORONTO, July 15, 1912. No. 14

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"
Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the
MINES PUBLISHING CO., LIMITED

Head Office - Room 36, Canadian Birkbeck Building, 10 Adelaide Street East, Toronto.
Branch Office - - - - - - - 34B Board of Trade Building
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.
U. S. A. Office - Ward & Smith, 931 Tribune Building, New York

Editor J. C. MURRAY. B.A., B.Sc.
Contributing Editor H. MORTIMER-LAMB

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

ORGANIZED LABOUR IN CANADA.

The Department of Labour, Ottawa, has added to the list of its instructive and timely publications a report on Canadian labour organizations. The recent history of some of these organizations in Canada has been marked (and marred) by many regrettable incidents, due principally to affiliation with United States bodies. It is important, therefore, to know just how far Canadian labour is dominated by extraneous influences. It is important, also, to see how much independent national organization has taken place. The report before us is entirely devoted to facts and figures. It is, as it should be, non-partizan.

The oldest labour union in Canada is the Toronto Typographical Union, established in 1844. To-day there are no less than 1,741 local unions, most of which are branches of large central bodies. The membership rolls of these local unions contain from ten to over one thousand names. In Ontario there are 706 local organizations, in British Columbia 234, in Quebec 205, in Alberta 153, in Nova Scotia 138, in Manitoba 118, in Saskatchewan 84, in New Brunswick 73, and in Prince Edward Island 7. The four largest cities, Montreal, Toronto, Winnipeg and Vancouver, comprise about one-fifth of the whole total, the western cities having proportionately the larger number.

In the industries of mining and transportation and in a few trades the methods of organization and procedure are much more complicated than in other callings.

Of the 1,741 local unions, 1,531 are in affiliation with international associations, the remainder being entirely Canadian. Welding together the various units of all trades are two general organizations, the Trades and Labour Congress of Canada, in which are represented the societies that have international connections; and the Canadian Federation of Labour, which has to do with purely Canadian unions. Both these bodies meet once a year.

Of the several advantages claimed for the principle of internationalism, that of the "travelling card," which gives members the privilege of moving from place to place, irrespective of the boundary, is the only one that can be admitted without argument.

The American Federation of Labour claims the loyalty of 78 of the 91 international unions having branches in Canada. It is by far the largest organization of its kind on the continent. With it is affiliated the Western Federation of Miners.

The largest individual trade union organization in Canada and the United States is the United Mine Work-

ers of America, with 277,050 members in the States and 12,950 in Canada. This marked disparity is significant enough.

As we are concerned primarily with mine labour we shall restrict our further remarks to those organizations that have to do with mining, quarrying and ore reduction.

Three international bodies are represented in the mining and quarrying industries of Canada. These are the United Mine Workers of America, the Western Federation of Miners, and the International Quarry Workers Union of North America. Of similar Canadian bodies there are two, the Provincial Workmen's Association and the Canadian Granite Cutters' and Quarry Workers' Union. In addition to these there are numerous local societies that have no branches and no outside connections.

The three international organizations mentioned above have, respectively, 50, 23 and 4 branches in Canada; while the Provincial Workmen's Association has 22 branches. The Canadian membership of the international bodies mentioned are, respectively, 12,950, 5,196 and 100; while the P. W. A. has 4,000 miners enrolled.

It will be seen that United States organizations absolutely dominate mining labour in Western Canada. The Provincial Workmen's Association is a Nova Scotian organization which received a strong impetus several years ago in a protracted fight with the U. M. W. A. While it is a vigorous society, it covers but a small area.

THE LAW OF THE PAY-STREAK.

In our issue of June 1st, 1912, we reprinted from the Bulletin of the Institution of Mining and Metallurgy, a paper contributed by Mr. J. B. Tyrrell, "The Law of the Pay-Streak in Placer Deposits." On this subject little has heretofore been written. Mr. Tyrrell's object was to correlate and classify observed phenomena and to demonstrate the applicability of certain simple natural laws governing the concentration of heavy metals and minerals in alluvial deposits. Elusive as the placer pay-streak may seem, it is nothing more or less than a "feature in the structure and growth of the valley in which it occurs, its formation is governed by certain geological laws, and those laws should be recognizable without great difficulty if the growth of the valley can be traced with reasonable accuracy."

While Mr. Tyrrell's facts were gleaned in the Yukon, his generalizations are meant to have the widest possible application, and to throw light upon the problems of prospecting for placer gold.

The latest Bulletin of the Institute, No. 93, contains a highly interesting discussion of Mr. Tyrrell's paper. It is timely to note here the trend of the criticisms offered.

Mr. Newton B. Knox demurs strongly to Mr. Tyrrell's conclusions. The valleys of the Klondike, says Mr. Knox, are ideal for concentration. Natural conditions there approach those of a long sluice with rapidly flowing waters, regular gradients, rough bottoms, and few or no floods. In regions subject to sudden floods, the laws enunciated by Mr. Tyrrell would break down. In answer to this we may remark that Mr. Knox is misinformed concerning the Klondike. Floods are severe and not infrequent in that territory. While the rivers do not become torrential, yet, even where they do, the problems to be solved as regards the concentration and disposition of placer gold differ in degree rather than in kind.

Mr. C. W. Parington follows, in the main, the line taken by Mr. Knox, and suggests that Mr. Tyrrell's hypothesis as to the V-shaped river valley needs modification when applied otherwheres than in the Klondike.

While both critics have a certain amount of right on their side, we believe that both have missed the real point of Mr. Tyrrell's paper. That point lies in the fact that Mr. Tyrrell has demonstrated that geological laws govern the deposition of placer gold. Experience in different countries may modify the laws; but a grasp of the philosophy of placer gold will inevitably aid the prospector, no matter what the local conditions may be.

Incidentally, it is refreshing to note that Mr. T. A. Rickard has his terminological fling in the course of the discussion. He objects strongly to the compound word "pay-streak" as being local, restrictive, and vicious. "Gold-bearing channel" is the substitute suggested. Unfortunately, the substitute is too lengthy to meet the requirements of a time-saving age.

REFINING SILVER AT THE MINE.

We quote elsewhere in this issue from an article recently contributed by Mr. T. A. Rickard, to the *Mining Magazine,* descriptive of the refining of silver at the Nipissing Mines. This innovation, which, we understand, is about to be adopted by at least one other important mine in the Cobalt district, will effect not only a large direct saving in marketing costs, but the practice now followed will enable the bye-products of the ores, notably cobalt oxide, to be conserved for future profitable realization. The demand for cobalt oxide is limited, as was also the supply prior to the discovery and operation of the Cobalt mines. The quantity thus made available demoralized the market, but eventually, without doubt, prices will return to their former level. Since, however, in most cases the smelters have made no allowance for Cobalt in ore-consignments from the district, the local recovery of this metal, even if marketted at obtaining prices, will mean so much additional profit to the mines adopting this course.

COBALT DIVIDENDS.

It is satisfactory to note that the dividends paid by the Cobalt mines continue to be well maintained. The

amounts distributed during the first half of the present year, by thirteen companies—in this case a lucky number—representing well over three and a half million dollars, the percentage rates being from 3 to 900 per cent. Thus two companies are paying at this minimum rate, one is distributing 4 per cent. on the capital; three 10 per cent.; three, 15 per cent.; one 16 per cent.; one 20 per cent.; one 30 per cent.; and one 900 per cent. This latter, the Hudson Bay, is capitalized at a very low figure.

FRENCH'S ZINC PROCESS.

Mr. A. Gordon French achieved much publicity by claiming to have developed a commercially practicable process for treating the Slocan (B.C.) zinc ores. His electrolytic zinc product, he states, is pure and easily marketable at a profit.

Without expressing any opinion as to the merit of the French's process, it may be of interest to outline the various steps taken.

The commercial recovery of zinc from the silver-lead-zinc ores of the Slocan district has long been an unsolved problem. The zinc concentrates on which Mr. French has worked, contained galena, zinc-blende, iron-pyrites and siderite, along with quartz and shale as gangue. After crushing to ten-mesh, the material is given a nearly "dead" roast. About five per cent. of nitre cake is then thrown on the ore and thoroughly mixed with it and the whole heated once more. Since there is free sulphuric acid in the "cake," the oxides in the ore are converted into sulphates. About fifteen minutes is allowed for the reaction, and the ore is then removed from the furnace and cooled. After transference to a wooden leaching-tank, acidulated water is added to dissolve the oxides and sulphates of zinc and to remove the sulphate of soda. Insoluble lead and silver compounds remain in the tank with the gangue. It is claimed that the sulphate of iron is not leached out until all the zinc is dissolved, and that it can readily be left in an undissolved condition.

The filtrate is run into a wooden box in which are hung alternate sheets of zinc and lead, the zinc connected with the positive pole and the lead with the negative pole of a low voltage direct-current dynamo. Metallic zinc is deposited in a hard mass on one side of the zinc plates, the plates are removed, the deposited zinc stripped off and melted. Black oxide of manganese is deposited on the negative lead plates, and is brushed off and collected. It is of commercial value. The filtrate, after electrolysis, is pumped back to the leaching-tank.

Mr. French's plant at Nelson is a rough experimental outfit, capable only of treating from 500 lbs. to 1,000 lbs. at a time.

The electrolytic zinc contains 99.5 per cent. of zinc, 0.5 per cent. copper, and 0.2 oz. silver per ton.

EDITORIAL NOTES.

Bush fires have been raging near and round Porcupine. Preventive measures seem no more effective now than in the past. An efficient patrol system is a necessity.

Our Quebec Special Issue has been received with marked favour by our readers. This, of course, is gratifying. Our hope is that succeeding special issues will be even more successful.

The net income of the International Nickel Company was $4,866,412 during 1912. The only year in which the figure was exceeded was 1911, when the net income of the concern was $5,028,874.

Captain Munn, well known to northern Ontario mining men, is off for Baffin's Land in the good ship "Algerine." With him is Captain Bartlett, formerly the companion of Peary. With him, also, is much hope and confidence. The "Algerine," by the way, was at one time a respected unit of the British navy. Dr. A. P. Low used her on several sub-arctic expeditions.

Many fantastic estimates are being published of the tonnage of ore being crushed in Porcupine stamp mills. At those mills where the practice followed includes tube mills and the ore, consequently, is stamped to a mesh coarser than 20, the stamp duty will probably range between 5 and 8 tons per day . Where tube mills are not installed, the duty per stamp will certainly not exceed 6 tons per day, and may be much lower.

Mr. A. A. Cole, mining engineer for the T. and N. O. Railway, predicts a long life for Cobalt. No one is in a better position to know the facts than Mr. Cole. He is thoroughly conversant with every phase of mining in Cobalt and occupies an important official position. With no axe to grind, his deliberate utterances may be taken as being humanly correct.

Among the Canadian members of the Canadian Mining and Exploration Company, are Sir William MacKenzie, Sir Thomas Shaughnessy, Mr. C. R. Hosmer, Mr. T. J. Drummond, Mr. D. Lorne McGibbon, Mr. David Fasken, Sir Henry Pellatt, Mr. R. B. Watson, and Mr. George E. Drummond. All of these gentlemen have had a great deal to do with mining in this country. A more representative list of names could hardly be selected.

CORRESPONDENCE

GOLD MINING IN NOVA SCOTIA.

Editor Canadian Mining Journal:—

Since reading Mr. T. A. Rickard's letter published in your issue of November 1, 1911, in sheer justice to the neglected industry of gold mining in Nova Scotia, I have had a desire to question Mr. Rickard's final thrust, but because of other duties, until now, it has not been convenient for me to do so.

In drawing and officially reporting to the Provincial Government his conclusions and repeating the substance thereof in the letter above referred to, viz.: that the gold deposits of Nova Scotia are inconstant, do not hold with depth, and consequently are not of sufficient promise to justify investment of large capital, in the main I believe Mr. Rickard to be absolutely wrong.

I attach hereto, in part, a report made by me, date of January 17, 1911, after eight months service in the Oldham gold district, N.S., as manager of the Sterling gold mine.

Snpported by the statements of fact contained in that report I wish to make the unqualified assertion that the history of at least one mine, the Sterling, said to have reached the greatest depth of any gold mine in Nova Scotia, and the showing as known to have been left in its workings at the close of 1910, offer positive and indisputable evidence of the error Mr. Rickard fell into and to which, through your excellent publication, he has given such wide publicity.

Elsewhere in that letter to you Mr. Rickard states that "Gold mining on a large scale has rarely proved profitable in Nova Scotia."

Excepting it may be the Boston and Richardson, which I understand was a very low grade proposition substantially from start to finish and extravagantly managed at that, gold mining in Nova Scotia has never in a single instance been conducted upon what could be rightly considered a large scale.

The Sterling would probably rank next, but throughout all the years of its operation, when working at its maximum of three shifts in 24 hours, the Sterling never employed more than 35 men underground daily, not more than eight of whom during any shift were on the drills, two men to each machine, and this maximum was exceptionally rare.

Had but a few intelligently located gold mines in this Province been even as crudely worked but pushed to depths approximating that of the Sterling, the results would undoubtedly have furnished much additional proof of Mr. Rickard's mistake.

In his unfortunate estimate of the value of the gold deposits and of the recurrence of ore shoots in Nova Scotia Mr. Rickard's conclusions were evidently arrived at (1) by what he saw and hurriedly examined; (2) by what he was told by others who may or may not have been biassed, and (3) by geological theories in which he is exhaustively learned and highly expert. Probably not having personally examined the Sterling, nor any gold mine in the Province approaching its depth, during the few weeks he was dashing over the hundreds of square miles of gold areas, and as his personal examinations were probably confined to mines of shallow depths, such information as he gathered of a reliable and materially practical character must have been narrowly circumscribed and decidedly insufficient as a base for the vastly important report expected from him.

Hence it is quite reasonable to contend that Mr. Rickard's lamentable verdict was reached far too hastily and without seeking or acquiring a full and authoritative knowledge of actual representative conditions which had been exposed and were readily open to him.

In justice, however, to Mr. Rickard the writer believes and is free to say that had that gentleman given the gold mining probabilities of Nova Scotia as much personal investigation and close study as he gave the Stratton Independence in Cripple Creek, Colorado, some twelve years or so ago, his report in 1905 to the government of this Province would doubtless not have been kept from the general public ever since.

Mr. Rickard's more recently published compilation of the opinions of others arrived at and given to the public during the past century and long before sinking had been done to anything but shallow depths, whilst clever and profound, stands out clearly and directly at variance with facts of great importance subsequently developed.

Halifax, N.S. EDGAR H. BRENNAN.
June 17, 1912.

The Oldham Gold District—Sterling Mine.

The Oldham gold mining district is located in Halifax County, Nova Scotia, three miles by wagon road east of Enfield Station on the Intercolonial Railway, Enfield being twenty-eight miles by rail from Halifax City.

Formation.—The country rock is quartzite, locally known as "whin," which, at remarkably frequent intervals, encases veins or "leads" of light to medium tints of grey and blue quartz bedded, as a rule, in several inches of firm, consolidated shale or slate.

It would seem that originally the quartz veins were flat, of a blanket character, but at a later period presumably because of eruptive disturbance, in common with the quartzit encasing them, were lifted en masse and left in the form of an elongated dome, or similar to that of an inverted hull of a ship, bow to the east, lines drawn in sharply at north and south sides, still more closely at the west end and, with some irregularity, the keel representing the anticlinal apex.

From its eastern extremity the dome pitches to the west at a slight angle and on their course or strike the quartz veins describe irregular curves of wide but varying radius first northerly and southerly from their eastern intersection with the break, or so-called "nose" and then in each instance swinging westerly to their westerly intersection of the anticlinal break. Thus of easy angles averaging at and near surface about the leads at the "nose" are given dips to the east 35 degrees from the horizontal down through the quartzite; whilst the leads as extended around on the north and south sides, or "legs," having been drawn inward, stand at much greater dips, averaging more then 65 degrees.

The quartz throughout the district is mostly well mineralized, the leads varying from one-inch to two feet in thickness, the gold content being generally free, although the sulphides carry more or less.

Operation.—Whilst nearly all the leads have to some extent been prospected here and there, and in most instances found to carry more or less gold at or near surface, a number have been worked somewhat deeper, producing good pay ore and from a few worked to a maximum of 450 feet in depth, large quantities of gold and heavy profits were realized.

The most important mine is the Sterling, which has been worked more or less for 14 years. In July, 1910, this mine reached a depth of 1,589 feet on the dip of the lead, whereupon further sinking ceased. The angle of dip of this lead will probably average 40 degrees from collar of shaft to bottom of mine. The general bearing of the shaft line is about N. 78° E., and nearly parallels the course of the anticlinal axis, keeping 50 feet or more to the south. At no time have the levels nor has stoping been carried far either way from the shaft, or hoisting line; in fact, the drifts in either direction from the hoisting line have never averaged 100 feet in length.

Although the lead has held continuously from surface to bottom of mine and still holds, in common with nearly all rich gold-bearing veins, both thickness and gold values have varied, the thickness from one to nine inches—the latter occurring at the bottom—and the gold content from one-half ounce to six ounces or better in gold per ton of quartz, not including the occurence of occasional pockets from which quartz has been taken and milled yielding up to 150 ounces gold per ton. Thus, it is apparent that from the opening of the mine, not only the lead, but the ore-shoot as well has been substantially continuous to the present depth of 1,589 feet, where it still exists.

Production.—The writer has no authentic data at hand of the gold output of the Sterling mine prior to 1903, but beginning with May 18, 1903, and ending Jan. 29, 1907, embracing a period of 44 months, as officially reported to the Provincial Mines Office, the production was 1,886 tons quartz, from which 3,188 ounces of gold were extracted, the bars selling at an average of $19.70 per ounce. During this period of 44 months, because of fire and other reasons, the mine was not operated continuously, frequent breaks intervening, each of several months duration.

During the calendar year 1910, since the close of which the mine has not been operated, the Sterling produced 847 tons quartz, from which 1,895 ounces of gold were extracted. The owner of the Sterling states that in 1908 and 1909 the gold values produced averaged $4,000 per month for the entire 24 months. Thus, it is shown that during the last seven years of operation the value of the Sterling's production of gold in round figures was $170,000, and all realized from a single shoot of pay-ore holding continuously to a depth of 1,589 feet.

At the 1,200 level, about 90 feet south of the hoisting line, in an effort made by the writer during the last three months of 1910 to prove the existence of other ore-shoots in the Sterling lead, a reef of extremely hard ground was first encountered. This was penetrated, proving to be a width of 30 feet, after which the ground or, we will say the new ground, broken into south of the hard reef was found to be similar to and quite as easy to break as was the old ground at any point in the old workings. This drift in the new ground was driven 84 feet further south—from the hard reef—and slightly overhead or back-stoped close to the south edge of the hard reef, uncovering quartz there which proved thin and tight, but good for one ounce of gold per ton. Another short raise was made near the south end, or breast, of this drift, uncovering quartz which was much thicker, not so tight, and which milled six ounces gold per ton; and from a pocket of 32 pounds, of which better than three ounces of gold was extracted, thus milling at the rate of $3,600 gold per ton of quartz.

Conclusion.—From close study of the Sterling Mine during 1910, the writer became convinced that, if properly worked, a liberal extension and stoping southerly of at least the ten levels from the 400 down to the 1,300, inclusive, would for many years to come be productive of extremely handsome profits. And with the installation of suitable equipment, sinking could also be resumed with excellent profit, as the quartz across the entire 100 feet of bottom, although carrying but half to three-quarters of an ounce gold per ton, averages quite 8 inches in thickness.

Of the other leads in Oldham, 45 ro more of which come to the surface, with a few exceptions heretofore referred to, none have been really mined, simply prospected to depths which would not average more than 50 feet over the entire district.

EDGAR H. BRENNAN,
Mining Engineer.

Oldham, N.S., Jan. 17, 1911.

IRON AND STEEL.

Commenting on a paper read by Dr. W. H. Walker, before the New England Waterworks Association, discussing the relative corrosion of iron and steel pipe, Water and Water Engineering remarks that no controversy of recent years has aroused more widespread interest than that which has centred round the question of the origin and mechanism of corrosion in metals. In elementary text-books on chemistry, the oxidation of iron and steel has often been brought forward as a typical example of a chemical reaction of a simple kind, yet chemists are not even yet agreed upon the details of the process by which the reaction is produced. Dr. Walker shows how easy it is in comparative experiment to obtain discordant results with material of varying quality. Thus, if iron of poor quality is compared with good steel, the result may be in favour of the steel, whereas if the steel is inferior and the iron exceptionally good, the reverse will be the case. Dr. Walker concludes from his investigations that "on the average" there is no difference in the corrosion of iron and steel pipe. An interesting result obtained in this investigation was the proof that no reliance can be placed upon the accelerated acid test, which did not agree with the Service tests, nor did it produce concordant results with regard to either iron or steel alone. It may here be mentioned that Dr. Walker's conclusions agree substantially with opinions expressed in a paper on a similar theme contributed to the Canadian Mining Institute by Mr. F. N. Speller some years ago.

RAINY HOLLOW, B.C., AND SOUTHWESTERN YUKON

(Contributed by E. Jacobs, Victoria, B.C.)

For some years efforts have been made to obtain capital for the construction of a railway from Haines, on Lynn Canal, south of Skagway, through United States territory, and thence across the extreme northwestern part of British Columbia and the much larger southwestern part of Yukon Territory. As the British Columbia section of this northern country has recently once again attracted attention, and is a part likely to receive still more notice in the future, the following information, taken from two or three available sources, is contributed with the idea that it will likely prove of interest to a number of readers of the Canadian Mining Journal.

The proposed railway would be in three sections: First, from Haines to the British Columbia southern boundary; second, across Canadian territory to the Alaskan eastern boundary; and third, through interior Alaska to a northern terminal on Yukon River. Part of the information relative to the first and second sections, that will presently be given, has been extracted from a description of the country prepared for the promoters of the railway above mentioned. Before quoting this, though, some particulars of the country south of the 60th parallel, from the official report of the Provincial Minearalogist as printed in the "Annual Report of the Minister of Mines for British Columbia, 1907," will be given, as follows:

From Haines, Alaska, to Rainy Hollow, B.C.

"Rainy Hollow is the name locally given to the basin surrounding the headwaters of the Klehini River, a tributary of the Chilkat River, which it enters from the west. The Chilkat River and the Klehini River both have their sources in the territory formerly comprising the Chilkat mining division of British Columbia, but which is now included in the Atlin mining division, of which it forms the northwestern part. Both these rivers, about midway in their course, pass out of British Columbia into Alaskan territory.

"Between Bennett Lake in British Columbia, on the line of the White Pass Railway, and the Chilkat River, there is a range of high mountains, which it is impracticable to cross, even with a pack-train, so that the only way to reach the Rainy Hollow Camp is through Alaskan territory. The route usually taken to the camp is from Skagway, Alaska, by a small gasoline launch, which runs daily to Haines Mission, and important U. S. military post, thence by wagon road a distance of a couple of miles across the peninsula to Chilkat Inlet, into which the Chilkat River flows. Here Indians and canoes can be obtained and the Chilkat River followed up to the Indian village of Klukwan, at the junction of the Klehini.

"The United States Government has already surveyed a line for a wagon road from Haines to Klukwan along the eastern side of the Chilkat, and it is expected that this road will be built within the next two years. The distance from Haines to Klukwan is about 20 miles, and at present the only method of travel, or for the transportation of supplies, is by canoe.

"From Klukwan the Klehini River is followed up to Porcupine City, a distance of 18 miles by a wagon road built by the U. S. Government along the southern bank. Porcupine City formerly supported a couple of hotels and as many stores, but in 1906 the only occupants of the townsite were the employees of a company engaged in placer mining on Porcupine Creek, for whose accommodation the company maintained a store, but the hotels have disappeared.

"From Porcupine the wagon road follows up the river bed for some four or five miles, being only available, in summer, during low water, crossing over to the northern bank, connecting there with a crude wagon road, formerly built by the R. N. W. M. Police, which is followed for a further distance of two miles to old Pleasant Camp, on the Alaska-British Columbia boundary line, and at one time occupied by the Mounted Police.

"The Province of British Columbia is entered at Pleasant Camp, from which point to Rainy Hollow the Provincial Government was last fall engaged in building a trail, or sleigh road, which was, however, not cut through in 1906, so the old trail had to be followed. This follows up the north bank of the Klehini for some three miles to Dalton's Cache. The cache is about 500 feet higher elevation than Porcupine City and is about 1,000 feet above sea level.

"From the cache the trail turns north, away from the river; rising, by a series of zig-zags, in two miles an additional height of 1,000 feet to the level of the plateau, which slopes slightly to the north and is devoid of trees or vegetation. The trail follows across this plateau for some six miles, when it gradually descends into Rainy Hollow. The plateau is said to be very dangerous to cross in autumn, owing to the prevalence of dense fogs, which arise without warning, and in winter on account of blinding snow-storms.

"To avoid this portion of the trail, with its incidental and unnecessary climb, impracticable for even a sleigh-road, the Provincial Government has chosen a line for the new trail following the river valley, and running through wooded country most of the way, which will afford shelter at all seasons, and it also has the advantage of being two or three miles shorter.

"The possibility of improved transportation facilities by the rivers is very slight, as they are only navigable for canoes, while the swift current and the ever-shifting character of the river-bed render any permanent improvement of the channel impracticable. Should sufficient ore be found to justify it, there are no serious engineering difficulties in the way of building a railway from Haines to Rainy Hollow, while Haines offers first-class terminal facilities and a good harbour.

"The Provincial Mineralogist, in the fall of 1900, made an examination of, and a report on, the mineral claims of Rainy Hollow, which is included in the Report of that year." (Note by E. J.—This report is now out of print.) "Since that time little real development work has been done; some prospecting has taken place and many of the claims then in existence, having lapsed, have been restaked under other names and ownership. Some new ground has been located, but as the old posts have disappeared, it was found to be impracticable how much of ground examined was of recent discovery.

Excerpts from Later Official Reports.

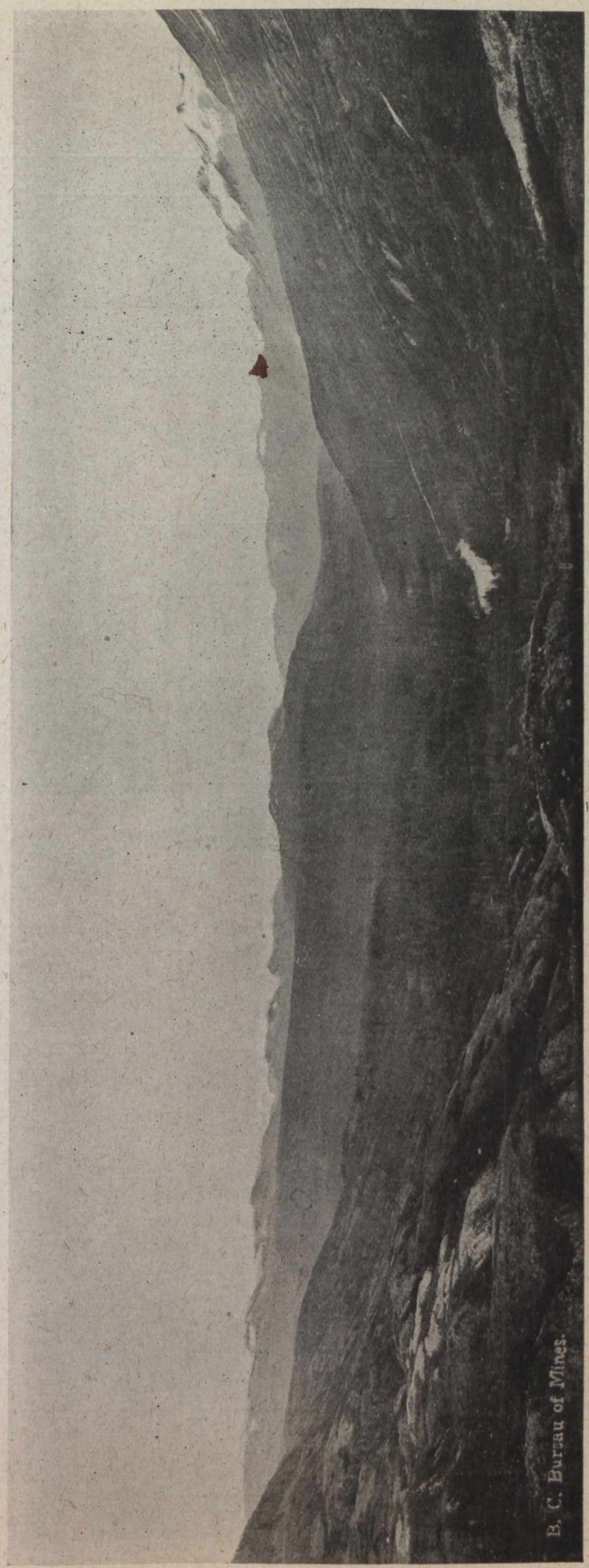
The gold commissioner for Atlin mining division reported for 1908 as follows:

"In Rainy Hollow nothing more than the necessary assessment work to keep the claims in good standing was undertaken by any but the Alaska Iron Company, which has acquired interests in several properties and has been systematically prospecting the same by hand and core drills, and in every instance with most encouraging results. This company has packed (on pack horses) a gasoline and drill plant up to its mine and packed out two tons of ore, which has shipped to the Tyee smelter, and from which the returns were 25.36 per cent. copper and 42.73 oz. of silver. Development work was being prosecuted there this winter and a tunnel was being driven, with the intention of placing ore on the dump for shipment next summer, when the wagon road reaches an available point, but a sudden snowslide having covered up the tunnel, with the men in it, led them to think that, although they escaped in that instance without injury, they might not be so forunate anoher time, and they decided to close down until they can take proper precautions against, and prepare for all contingencies. Land has been located for a mill-site and other purposes, with a water right on Jarvis Creek. The plant for a concentrator has been stored at Pleasant Camp, to be taken into the company's mine when the wagon road will permit of its being done. Altogether, the company appears determined to develop its prospects.

"Owners of other properties have moved for Crown grants for as many of their claims as they could get surveyed this season, and some are preparing to mine and ship their best-grade ore as soon as the wagon road is sufficiently advanced to enable them to do so. Nearly 30 claims are now being, or have been, Crown-granted.

"Coal has been located about 20 miles eastward from Rainy Hollow, on the old Dalton trail, and pretty well up toward the summit of the Chilkat Pass. It is claimed that the quality is good and the quantity in sight sufficient to warrant the expense of locating and prospecting it."

For 1909 the gold commissioner reported:—"In Rainy Hollow section of the district quite a large number of claims are being Crown granted ,but nothing beyond necessary assessment work has been done on other claims, except by the Alaskan Iron Company and Burnham & Kennedy. The wagon road which the Provincial Government has opened from the International Boundary at Pleasant Camp to Jarvis River, although not completed, has made it possible to ship supplies in and ore out by horse-team, and the parties above-mentioned are taking advantage of it to ship some of the bornite ore to the smelters. Burnham & Kennedy, anticipating the construction of the road, prepared for shipment from 100 to 200 tons of choice ore from the Maid of Erin claim during the summer, which will be shipped this winter. The Alaska Iron Company shipped a few tons of high-grade ore during the summer, and this winter there are about ten men engaged on the State of Montana claim, mining and preparing ore for shipment, which will be hauled to Haines (Alaska) by the company's own teams. Some discoveries of the same class of high-grade ore have recently been made about five miles to the east or southeast of the claims above-mentioned, and a number of claims have been located which will demand attention (and a road) in the near future. There was also the discovery of a large ledge of free-milling ore reported on last fall, upon which about a dozen claims have already been located. It is situated in the heart of the Rainy Hollow district, and

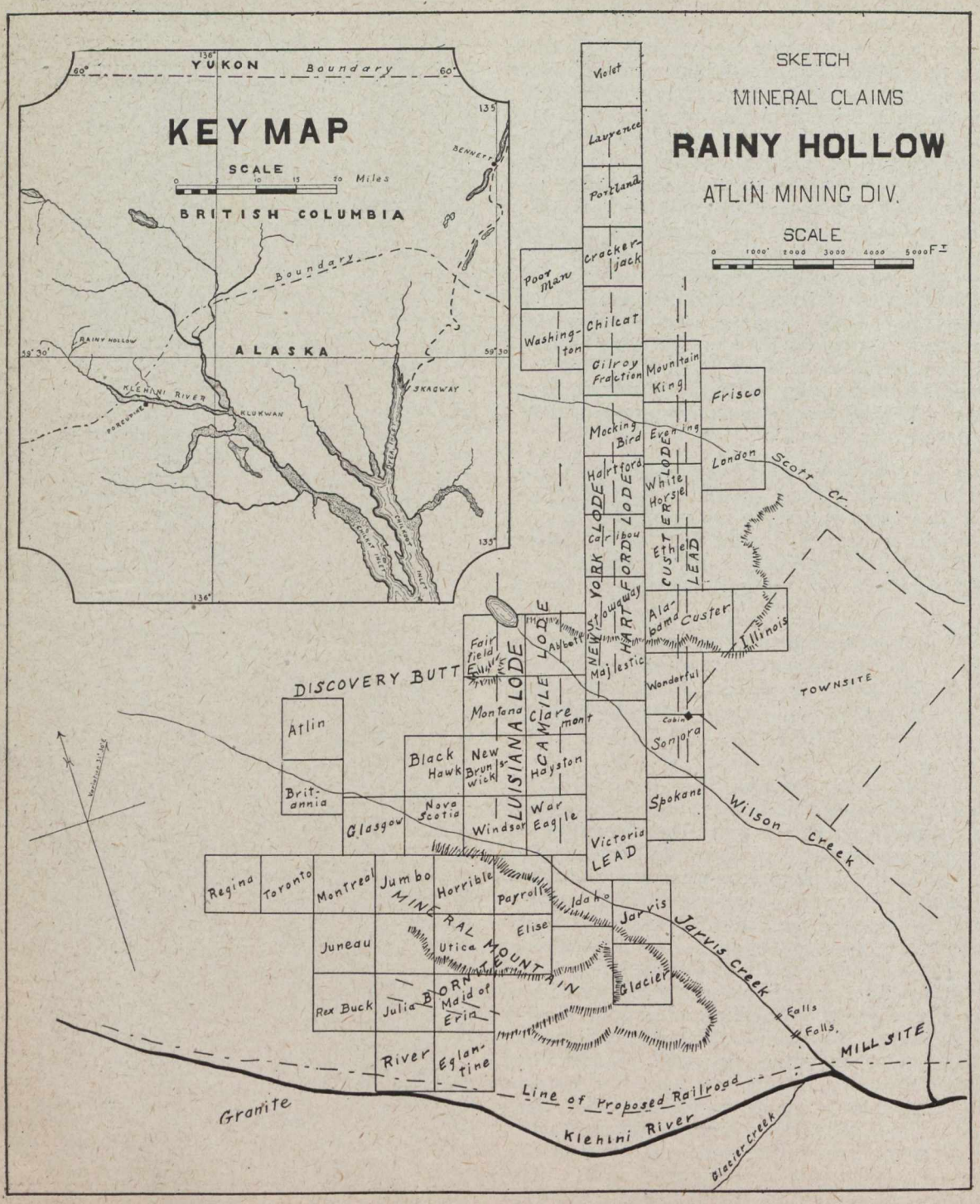


Looking Down Valley of Rainy Hollow Chilkat District, Atlin, M.D.

if upon development the value justifies the expectations created by the assay returns from samples submitted, an additional impetus will be given the mining industry in that section."

For 1910 the gold commissioner reported:—"In the Rainy Hollow section development was not prosecuted as actively as was anticipated, but what was done simply increased the confidence of the owners in the value of their respective properties. On the Fairfield

"In my report for 1909, I mentioned the discovery of high-grade ore about five miles to the east or south-east of the principal properties in Rainy Hollow, and that a number of claims had been located thereon. Those were at the base of what is locally known as the Three Guardsmen Mountain, and were so near the International Boundary that the locators were in doubt as to whether some of the properties were in British Columbia or Alaska. All the locations are now found



mineral claim, which adjoins the State of Montana, development work was prosecuted during the summer, by the Alaska Iron Company, with very satisfactory results. On other properties not much more than assessment work was performed.

to be in British Columbia, and development has disclosed deposits of high-grade ore. As soon as railway transportation to tide-water is assured there is encouragement to hope for the establishment of a copper camp at this point, as all those properties, as well as a large

number of the older properties to the westward, have been bonded to parties who are promoting the railway from Haines to the interior. A few miles to the east of Rainy Hollow a new discovery of coal was reported, and a number of locations (about 40, I believe) staked on it, but for some reason, unknown to me, they have not been advertised. The various samples shown and the reports of the locators, however, indicate the presence of coal there in some quantity, and should development prove its existence in commercial quantities it will enhance the value of the ore-deposits already mentioned as lying a little farther westward."

Excerpts from a description of the country (prepared for the promoters of the railway) already alluded to, are given below:—

For 1911 the gold commissioner reported:—"A large number of the best claims in this vicinity were bonded in 1910, as mentioned in my report for that year, but I regret to say that the bondees did little or nothing except upon the Three Guardsmen group, so that a whole year has been practically lost as far as development is concerned.

"On the Three Guardsmen group some development work was done by the option holders, but they all failed to meet their payments and the bonds have lapsed. The confidence of the owners, however, does not appear to be at all shaken, as they are developing and procuring Crown grants for their properties as their means will permit.

"I may say that a shipment of about 300 tons of ore (bornite) from the Maid of Erin mineral claim was sent to a coast smelter, from which the returns were more than $100 per ton, but no larger shipments were made from any of the properties.

"No material improvement can be looked for until railway transportation to tide-water shall be provided."

Resources of the First Section Along Railway Route.

There is along the first 30 miles of the railway route a limited quantity of land suitable for agricultural purposes.

The first important resources for traffic are at Klukwan, about one mile from which there is a large deposit of iron ore. It is magnetite, containing more than 50 per cent. metallic iron, and remarkably free from phosphorous, sulphur, and titanic acid.

Across the Chilkat River from Klukwan is situated Salmon River gold mining district, where in several places placer gold mining is carried on. The existence of gold-bearing quartz in this district is also reported. At mile 25 is Wells, at present only a supply station, with a hotel and store for the convenience of settlers in the surrounding country. There the Government wagon road crosses the Chilkat River and runs thence to the Porcupine and Rainy Hollow mining districts. At Porcupine gold mining has been going on for several years and will continue for many years to come. With the advent of the railway, giving reasonable transportation rates for heavy machinery gold mining will be greatly increased by dredging and hydraulic mining operation.

From Wells up, on both sides of the Chilkat and Klehini Rivers, stands one of the best large forests of timber in the north, part of this timber land is in British Columbia.

The foregoing, in a general way, covers the known resources along the first section; they are gold, iron, and timber, with limited agricultural possibilities. However, with the coming of the railway and consequent increase in population and activities, there will be many new discoveries of mineral resources in the districts tributary to this section.

Second Section—The British Columbia and White River Railway.

This section commences at mile 40 from tidewater and proceeds by the Chilkat River for a distance of about five miles, there crosses the river and then goes up through the timber belt on Glave Creek. At mile 51 the main line of the railway comes within two miles of the Three Guardsmen copper lode. This is probably the largest known copper deposit in the North, with a true and well defined vein, or rather mineral zone, from 30 to 150 feet in width. The ores in this deposit are bornite, copper glance, chalcopyrite and sulphite. At one side of the deposit is a large mass of magnetite iron running more than 60 per cent. metallic iron, and the chalcopyrite and sulphite are impregnated with this iron; wherefore, there is under consideration a special treatment of this ore, to separate the copper from the iron and save the iron ore for blast furnace purposes.

From mile 52 there will be a spur about seven miles long to tap the Rainy Hollow mining district. This district has been officially recognized by the British Columbia Government for more than eight years. A number of copper and galena mineral claims have been located there, and sufficient work has been done on many of these to entitle them to Crown grants, which have been issued by the Government. However, up to 1910 this district was not easily accessible, requiring excessive cost for transportation. In 1910 the British Columbia Government finished a wagon road from the Boundary to the foot of the mountains at Rainy Hollow, and development work will be proceeded with under less unfavourable conditions, though transportation of ore from the mines will not be practicable, except by means of a railway. The work that has been done has disclosed the existence of high-grade bornite ores, also galena ores containing as high as 50 per cent. lead. On the Klehini River side there is one ore deposit from which about 50 tons has been mined. The ore runs higher than $100 a ton in silver and copper. Wherever the iron capping has been broken through there is galena ore, containing in some places as high as 30 ounces of silver and 50 per cent. of lead. Everywhere there are great indications of minerals, more than sufficient to supply ample tonnage for a railway.

Near mile 60 lie large coal deposits, which are unexplored. A few hundred pounds was taken from them in the summer of 1910 and packed out on horseback for sampling purposes. This coal proved to be a good grade of lignite, suitable for locomotive and household purposes.

The resources along the line from tidewater to mile 60, as enumerated hereinbefore, include gold, silver, lead, copper, iron, coal, limestone and timber.

Mile 60 is as Isobel Pass, which is the summit of the Chilkat Mountain range, and this summit is attained without a single tunnel or deep rock cut, and in no place does the grade exceed two per cent. From Isobel Pass the route descends gradually to the Alsek River Valley, near Dalton Post. The existence of placer gold in payable quantities has been reported in a number of places between Isobel Pass and Dalton Post, but

owing to difficulty of access to this section, very little work has been done; furthermore, the existence of this gold has been kept secret as much as possible by the prospectors in the hope that they would be able to hold the ground until the provision of railway transportation. One company, believing that the railway will surely be constructed, has this year taken in about $30,000 worth of supplies and machinery for placer gold mining purposes in this vicinity.

From Dalton Post to Lake Kluane the distance is approximately 100 miles, and this is the most important 100 miles along the entire route. This portion of the route runs through the great Shakwak Valley, which is destined to become an important agricultural district. The soil in this valley is rich and fertile, and the climate is favourable to northern farming operations. The Shakwak farmer will find a demand for all his products in the mining towns along the line of the Alaska Midland Railway, at prices considerably in advance of those received by his brother farmer to the South. The farm conditions here are more favourable than those existing in Finland, which is in the same latitude, and Finland has more than 3,000,000 people and exports annually more than $50,000,000 worth of agricultural products. Indeed, from a northern point of view, the condition for agricultural purposes along the route of the British Columbia and White River Railway are ideal. Furthermore, minerals in the form of gold, copper, galena, coal and seepage of coal oil are reported in all directions in the mountains on both sides of this great valley. It is known that placer gold occurs on Sheep, Bullion, Duke, Burwash, Quill, Arch, and a number of other creeks.

One of the largest copper deposits in this section is at Jarvis River. This is a deposit of chalcopyrite, stated to be more than 50 feet in width. It lies within one mile of the railway route, and the ore is reported to be of a character that can be reduced to concentrates containing more than 20 per cent. copper.

North from Lake Kluane, the Alaskan Boundary at the 141st meridian, lies what is believed to be the largest and richest amygdaloid copper district in the North American continent. As a result of the existence of this class of copper ore, placer copper is found in many of the streams in quantities, from small grains to big slabs weighing several thousand pounds. At Kletsan Creek, Jack Dalton, who is one of the pioneers of the North, has located, or acquired, some 25 placer copper claims that he believes contain enormous quantities of free copper.

In the White River district, near Canyon City, there has been a small community of miners for a number of years holding on to copper claims of this character for themselves and their associates. Congress man Sulzer, of New York, is interested in some of these copper claims, and sends a representative in there regularly every year. Inasmuch as the average cost of transportation under existing conditions is about $300 per ton, the development work actually accomplished up to the present time is not of an extensive character, and outside of the limited area that has been explored by these pioneers who have been there for the past eight years, the resources of this section of the territory are practically unknown, but if they are to be judged from what is known to exist in the surrounding districts, they must be very rich. (See report of A. H. Brooks, United States Geographical Survey.)

Mineral Mountain—Chilkat M. D., B. C.

The well-known capitalist and mining engineer, Mr. Henry Bratnober, wrote as follows concerning this district:—

"If it were not for the difficulty of getting supplies in that country there would be a very great deal of work going on there now, but at the present time very little can be done. If a railway was in there, so that

we could get in supplies and machinery, there would be great activity. I consider this is the greatest copper country of North America, or any other country that I know of. The copper on White River is metallic copper, identical with that of the Lake Superior district, only more extensive. At the upper canyon of White River I have seen chunks of native copper lying on the surface weighing more than three tons each, and a great number of slabs of copper weighing from 300 to 600 pounds apiece. Kletsan Creek is full of copper in the gravel, carrying a high percentage of copper, which indicates that there are veins farther up the creek which have not yet been discovered. There has been very little prospecting done, but I consider this the future copper country of America.

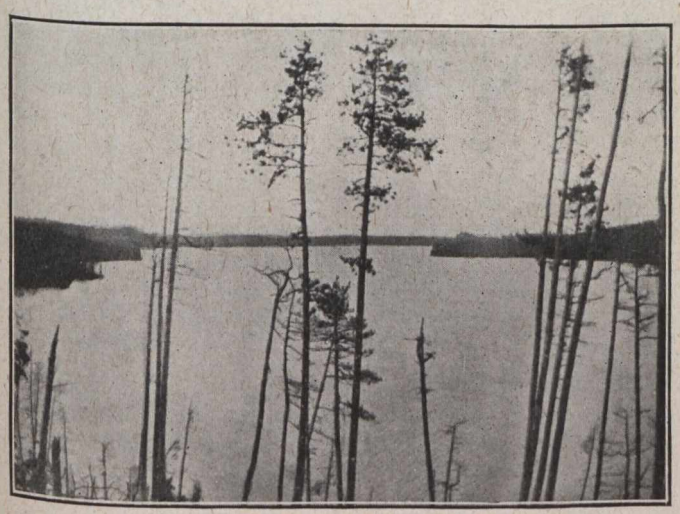
"I am now operating on the Nabesna River, where the ore is bornite, running about 60 to 62 per cent. copper. What I would like to impress upon you is the possibilities of that country, namely, that it will no doubt keep two railways busy, as there will be enough business there for hauling in supplies and hauling out copper to keep two railways going for a long time to come."

Once the railway arrives at White River it will be only a matter of time when it will be decided to construct a branch down the White River to Yukon River and thence to Dawson, as by so doing the present mode of transportation and existence for Dawson will be revolutionized. For example—under existing conditions it requires at least three days to go from Skagway to Dawson and at least five days to go from Dawson to Skagway, while with a branch line connecting Dawson with the British Columbia and White River Railway, one could always go from Haines to Dawson in less than 18 hours, making not only an important saving in time, but also a reduction in cost of transportation.

WHISKEY LAKE AREA

By W. E. H. .Carter.*

The Whiskey Lake area, so-called from the presence within its boundaries of a fairly large lake of that name, is included at the present time within four townships, each six miles square, and known as Nos. 137, 138, 143 and 144. These are continguous in the form of a square, whose southern boundary lies two townships north of Shedden and Lewis, which border on the north shore of Lake Huron. The lower end of Whiskey Lake is distant about fifteen miles due north of Cutler, on the Canadian Pacific Railway, Sault Branch, from where one may reach the lake by canoe, up the Serpent River waters. The usual route followed is by a roundabout road 33 miles long from Massey Station, farther east, northwesterly through the Townships of Salter and Tennyson, and township No. 130 to the east side of Whiskey Lake, after which all travel is by canoe through the lakes and rivers which abound in the region. Another road of about the same length, but in a worse condition for travel, goes northeast from Spragge, to the west of Cutler, arriving at Picard's Lake. At this point the canoe is taken, passing up Whiskey Creek, about three miles in length, and thence into Whiskey Lake.



Whiskey Lake

*Mining Engineer, Toronto, Ont.

Most of the townships in this district have been under timber license to lumbering firms for thirty-five years or more, with authority to cut the pine and other trees thereon, and the existence of these valuable timber interests has operated to discourage prospecting or mining, which would tend to expose the timber to danger of loss by fire. Most of the townships have been cut over once, a number of years ago, but the timber, then too small to take, has grown in size and in certain portions of the limits is now merchantable. Where the lands have been denuded of their timber this obstacle to mining does not, of course, exist. Since my earlier visit the area has been extensively lumbered so that over much more of it mining could now be conducted.

Whiskey Lake

The first official examination of this area for the Ontario Government was made by the writer in the spring of 1904 to investigate the reported discoveries of copper bearing veins. Those interested did not then give much consideration to its possibilities in gold or any other valuable metal, and the value of the field remains still to be proved.

The existence of copper in this region was known for a number of years prior to 1904, but not until then

were other than the original few scattered finds made. Some of these newly discovered veins proved to be unusually unbroken in horizontal extension. A large number of claims were staked out, some of them surveyed and the rest simply applied for pending the opening of the district for mining operations.

The Whiskey Lake country has several characteristic features in which it differs from the lower land to the south, amongst these being the large number of lakes, long and narrow for the most part, separated by high rocky hills and connected one with the other by typical mountain streams. Although the hills do not rise much over 300 feet from the lakes at the foot, they are markedly precipitous and strewn with rock debris. The rocky nature of the country is frequently hidden at a distance by the heavy growth of stout, healthy trees of both hard and soft woods.

For a couple of miles or so north of Massey Station the road passes over quartzites intersected at intervals by dykes of greenstone, probably diorite, and then into a stretch six to ten miles wide composed entirely, as far as could be observed, of the igneous rocks, granite, gneiss, and diorite, the last intersecting the other occa-

Whiskey Lake

sionally in narrow, though more frequently extensive eruptions. At Whiskey Lake the quartzite again appears, and here, as in the belt to the south, it is broken up by a series of more or less parallel intrusions of diorite, having a course east and west and vertical dip. Where observed, the width ranges from 100 feet to as much as half-a-mile. In texture the greenstone is usually medium-grained, granular, and green in colour, although along its contacts with the quartzite this disappears in an alteration towards a darker compact schist.

The quartzite, in texture, composition and colour, varies considerably, but in the main is of rusty white, clear, quartz of medium grain. From this it ranges on the one hand through a pinkish arkose to the fine grained greywacké; and in the other extreme to a coarse matrix of almost clean quartz in which large stones of the same material are included, giving the effect of a conglomerate.

Along the east shore of Whiskey Lake, where the eastern boundary of the four mentioned townships lies, granite outcrops on some of the hills. No discoveries had then been made in this direction.

The vein formations may be separated into several varieties each with distinct features, as will be noticed from the descriptions below, but all appear traceable to faulting or fracturing subsequent to the ejection of the basic eruption.

On Campbell's Island near the centre of Whiskey Lake, and also at the falls, where a stream flows into the north end of the lake, quartz veins outcrop lying well within this greenstone eruptive. The filling is of quartz, of lenticular outline, varying in width from small stringers up to 6 feet and carrying galena and iron and copper pyrites in irregular pockets. These last are quite small and unimportant in themselves.

Samples from each of these veins at the places where uncovered gave by assay only traces in gold, and from $1.00 to $3.00 per ton in silver, according to the quantity of galena present. The amount of copper was too small to warrant a determination.

On the west shore of Whiskey Lake, on mining location W. R. 94, and at a point about southwest from Campbell's Island, a vein of quartz is exposed back from the water's edge a short distance and lies well within the coarse quartzite rocks. Quartz and chalcopyrite compose the vein material. Of this, from the exposure on the shore, a small amount was raised by open

Whiskey Lake

pit which ran high in copper content. In a 25-foot shaft sunk a short distance back from the lake the quartz body breaks up into a few smaller stringers with less copper. The small amount of work done with the meagre surface exposure is insufficient to give any idea as to the continuity of either the vein or the copper values therein.

The veins which have, however, been found more frequently than any of the others consist of quartz and chalcopyrite, filling faults or shattered zones of the greenstone, always either in or quite close to its contact with the quartzite. From their unusual continuity along unvarying lines of strike, and the content of fair quantities of copper pyrites, it would appear that they constitute the most important copper bearing deposits in the area. The greenstone alongside of these contacts evidently marks the main lines of weakness in the rocks in the locality, since no other fissures approach the prominence of these.

Where a clean fault was made the vein has all the characteristics of a true fissure deposit. The walls are often slickensided and lined with more or less gouge, being in such case well defined. Most of the gangue consists of quartz, especially where the vein has narrowed

down, the only other rock being trap, which is interbanded through the quartz in greatest quantity where the vein is widest. The brecciated ore bodies, which follow lines or zones of fracture rather than of faulting in the diorite, are composed mainly of the trap itself in angular masses, both large and small, cemented together with a much smaller quantity of quartz and chalcopyrite. The walls in this case are rather indefinite.

The strike of these veins, like that of the contacts they follow, is most often a few (about ten) degrees south of west, but it varies locally as much as 45 degrees. They have a width of from three or four feet to over twenty feet. The copper occurs as chalcopyrite, and constitutes practically the only sulphide present, iron pyrites being visible only in the inclusions of diorite and in the walls. The chalcopyrite is both finely disseminated and in large masses or bands, sometimes a foot wide. As very little work has been done, it was not possible to fairly sample the veins for their copper content; but it will be neither too much nor too little to say that they are very good prospects.

One of these veins is especially interesting. It was discovered and located by Mr. H. E. Long, who has since traced it for nearly three miles, and for a further distance of two or three miles more on either side he found similar outcroppings of apparently the same deposit. The locations covering it for about half their total length border on and include most of the land under the waters of McCool and Corner lakes. The property is known as the Long Tom, and aggregates about 1,760 acres. The fissure follows an almost straight course S. 80 W.

Whether or no any portion of this vein carries gold had not at the time of my examination been determined. The area is new and almost unknown so that one can hardly express an opinion in the matter. Certainly no gold of any account has been met with up to the time of this former examination.

Still another kind of copper bearing vein occurs, near the shore of Whiskey lake at its northwest end. The vein has the same strike as that of the Long Tom. One opening showed a width of 20 feet, which seemed to be maintained over its uncovered length of 300 feet. It traverses the greenstone formation, the nearest quartzite lying a short distance to the south. The composition is of quartz and slightly altered greenstone closely intermixed into a dark mass through all of which chalcopyrite is disseminated, mainly in a fine state and in fair quantity where exposed, probably around 2 or 3 per. cent.

There were a number of other veins staked more or less similar to some of those described and in various parts of the area. Some also had previously been discovered a few miles farther south and this last may indicate a possibility of more veins being found over a considerably larger area than this immediate vicinity of Whiskey lake.

THE FACTOR OF SAFETY IN MINE ELECTRICAL INSTALLATIONS*

By H. H. Clark.

Introduction.

This paper is not written for the purpose of discouraging the use of electricity in mines. The advantages that have in the past attended the use of electricity in mining work will be even more apparent in the future as operations are extended, power systems consolidated, and generating stations centralized. A discussion of these advantages is unnecessary since they are well known to everyone interested in the subject. The purposes of this paper is to urge that the requirements of safety, as well as those of efficiency, be considered in the installation and operation of electrical mining equipment. The Bureau of Mines publishes this report as one of a series dealing with the use of electricity and the prevention of electrical accidents in mines.

A factor of safety may be regarded as representing the ratio of maximum capacity to average duty. Factors of safety are used in the solution of engineering problems in which the conditions can not be exactly determined in advance, or in which unforeseen happenings may arise to introduce severe stresses. Especially does this apply to problems in which the safeguarding of human life is a consideration.

The use of a factor of safety is not a sign of poor engineering, but quite the contrary. Good engineering is based upon recognizing conditions, not upon ignoring them. The wise engineer prepares for emergencies instead of assuming that the emergencies will not arise. A factor of safety is good insurance, which is everywhere recognized as a business necessity.

The safe operation of electrical mining equipment is an engineering problem that involves the element of human life and that is influenced by conditions and events that can not always be foreseen. The successful solution of the problem will, therefore, depend largely upon the factor of safety that is considered in the selection, installation, and maintenance of such equipment.

In problems in which the factor of safety can be expressed numerically it is seldom made less than three, and often more than 30. In the present discussion the factor of safety can not be numerically expressed because neither the capacity for safety nor the duty to be performed in preventing accidents can be measured in the same terms, or even in any terms at all. Therefore, more care, better judgment, and more liberal allowances in design, construction, and installation are required to insure a factor of safety than would be required if its existence were susceptible of mathematical proof. But above all, the absence of a mathematical basis for argument demands great courage of conviction on the part of those advocating increased expenditures in the interest of safety.

To facilitate consideration, the problem may be divided into two principal parts: First, an analysis of the conditions to be met; second, a discussion of how to meet them and insure a desirable factor of safety.

*Technical Paper No. 19, U.S. Bureau of Mines.

Classification of Accidents Due to Electricity.

In analyzing the relation that the use of electricity in mines bears to the accidents that occur there, the first step is to classify the different ways in which electricity can cause injury, death or disaster.

One characteristic of the electric current with which everybody is familiar is its ability to produce electric shocks. The conditions underground are favourable to their occurrence. There is a well-known fire risk in connection with the use of electrical apparatus. The use of electricity in the vicinity of gas, explosive dust, or explosives, all of which may be found in mines, is attended with danger. There are, therefore, in connection with the use of electricity in mining work three possible dangers—shocks, fires, and explosions.

Electric Shocks.

The conditions under which electricity can start a fire or cause an explosion may be absent from a mine at any or all times, but the chance of receiving an electric shock is always present in any mine where electricity is used and men are at work.

Many conditions that are peculiarly favourable to the occurrence of electric shocks are found in mines. Most of these, such as dampness, dust, limited space, and scanty light, are unavoidably associated with mining work. In addition, many underground employees are unfamiliar with electrical apparatus and the proper way to regard it. They may have no responsibility as to its operation or condition, nor any direct interest in it whatever. To some of them electricity may be not even a name or at most only something about which conflicting and confusing statements are made. Yet though the conditions underground favour electric shocks and though the men may be unfamiliar with electricity, trolley wires and uninsulated feeders are frequently found operating at 250 and 550 volts, the earth being used almost universally as the common return for all direct-current apparatus.

Danger from Ground-Return Circuits.

Under the best of conditions ground-return circuits offer more chances for shock than do completely insulated circuits. The risk is increased where workmen are obliged to stand upon the ground when handling apparatus operating with ground returns. In ground-return systems one side of the generator is connected to the earth, to the track-rail network, and to the return feeders which are in parallel with both. As a result anyone who stands upon the ground stands upon one side of the electric circuit and only a single contact with the other side of the circuit is necessary to give a shock.

Dangers from Trolley Wires or Bare Conductors.

Trolley wires in mines present a most fruitful source of electric shock. Trolley wires are necessarily bare conductors; they may extend for long distances through out a mine, and often they must be installed less than a man's height above the track rail which is used as part of the return circuit. A low trolley wire is especially dangerous in places where men must work in making up trips of cars, as at partings where loaded trips are brought out to the foot of a rope-haulage system. Under such circumstances both the loaded and the empty trips are in the parting at the same time, and manipulation is required to make up the loaded trip to be taken out on the rope and to split up the empty trip to be taken in by the various locomotives. It is often desirable to do this work rapidly, and if the trolley wires are lower than a man's head the chance for shock is considerable. Even if the men are familiar with the conditions their attention, while hurrying to get the trips away from the parting, can not be constantly on the trolley wire.

Trolley-wire feeders and the wires of circuits that operate motors of any description, if exposed to the same extent, offer the same chance of shock as does the trolley wire. Usually such exposure is not necessary, however, as the wires can be strung along the sides of entries in positions less accessible to persons passing. It is also possible to insulate or protest the wires.

Danger from Accidental Charging of Equipment.

Apparatus that has accidentally come in contact with the ungrounded side of an electric circuit is almost as dangerous as the trolley wire. If such apparatus is metallic and is insulated from the earth it offers all the necessary conditions for giving a severe shock, and the danger from such a shock is accentuated by the fact that the victim, being unaware of his proximity to danger, may firmly grasp the charged part. If a shock is received while the victim is grasping the source of current, the results are more likely to be severe than under other conditions, because the grasp is "frozen" in place by the sudden contraction of the muscles, and voluntary release from contact with the circuit is impossible. By connecting to the earth such parts of apparatus as are made of conducting material but are not designed to carry current they can not become charged with electricity to a potential above that of the earth; consequently a shock can not be obtained by a person's establishing contact between such parts and the ground.

Shocks from Locomotives and Cars.

There are certain ways in which shocks can be received from locomotives and mine cars. The frames of locomotives are connected to the current-carrying parts of the motors and become charged whenever the motors or headlights are in operation. If the locomotive loses its ground or contact with the rail by reason of oversanding or for any other cause, the full line potential exists between the frame of the locomotive and the rail. Under such circumstances as severe a shock can be obtained from the locomotive frame as from the trolley wire.

Since the drawbars of the mine cars are connected to the locomotive frame and are continuous throughout the length of the trip, it follows that, whenever the locomotive loses its contact with the rail, all the drawbars are raised to the potential of the trolley wire unless some of them are in contact with the car axles, axle boxes, or some of their connections.

Relative Danger from Different Voltages.

An electric shock is caused by the passage of current through the human body, the severity of the shock depending upon the amount of current passed. The amount of current depends upon the voltage and the resistance of the circuit, the latter including the resistance of the body, the resistance of its contact with the source of current, and any resistance that may be in series with the body, such as ground resistance.

Obviously, therefore, all other factors being equal, the severity of the shock varies with the voltage causing it. There are voltages so small that they are not capable of passing through the body current sufficient to produce a shock. As these voltages are exceeded, a value is reached at which shocks begin to be felt. As the voltage is further increased a value is reached such that shocks may be fatal if the contact is maintained for a sufficiently long time. At still higher voltages the period of contact necessary to cause death becomes shorter.

The effect of any shock depends so much upon the particular conditions involved that no specific values of voltage can be assigned to any of the conditions mentioned. The physical makeup of a man greatly affects the outcome. Some men seem practically immune from shocks from potentials as high as 500 volts, while others may be killed by a much lower voltage.

As regards the relative danger of a current having a potential of 250 volts and one having a potential of 500 volts, both have been known to cause fatal shocks. Compared with a 250-volt potential, a 550-volt potential not only passes more current through a man's body under a given set of conditions, but it is also more likely to break through insulation to ground. The higher voltage will pass the same current through poorer contacts and greater resistances than will the lower.

Fires Caused by Electricity.

The danger from fires caused by electricity arises principally from defective installation, careless upkeep, or from injuries to equipment resulting from falls of roof or similar causes. A short circuit or a ground that does not blow the circuit breaker nor the fuses may produce heat enough to start a fire by leaking across coal or timbering. The blowing of an open fuse is accompanied by sufficient heat to ignite combustible material that is very close to the fuse, especially if for any reason the arc is long drawn out. The presence of inflammable material around electric motors or starting boxes may prove to be a source of trouble. Incandescent lamps produce heat enough to ignite combustible materials if the dissipation of heat from the bulbs of the lamps is allowed to become restricted. With conductors bare and with both sides of the circuit strung side by side there is a chance that leakage from one side to the other across coal or damp timbering arcing, and heating enough to start fires.

The conductivity of coal, especially dry coal, is usually very low. This fact tempts careless workmen to poor construction and poor installation; also it aids in covering up these defects. Such poor work might be logically expected were it not for the fact that, under some conditions, grounds to coal will produce sparking, arching, and heating enough to start fires.

Inflammable material should never be allowed to collect about a motor or in the vicinity of fuses or other apparatus that can produce arcs, flashes, or considerable heat.

To provide a factor of safety, starting boxes, fuses and all apparatus that may throw off sparks under normal conditions, or that are subject to abnormal conditions that result in the production of even greater heat, should be mounted on or protected by a sheet of metal or other strong non-conbustible material.

Explosions Caused by Electricity.

Explosions may be caused by the ignition of explosives, gas, or coal dust.

Ignition of Explosives.

Accidents due to the ignition of explosives by electricity may be divided into two classes: Those that occur while handling and transporting explosives near electric circuits and those that are incident to the detonation of explosives by electrical means.

As to accidents of the first class (with a single exception noted below), electricity is no more of a menace than any other source of flame and heat, but it is as great a menace and should be treated accordingly. As much care should be used in handling explosives in the vicinity of electrical apparatus as though the flashes and sparks that it is capable of giving were constantly in evidence.

Any source of heat may attack an explosive from the outside, but electricity may, under certain conditions, do more than that. An explosive that is a conductor of electricity may come in contact with an electric circuit in such a way that current may be passed through the explosive itself, and although no spark may occur outside the package, ignition may take place on the inside. The possibility of such an occurrence may seem to be extremely remote, but accidents have been reported for which no other cause could be assigned and in which the existence of the above conditions was quite probable. As mentioned in a foregoing paragraph, it is possible, when mine cars of a certain type are used, that a considerable difference of potential may exist between the drawbars and those metallic parts of the car that are in electrical connection with the track rail. If such a care were loaded with metallic packages of explosives, the points of different potential might be so joined that current would flow through the packages and possibly through the explosive itself.

Accidents Due to Electrical Shot Firing.

The accidents that occur in connection with electrical shot firing are due, for the most part, to the accidental discharge of detonators in the vicinity of explosives or to the premature ignition of shots after holes are charged. With regard to the accidental discharge of detonators in the vicinity of explosives, a cardinal principle of safety is that detonators should be kept separate from explosives and that batteries and other sources of electric energy should be kept separate from detonators.

With regard to the premature ignition of shots, it is not the best practice to shoot electrically under conditions that require one side of the detonating circuit to be connected to the earth, because whenever grounded systems of distribution are used, unexpected differences of potential exist in the earth in the vicinity of such circuits. If, therefore, one side of the detonator be purposely grounded, an accidental ground on the other side may connect the detonator across a potential sufficient to cause ignition. Premature ignitions have been reported which seemingly have been caused by the conditions just described.

Ignition of Gas.

Electric sparks will ignite mine gas and air mixtures that contain between 5 and 11 per cent. of gas

(methane). Between these limits a comparatively small spark is sufficient to fire the gaseous mixture. The size of arc or spark that will occur when an electric circuit is opened depends upon a number of things, such as the voltage of the circuit, the amount of current broken, the speed of break, and the character of the circuit. The determination of the exact influence of each of these factors is an interesting problem. For all practicable purposes, however, it is safest to assume that all sparks which occur around such apparatus and circuits as are used for power and light in a mine are capable of igniting gas. Although this assumption may not be correct at all times, the continually varying conditions surrounding such equipment make a contrary assumption unsafe. For instance, a motor that is so well designed and so adapted to its load that the commutating sparks are too minute to ignite gas may, in starting, develop dangerous sparks.

The ignition of gas by electric incandescent lamps is now being investigated by the Bureau of Mines. A large number of lamps of various sizes are being broken in different ways while surrounded by a highly explosive mixture of gas and air. The results so far obtained show that certain sizes of lamps when broken in the presence of gas will ignite it, and that in the action of the lamps there is a difference which depends upon the size of the filament, the larger filaments being more likely to ignite gas than the smaller ones.

Ignition of Coal Dust.

The study of the ignition of coal dust by electric arcs and electric flashes has been undertaken to some extent by investigators in Europe. The results of their experiments indicate that electric flashes can ignite coal dust suspended in the atmosphere. The Bureau of Mines is now devising apparatus preparatory to making an extensive investigation of this subject.

Conditions Surrounding Electrical Installations in Mines.

The conditions surrounding electrical apparatus in mines are more severe and less constant than those surrounding similar installations above ground; there are more trouble-causing factors than are found upon the surface.

Physical Conditions.

Falls of roof sufficient to wreck trolley lines and feeder systems are not uncommon. Dampness, dust, and acid water in sufficient quantities to be detrimental to insulation are present in many mines. Some or all of these conditions must usually be considered in selecting mine electrical equipment. Apparatus that might operate satisfactorily in the absence of these elements will fail when they are present.

The space available for installing and operating underground electrical equipment is usually limited, thus increasing the chance for accidental contact with the live part of the system.

Another factor that has more influence than is usually recognized is the lack of light. Not only has this condition a direct bearing upon accidental contact with electrical apparatus, but it also has an undesirable indirect influence because of the difficulties which it places in the way of properly installing and inspecting the equipment.

Temporary Character of Installations.

As compared with electrical installations on the surface those underground are temporary in character. Circuits and machines are put in place with the certain knowledge that sooner or later they must be removed and installed elsewhere. This fact undoubtedly has an undesirable influence upon the quality of work performed. For economic reasons it is not practicable to resort to methods of installation that would be followed if the work were to be permanent. The men who direct the work must have peculiarly good judgment and must be keenly alive to all the requirements of the situation if a suitable factor of safety and a desirable low installation cost are to be maintained. Although elaborate methods of installation may in time pay for themselves in low cost of maintenance, such methods are not economical if the equipment is to be moved frequently. Obviously, an installation investment in excess of the amount necessary for satisfactory operation during the period of service is an entire loss. If the period of service is to be short, there is a natural tendency to limit the cost of installation. Whether such curtailment is wise depends so largely upon circumstances that no general statement can be made. However, undue reduction in installation expenditures not only reduces the factor of safety at one point, but also lowers the general standard of workmanship throughout the mine. If no accident occurs as the result of poor or cheap work, it is natural to assume that the work met the requirements. The fallacy of making a general application of results obtained in a single instance is manifest at a glance. Yet arguments of this kind have undoubtedly been used in the past to justify inferior work.

The Prevention of Accidents Caused by Electricity.

The problem of safeguarding electrical mine equipment is not a simple one. There is no general formula or equation for its solution. Moreover, there are so many variables involved, so many factors that cannot be exactly related, so many possible coincidences, that results can not be predicted with mathematical exactness. It is necessary to consider each part of the problem by itself, in the light of local conditions, and to adopt such measures as insure a large factor of safety.

Elimination of Contributory Causes.

A logical first step would be to remove or to counteract as many unfavourable conditions as may be disposed of thus.

As previously stated, scanty light, limited space, and the presence of dust and dampness are underground conditions that are favourable to the occurrence of electrical accidents. The influence of the first of these may be eliminated by providing lights at particularly dangerous places, such as partings and crossovers. If electric wires are a source of danger at such places they can be made a source of light also.

Although it may be impracticable to eliminate entirely the effect of limited space, this condition may be counteracted by the erection of guards about apparatus.

Dust and dampness are elements that can hardly be separated from the operation of a mine; in fact, the presence of dampness is often desirable to offset the effect of dust. It is possible, however, to provide

apparatus so designed and installed as to resist the action of dust and dampness, and the more generous the factor of safety included in such design and installation the greater will be the resistance.

Confinement of the Current.

The problem of safeguarding may be divested of some of its vagueness and put in concrete form by considering that if the electric current can be kept where it belongs—in the conductors designed to carry it—it cannot give shocks, set fires, or ignite gas, dust, or explosives. Electricity becomes actively dangerous only when it breaks away from its proper channels in stray currents or as sparks and arcs.

As far as stray currents are concerned the confinement of electricity in its proper place is primarily a question of insulation, a term that includes the covering of conductors, the insulators upon which they are supported, and the insulating material used in motors and accessory equipment. Against insulating coverings for conductors is brought the argument that such coverings deteriorate rapidly and are an added element of danger because they give false impressions of safety. The truth of this argument depends upon the kind of insulation and the conditions of service, and cannot be regarded as universally applicable. If bare conductors are used they must be well installed and, to some extent at least, guarded, in order to confine the current. With the possible exception of high-voltage cables all conductors, bare or insulated, should be supported upon insulators that are mechanically strong as well as electrically efficient. If bare conductors are used, confinement of the current depends entirely upon the insulators. Moreover, dampness and dust can come into direct contact with the wire, a condition not consistent with the highest factor of safety.

In order to insure a high factor of safety in the insulation of motors and other electrical machines they must be carefully selected with a view to the service which they are to perform. They must then be protected from moisture and dust unless such protection is inherent in their design. Care in this respect will be rewarded not only by increased safety, but also by decreased cost of upkeep. The maintenance cost of inclosed motors operated in damp and dusty places should be less than for open motors operated under the same conditions if both types of machines are properly designed, constructed, and rated.

It must be admitted that the electric current can not be kept where it belongs in the sense of eliminating entirely such sparks and arcs as occur at fuses, circuit breakers, air-break switches, starting rheostats, and the commutators of direct-current machines. In this connection the factor of safety must be applied by arranging to confine the outbursts of current to a limited area unoccupied by anything which may be affected by heat or fire.

Additional Precautions.

Assuming that in the selection and installation of electric equipment care has been exercised to insure the proper confinement of the current, the factor of safety may be increased by grounding the dead metallic parts of apparatus, by providing means for insulating the bodies of those who work upon such apparatus, and by barring from the vicinity of the current such elements as are explosive or combustible.

Maintenance of Safety Factor.

It is as important to maintain a high factor of safety as to obtai nit in the first place, and this requisite call for careful and frequent inspection by the mine electrician, whose responsibilities can scarcely be overrated. The supervision of the electrical equipment of a mine is a task that requires unusual ability, sound judgment and experience of a peculiar sort. To select suitable apparatus, to install it properly and economically, and to maintain it free from interruption of service at a minimum cost demands much ability. When the requirements of safety are added to the list of duties the responsibility is not lessened. The establishment and maintenance of a high factor of safety rests as much with the man who has direct charge of the electrical equipment as with anyone. It seems reasonable also to assume that a man who is competent to maintain a high factor of safety is no less able to maintan as low a cost of maintenance as is consistent with satisfactory operation.

Summary.

By way of a summary there follow five terse suggestions for reducing the number of accidents due to the use of electricity in mines:

1. Remove contributory causes.
2. Remove from the vicinity of electrical apparatus all elements susceptible to its influence (gas, dust, explosives, combustible material, etc.).
3. Keep the electric current where it belongs.
4. If under certain circumstances the current can not be entirely confined, at least limit the area of its activity by using protective devices.
5. Insure a high factor of safety by: (a) Selecting materials and apparatus with care; (b) installing equipment in a strictly first-class manner; (c) inspecting equipment frequently and thoroughly; (d) maintaining it in good condition at all times.

BOOK REVIEW

The Examination of Prospects—A Mining Geology—By C. Godfrey Gunther, E.M.—222 Pages—Soft cover—Price $2.00—McGraw-Hill Book Company—New York—1912.

At last a serious gap is filled. The theory and practice of mining have been fully exploited. The geology of ore deposits has been discussed by scores of writers, and the results of discussion and investigation have been given to the public in various forms. But the problem of reporting upon undeveloped prospects has heretofore received but scant attention.

Writing from the point of view of the prospector in the United States, Mr. Gunther states that the demand for good properties greatly exceeds the supply. No

one will dispute this. Also, no one will dispute the statement that money and energy are wasted over properties that should never be touched. While those in search of promising properties no longer expect to find large proven ore bodies, yet to justify even preliminary outlay there must be definite indications of an ore-shoot, if not a clearly certain amount of blocked-out ore.

Preliminary examinations and work should be of such a character as either to condemn any given property or to determine rightly its immediate possibilities. Hasty topographical and geological surveys and a few assays of outcrops may mean little or nothing, or may be totally misleading. It is essential that all other factors that influence the life of a mine be considered. While, in many cases, a cursory examination only is required to throw a property out of court, yet more than this is needed before a mining claim can justly be condemned. And when work is to be continued, a thoroughly detailed study of the situation is a prerequisite. Moreover, this study should be continued as operations progress. This is, in fact, the text of Mr. Gunther's book.

The book opens with a chapter entitled Mining Examinations. After touching on formal and preliminary examinations of mines, examinations for the rescue of badly expended capital, examinations of prospects, etc., the author takes up the price and terms of sale. These last, he asserts, are too often given but small consideration. "Sales of undeveloped properties are made at prices that largely discount even a decidedly favourable outcome for the proposed development."

Again, "owners generally suffer from extreme optimism, and many engineers from excessive professional timidity, and neither is willing to meet the other half way. Owners of prospects are usually brought to their senses after repeated unfavourable examinations, but many engineers more make a favourable report because of the risk of personal reputation." By a curious obliquity of human nature, the quality of "timidity" referred to by Mr. Gunther is labelled "conservatism" by the profession, and is often mistaken for an indication of sound judgment.

Mr, Gunther points out that no engineer should expect to find a mine having ore of a greater net value than the purchase price asked, unless the mine is "admittedly bottomed and has no possibilities beyond the ore already developed." We agree with the author that this is a rare case. Some such rule as that enunciated by Mr. J. H. Curle, to the effect that 66 per cent. of the purchase price should be represented in net value of ore reserves, with the lower levels still looking well. Even on this basis, most prices are set too high.

"Cash payments," continues Mr. Gunther, "should not be made on prospects." This may or may not be good advice. In a rush district cash payments are often essential as a token of good faith and financial responsibility on the part of the purchaser. But in all cases, first expenditures should be reduced to a minimum, and the whole object should be to follow the ore. The expedient suggested by Mr. Gunther of a monthly "salary" payment to the owner is not to be commended.

In the course of Chapter I., Mr. Gunther develops the theme of preliminary examination and touches particularly on the equipment for, and the work of, sampling. He recommends personal re-sampling as a check upon work done by assistants. The "foot-ounce" method is suggested as that best adapted for calculating ore reserves. "In this method the length of each sample is multiplied by its assay value; the products from all the samples in the block under consideration are added, and this total divided by the sum of the lengths, the quotient being the average value." With paragraphs upon such considerations as stoping width, hand-picking, metallurgical losses, etc., the chapter closes.

Chapter II. has for its subject "Structural Geology." Then come chapters on the structural features of ore deposits (this is a particularly strong chapter); primary ores and their distribution, types of primary ore-deposits, primary ore-shoots, primary alteration of wall rocks, alteration by surface agencies, residual ores, secondary ores and ore-shoots, and, lastly, outcrops.

The last chapter, "Outcrops," deserves more than passing notice. Mr. Gunther here discusses fully the relation between outcrop and vein. He points out that strong, persistent outcrops of uniform width indicate the probable size and character of the underlying vein, "whose persistency in depth is likely to be proportional to the length of its outcrop." Fissures, traceable for long distances, are commonly found to possess at least equal depth. Short, irregular outcrops indicate irregular underlying deposits. "Outcrops that comprise a series of large, irregular masses, perhaps connected by narrower veins, are in general likely to become smaller in depth." These generalizations, while open to incidental exceptions, are true in the light of experience.

The mechanical effect of erosion, the topographic expression of mineralization, the porosity of outcrops, "casts" in resistent gangue minerals, and other common phenomena, oftener than not overlooked by the prospector, and the engineer, are given careful presentation in this chapter. For instance, the fact that small percentages of copper, contained in iron pyrite as chalcopyrite, interrupt and modify the crystallization of the iron pyrite. In the case of galena, the crystallization is marked when considerable quantities of silver are present. Thus, careful scrutiny of the mineralogical features of an outcrop may lead to very important conclusions. Microscopical examination, also, may play a strong part.

Mr. Gunther's book fills the traditional "long-felt need." It helps to make complete the list of guides to the varied branches of the profession of mining engineering. Like all proper books of the kind, it emphasizes explicitly and implicitly the fundamental business aspects of prospecting and mining.

"Examination of Prospects" is well bound, clearly printed, adequately illustrated, and creditably edited.

PETROLOGICAL DEPARTMENT

By G. S. Scott.

R. A. B.—This rock was received by the Petrological Department for determination of its value as road metal.

The specimen submitted is a dark green mottled rock which is exceedingly tough under the hammer. It has a very obscure schistosity but no cleavage what-

ever. Many small glistening cleavage planes of a dark mineral and a few grains of pyrite can be seen. The specific gravity was shown by several determinations to be near 3.02. The porosity was found to be only several one-hundredths of one per cent. It is, accordingly, a negligible factor in the use of the rock for road metal.

These few facts were all that could be learned from mere inspection of the specimen. To supplement them, a thin transparent section of the rock was prepared and examined under the microscope. This examination showed the rock to be an epidote amphibolite, a member of the family to which gneisses and schists belong. It consists chiefly of hornblende crystals felted and woven together with interspersed grains of feldspar, epidote and ilmenite.

This rock meets the different requirements of material for road metal quite completely. These requirements are: 1. High specific gravity; 2. Low porosity; 3. Toughness together with the quality of yielding to the crusher without the production of too much fine material; 4. Resistance to weathering. With regard to the last point, there is no danger of a rock of this kind crumbling upon exposure to the weather after quarrying, as many trap rocks do. Another advantageous feature is the titaniferous composition of the iron ore, for such iron ore is not nearly so susceptible to weathering as the more common magnetite. The comparatively high content of iron ore makes the rock an unusually heavy one even for a rock of its kind.

This epidote amphibolite was produced by the metamorphism of a gabbro or coarse diabase deep within the earth's crust. It is remarkable that if this alteration had proceeded either farther, or not so far, the resulting product would not have been so suitable for use as road metal, as it is. In the former case it would have become more granular, like a gneiss, and in the latter case the porosity would have been left too great and the cohesive felted structure would not have been developed.

Prospector, Porcupine—Sericite Schist.—This is an extremely fine-grained soft fissile rock of light silvery-grey colour and greasy feel. With hydrochloric acid it effervesces briskly at all points.

The thin section shows an aggregate of clear colourless grains with calcite, much sericite and pale chlorite. The colourless grains, though unstriated, are in all probability feldspar. Opaque streaks that are yellow in reflected light are seen with a high power to consist of hosts of minute brown rutile crystals. Several large striated feldspars of irregular shape are also present. The chlorite sericite and opaque streaks form a beautiful schistose structure, the bands of which bend about these large feldspars.

There seems no reason to doubt the derivation of this rock from a diabase, gabbro or basalt. It is probable that it is from a part of a mass of such rock that suffered extreme mashing. It is not likely that the whole of the mass would have been so crushed.

The original ilmenite is now represented by streaks of leucoxene, composed largely of rutile. The alteration of ilmenite to rutile is a common effect of weathering; but, as it is known to be produced by metamorphism also, there is no reason to assume that the rock was subjected to weathering before being crushed and recrystalized under metamorphic conditions. The large feldspar fragments are relics of the original feldspar that escaped crushing. They are remarkably fresh. A few grains of pyrite in the form of sharp cubes are present.

PEAT PRODUCTION

In European countries, where labour is cheap, peat fuel has been produced for many years. In Canada, where labour is expensive, development of the peat industry has been retarded on account of the cost of production.

The history of the many attempts made on the continent of America to produce peat fuel indicates "failure after failure." But persistent effort was bound ultimately to meet with its reward; experience taught that hand labour must be replaced by machinery and that natural instead of artificial methods of drying were preferable. The result is that to-day peat fuel is produced commercially, and although improvements must and will be made, still the methods now employed give a product that will compare favourably with the best coals on the market, and if taken on a B.T.U. test might be found to beat some of them.

Before any machinery is installed on a bog the land must first be thoroughly surveyed and tested. To ensure success a competent peat engineer should be employed, who will lay out the bog for proper working. A system of ditching must be devised to provide for partial drainage. A new bog will hold about 95 per cent. water, which volume should be reduced to say 85 per cent., as this amount of moisture seems to have the best effect on the peat in process of manufacture.

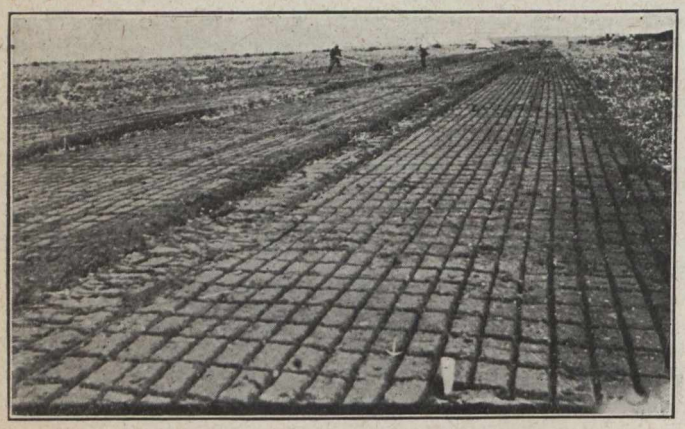
The machinery used for the excavation, and maceration, to give the best results, must be both light and strong. The most modern is a self-propelling machine, or system of machines, mounted on a large platform, which in turn is mounted on a tractor of the caterpillar type. On the forward end is placed a gasoline engine, of anywhere from 50 to 75 h.p. to furnish power for the propelling of the machine, for the excavator, the macerator, the cable for the cars, and the drawing of the field press.

On the rear end is placed the excavator boom, on which are mounted bottomless buckets. As the machine advances the excavator digs out a trench behind, and being mounted on a pivot it has a sweep of about twenty feet. The object of the "bottomless" buckets, is to overcome the natural stickiness of the peat and aids greatly in the evacuation. The buckets, operating on the underside, scrape up the face of the cut, thereby ensuring the mixing of the several layers of peat. Each layer has a different fuel value, and by the mixing is secured a product of uniform quality. From the ground surface to the upper end of the boom extends an apron under the buckets, which keeps the contents in place as they travel. When the buckets reach a certain point they empty the raw peat on to a belt conveyor, which carries it to the macerator. The use of

this machine is responsible for the difference between the smoky, quickly consumed fuel of other days, and the modern product of peat. It was invented by the late Aleph Anrep, a Swede, who gave his whole life to the study of peat, and through whose energy and inventiveness Sweden owes her place to-day as first among peat-utilizing countries.

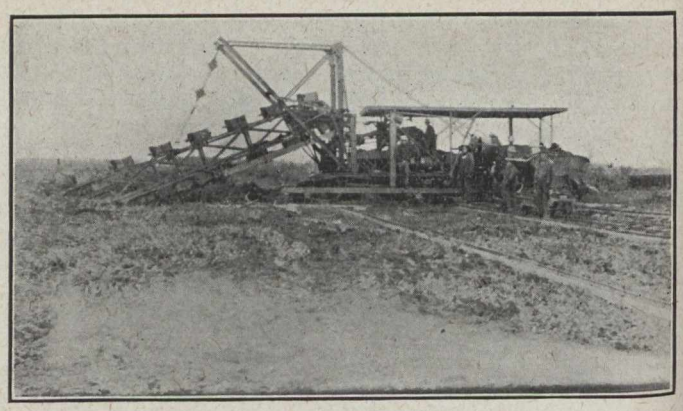
Peat is of cellular formation. The cells hold moisture which they give up most reluctantly; after drying they re-absorb moisture, and consequently without special treatment the fuel can never be drier than the surrounding atmosphere. Tht Anrep macerator, through the medium of a series of rapidly revolving knives, cuts and tears the fibre, destroys the cells and reduce the whole to a pulpy mass of even texture. After being macerated the peat is ejected into a spiral conveyor, which carries it to dump cars for transportation to the drying field. On each side of the working trench the ground has been cleared; in the case of a trench, say twenty feet wide and ten deep, four hundred to four hundred and fifty feet wide and running the whole length of the trench.

The dump cars carrying the prepared peat run on a loop 24-inch gauge railway. The rails are mounted on steel ties and quite easily handled—an essential fea-



A Prepared Peat Bog

ture—as this loop has to be moved from time to time, a sthe machine advances. The power is derived from an endless cable passing over drums on the machine. When a car is filled it is clamped to the cable and starts on its journey to the field press. When it reaches this point, it is uncoupled and the contents thrown into the press, which is merely a heavy frame of say eight feet wide and fifteen long. The rear end is raised about five inches above the surface of the ground. It works from the outer margin of the drying field towards the machine, being drawn by a cable attached to the forward end and passing through a sheave anchored at the point where the row of peat is to be, from thence it passes around a revolving drum on the machine, to a winder operated by a boy, which takes up the slack as it is advanced. Just forward of the rear end of the press, is a platform weighted, so that as the press moves ahead, it passes over the peat which has been dumped into it, smoothing it out into a row of even thickness. Behind the press is drawn a shaft attached to which are revolving disks, that cut the row longitudinally. Afterwards a man armed with another disk attached to a long handle does the cross-cutting, which forms the bricks. During good drying weather in, say the month of June or July, the bricks, in from eight to ten days, are ready for turning, after which they are piled into stacks of from fifty to sixty bricks, in such a way as will allow for the free circulation of air. Until the peat is shipped it is left standing thus. For the carrying of the prepared peat fuel from the drying field to the shipping platform, special cars art used and are drawn by an internal combustion locomotive. A very good type of locomotive for the purpose is one made in Sweden, burning kerosene for fuel. A locomotive of this type is in use at the plant of The Peat Industries, Limited, near Farnham, Que.



Anrep Peat Machine

The complaint that peat fuel was too bulky for shipment no longer holds good, as from twenty-five to thirty tons can easily be loaded into an ordinary freight car. For the railway companies the freighting of peat is more satisfactory than other fuels, as being cleanly to handle. Any kind of cars can be used, and, being available for return freight, are not hauled back empty as in the case of coal cars. The fuel stands handling well, and once dry cannot be made to re-absorb moisture, consequently open cars can be used for transportation.

THE PEAT INDUSTRY IN QUEBEC.

A beginning has been made in the utilisation of the peat bogs of the Province of Quebec, by the operations iniated last year at Farnham by the Peat Industries, Limited. After preparing the bog, a main ditch ten feet deep, seven feet wide at the top and three feet wide at the bottom, dug for a distance of twelve hundred feet, while, in addition, surface drainage aggregating between seven and eight thousand feet was undertaken. By the time, however, that this work was completed and the machinery installed, the season was fairly advanced, and while some production was made, the remaining period before winter set in was occupied largely by experimentation with a view to perfecting the system. The system of manufacture, by the way, is a modification of Swedish methods, as devised by Aurep. In one respect only was a difficulty experienced, namely, in respect of the handling of the prepared peat. The costs have proved to be disproportionately heavy, and to remedy this state of affairs dump cars of a special design have now been provided, while the product will be drawn in train-loads by locomotives of the internal combustion type directly from the drying field to the railway cars. The company, it is affirmed, is not in the least concerned regarding the question of profitably marketing their product, for which already an excellent demand has been established.

H. M. L.

PEAT AND ITS UTILISATION FOR POWER PURPOSES.

The successful utilisation of peat for power production on a large and economical scale at Portadown, Ireland, would appear to fully justify the convictions so forcibly and frequently expressed by Dr. Eugene Haavel, Director of Mines for the Dominion, concerning Canadian potentialities in this regard. The conditions are ripe, in Ontario at least, for experimentation, on the part of industrial concerns, to determine how cheaply power may be developed in certain districts from peat fed to gas producers. Really, that is the only point upon which more precise data is, perhaps, desirable or necessary. Not long since when reporting on an important copper property near Temagami, Mr. John E. Hardman strongly recommended that for the operation of a plant and for the generation of power required for the local reduction of the ores, the peat bogs in that neighbourhood be turned to account. There are many other localities where conditions are similar and where the utilisation of peat would enormously benefit and cheapen the costs of mining. The power plant in Ireland to which we have referred has a capacity of 400 brake horse-power and consists of two gas producers, each of 200 brake horse-power capacity, coke scrubber, tar extractor, saw-dust scrubber, exhauster and expansion box. Its operation is extremely simple. The peat is fed into hoppers at the top of the producer, from which it falls by gravitation into the body of the producer as combustion of the lower layers of peat takes place. The gas as it is formed passes through the coke scrubber to the tar extractor, where the tar is separated from the gas by centrifugal action. The gas then passes to the saw-dust scrubber, where the final cooling and cleaning takes place. It is drawn through the plant by an exhauster in the form of a high-speed fan, which delivers it to a gas-holder for use in the engines. The nature of the gas produced is similar to that of suction gas from Welsh anthracite, though it contains a smaller percentage of hydrogen gas, and the thermal value—about 140 B. T. U.—is slightly more. The cost of the peat delivered to the plant is said to be six shillings per ton. Since the weekly consumption is approximately twenty tons, the prime cost of the fuel is £6, but from this is deducted the value of the tar recovered from the plant, representing thirty-five shillings a week, or a net cost for fuel of £4 5s. Previous to the introduction of the peat plant, the factory engines were driven by a coal gas plant, consuming 8½ tons of anthracite per week at a cost of £13 16s. 3d. The cost in Ontario of cutting and delivering peat to a producer plant would probably slightly exceed the figure above quoted in respect of this item; but not necessarily so. On the other hand, the cost of anthracite would be somewhat higher. Consequently the relative costs would not be radically different from those here presented.

THE PARKS ELECTRO-CYANIDE PROCESS

By John R. Parks.*

Heretofore, practically all successful metallurgical processes in which cyanide salts have been used to extract gold and silver from their ores have contemplated:

1. Removal of coarse particles of the precious metals by amalgamation in a separate device before the ore is submitted to cyanide attack.

2. Presentation of the more or less finely crushed ore to chemical attack by an aqueous solution of cyanide salt, to which is added an alkali to neutralize acid radicals of the ore, to save cyanide salt; this solution must also contain oxygen, either the normal amount that water will dissolve from the atmosphere, or a superabundant amount added by aero-agitating devices.

3. Separation in a clear state, by settling and filtering devices, of the aqueous solution containing gold and silver cyanides, unused cyanide salt, and complex impurities, cyanates, sulphocyanates, etc., of the base metals.

4. Continued and perfect contact of the cyanide solution with the shavings or dust of an inexpensive base metal which precipitates part or all of the precious metals.

5. Separation of the precipitated precious metals from the remaining base metal, washing, collecting, drying and compressing the finely divided precious metals for melting and casting into bullion.

The object of the Parks electro-cyanide process is to apply economically all of the chemical and physical forces necessary to extract and collect the precious metals, applying them at their highest potency, and simultaneously. This necessitates economy in chemicals, their almost instant presentation under their best operating conditions to every particle of precious metal in the ore, and for only such length of time as is required for a thorough chemical interchange. That this has been accomplished will be shown by quoting results of its application to simple and to refactory ores; all of these ores, in their raw state, were made to yield their precious metals rapidly in the form of amalgam, in a single operation, in a single machine, eliminating all filtering and precipitating devices.

The Parks electro-cyanide pan consists of a wooden tub, 15 ft. diameter and 30 in. deep, through the centre of which projects a small conical casting for the passage of the working shafts. Practically the entire bottom of the pan is covered by an amalgamated copper plate, to which quicksilver is automatically added during operation, in proportion to the amount of precious metal in the ore being treated. About 9 in. above the copper, or cathode, plate, a cast-iron anode plate equal in area to the copper plate is mechanically suspended. The cast-iron plate is divided into two annular rings, the outer one containing 60, and the inner one 40 per cent. of the anode area.

These annular anodes are revolved in the same direction, and independently, by means of pulleys, gears, and a solid and a hollow shaft, so that any midway point of the inner ring travels practically the same number of feet per minute as any midway point of the outer ring. On the lower side of each of the anode rings, wooden paddles 7 in. deep are fastened radially,

*Abstract article from the School of Mines Quarterly, Columbia University.

about 5 ft. apart, the bottom of the paddles being 2 in. above the copper plate.

The compound rotary motions of the anode rings and their paddles give to the pulp confined between them and the cathode plate a very uniform spiral motion outward, keeping the ore in a perfect state of suspension, and at a little higher speed than pulp travels down a stamp-battery plate. By the centrifugal force of the paddles, the pulp on reaching the staves of the pan is forced up between them and the outer edge of the outer anode to a height of about 16 in. above the anode, retaining the rotary motion imparted by the paddles and now endeavouring, by gravity, to seek the lower level at the centre of the pan; the resultant motion is a downward and inward spiral until the ore passes over the inner edge of the inner anode, near the centre cone, when it again meets the paddles and starts to repeat its cycle of travel.

At the periphery of the pan, and on a level with the cathode plate, 20 jets of compressed air are admitted through needle valves set at regular intervals around the pan. The air pressure—about 12½ lb. per sq. in.—is sufficient to overcome the centrifugal force of the pulp against the valve exits and to keep them clear. The amount of air is calculated from the oxygen demanded by Elsner's formula for dissolving the precious metals by cyanide salt, with an allowance for unavoidable waste in mixing. The air, on leaving the valve, travels against the outward spiral motion of the pulp between the anode and cathode plates, and nearly all the excess makes its appearance as a slight effervescence around the centre cone, being thoroughly incorporated with the pulp; comparatively little escapes by rising to the surface without passing between the plates. At 100 lb. pressure, 1½ ft. of air per min. is an ample supply for the pan during treatment.

The writer, during the past eight years, has experimented with many iodine, bromine and other chemicals, seeking economy and efficiency, and has found nothing so effective and economical as commerical potassium or sodium cyanide, or the commercial double salt, together with common lime and common salt, aided by the sodium amalgam and caustic soda generated by the process.

The electrical factor of the process, which consumes from 75 to 80 per cent. of all the physical power necessary to operate it, and accounts for the speed, efficiency and economy of this as compared with other processes, is worthy of considerable attention.

From a 10 to 12-volts, 400-ampere, D. C. generator the positive wire, after leaving the switch and indicator board, is led to the mechanical portion of the pan in four branches, each of which terminates in a suitable brush; two play against the copper collecting ring on the solid shaft which drives the outer annulus of the anode, and two against a similar ring on the hollow shaft which drives the inner annulus of the anode. By this means, the electric current passes up the vertical driving shafts, insulated from the cone through which they pass, and proceeds down the driving arms and supporting rods to the anode annuli, where it is uniformly distributed.

The negative wire from the electric generator, after passing through the switch and indicator board, also terminates in four branches, each of which connects with a copper tail piece projecting through the pan. each tail being a portion of one of the four segments of the copper plate forming the cathode. Owing to the insulation of the machine, all the electric current must pass from anode to cathode through the pulp.

In treating a charge consisting of 7½ tons of ore (dry weight) with an equal weight of water, and containing its quota of lime previously added during the crushing of the ore, such an amount of strong cyanide solution is added as to equal 1 lb. of cyanide salt per ton of ore in the pan. The correct weight of cyanide per ton of ore may be previously determined by titrating filtered samples from the pan charge during a test run for cyanide consumption. After addition of the cyanide, finely crushed common salt is added until the ammeter registers 300 to 500 amperes, at 9.5 to 10 volts, as determined by a test run. The plan is then put in motion, the air is turned on, and the quicksilver is put into its distributor.

Many complex chemical compounds are formed, some of which are decomposed, in a manner which baffles the skill of the electro-chemist to explain, but among the established effects of the electric current the following may be stated:

The salt is decomposed by the electric current and metallic sodium is constantly precipitated on the mercury-coated copper plate, forming sodium amalgam; the sodium is converted into caustic soda, by its reaction with water, which, uniting with acid radicals in the ore, protects the cyanide from compounds from which the lime does not so readily protect it, thus saving a much larger portion of cyanide salt than can be saved without the current. Chlorine is also generated, but rarely indicates its presence, probably being united with basic radicals of the complex charge.

These several ions travel very slowly in quiet solutions, but in this mechanical device the pulp travels an average of seven miles over the copper plate in a 2½-hour treatment, presenting the cathions rapidly for discharge and deposition. This is analagous to the method by which copper is precipitated on a platinum dish, in modern electro-analysis for copper, by a revolving anode in a small fraction of the time required for precipitation in quiet solutions.

The cyanide anion probably seizes a potash or soda radical and is reconverted into nascent cyanide salt, unless a particle of precious metal, for which it has a greater affinity, presents itself first. However, there can be no question as to the so-called restoration of cyanide, for the writer has frequently found much more free cyanide of potash or soda in a sample of solution taken a half hour or an hour after a previous sample.

Theoretically no mercury can be lost by scouring or flouring in the charge, as any subdivided particle of this metal too small to seek the cathode by gravity is sufficiently small to yield to electro-cyanide solution, whereby it is electro-chemically precipitated back on the plate. Practically, a small amount is lost, for in a 2,500-ton run on Ruth ore a loss of about 5 lb. was reported.

On samples containing 0.8575 oz. of gold per ton, the writer has reduced the average tailing sample to 0.0075 oz. per ton, showing an extraction of 99.1 per cent. by six hours' treatment in the electric pan, using 1 lb. KCN per ton of ore; the same ore, reduced to the same fineness, yielded but 92 per cent. to solution in 48 hours' treatment in Pachuca tank (generally recognized as one of the best aero-agitating devices) using

three tons of solution containing 3 lb. KCN per ton, or 9 lb. of cyanide salt per ton of ore.

Many of our western precious-metal ores from oxidized zones are contaminated by carbonates of lead, zinc and copper, which preclude economic treatment by the ordinary cyanide methods, owing to the difficulty in precipitating the precious metals in the presence of the cyanides of the base metals, aside from the excessive consumption of cyanide salt. The electric current however, precipitates the base metals as well as the precious metals, on the amalgamated plate. The writer has produced, by the electric pan, bars of bullion worth $1,200 or $1,400 which averaged but 512 fine in precious metals, the other 50 per cent. of the bars being lead, zinc and copper, alloyed with the precious metals. The refining charges on such bullion are low.

As precipitation of precious metals takes place more rapidly from strong than from weak solution, in treating certain ores economy can be introduced by discharging the pan at a fixed value of unprecipitated precious metals in solution (50 c. to $1 per ton). After passing the charge through a revolving settler used as a precautionary amalgam trap, it may then be sent through a Dorr thickener, whereby 50 per cent. of the solution from a 1:1 charge, and 80 per cent. of that from a 1½:1 charge, can be returned clear for original charges; this not only saves time and increases the daily capacity of the plant, but secures a higher percentage of recovery of the precious metals, while preventing undue waste of common salt and unused cyanide.

The total horse-power required for a single pan is 0.6 h.p. for mechanical agitation; 1 to 1.5 h.p. for compressed air; and 4.5 to 6 h.p. for electric current.

The capacity of the pan depends on the amount and character of gangue in the ore and on the nature of its precious metal minerals The proportion of gangue determines whether one ton of ore may be treated with 1 ton or will require 1½ tons of water; none but the very clayey types require the 1:1½ charge.

A single pan charge of the 1:1 class is 7.5 tons of ore, dry weight, and of 1:1½ ore, is 6 tons; the time required for treatment varies from 1 to 12 hours, generally being 2½ to 4 hours; hence the capacity of the pan, allowing for charging and discharging, varies between limits of 15 and 90 tons per diem, but on the average run of ores it varies from 36 to 60 tons per diem.

The large capacity of the pan, the small tonnage of ore under treatment in the mill at one time, and the small amount of machinery and apparatus required, reduce the total cost of installing mills using this process to 30 to 60 per cent. of the amount necessary to install any other process of equal daily capacity.

A few examples will show the efficiency of the process.

Ruth Gold Mining Company's mill, Kingman, Arizona.—Daily capacity 50 tons. Quartz ore with large amount of manganese minerals; little free gold. Values occur in sulphide minerals; ratio of gold to silver 1 to 12. Test in 40-in. testing plant. Pan charge, 215 lb.; 1 lb. KCN per ton of ore; six hours' treatment; 200-mesh pulp. Results: Precipitated as amalgam, gold 96.76 per cent.; silver 87.7 per cent.; monetary values 95.6 per cent. Shortly after the mill was turned over to the Ruth Company, three pans being used, each with 7½-ton charges, the mill foreman's samples and his assayer's results showed as follows: Precipitated as amalgam, gold 96.66 per cent., silver 87.77 per cent., monetary values 95.09 per cent.; 1 lb. KCN per ton of ore, six hours' treatment; value of ore $18 per ton.

Maginnis mill, Maiden, Montana.—One pan; 7½-ton charge; 30-mesh pulp. Oxidized ores containing 0.33 to 0.50 oz. gold and from 1.5 to 4 oz. of silver per ton, contaminated with carbonates of lead, zinc and copper. One pound KCN per ton; 2½ hours' treatment. Precipitated as amalgam, 86 to 92 per cent. gold, 62 to 72 per cent. silver. The low silver contents of this ore prohibited the economic use of cyanide salt in stronger solutions, in order to secure higher extraction from its silver minerals.

Gold ores from Kendal, Fergus County, Montana.—Decomposed, porous limestone, impregnated with gold; an ideal cyanide ore. Test of 225 lb. in testing pan; 12-mesh; 1 lb. KCN per ton; after one hour, 90.5 per cent. of gold as amalgam; after 2½ hours, 97 per cent. of gold contents of the ore reduced to amalgam. Ore valued at $8 per ton in gold.

Orient, Washington.—Auriferous, fine crystals of pyrite in andesite; no free gold. Average value, 1.03 oz., $21.29 per ton. Four hours' treatment on 230-lb. lots; 4½ lb. NaCN; pulp 120-mesh. 95.35 per cent. of gold contents saved as amalgam.

Whitman mine, Pearl, Idaho.—Ore contained arsenical pyrites, 25 to 27 per cent.; pyrite 40 per cent.; gangue 35 to 37 per cent. Six hours' treatment with 4 lb. KCN; 120-mesh. Gold, 1.3385 oz. per ton, worth $27.67; saved in form of amalgam, 88.8 per cent.

Metates mine, Sinaloa, Mexico.—Ore contained 5 per cent. pyrrhotite, with galena and antimonial sulphide minerals, in quartz gangue. Twelve hours' treatment; 230 lb., 120-mesh; 12 lb. KCN used; 7.7 consumed. Gold, 0.625 oz.; silver, 63.015 oz.; value, $44.43 per ton. Extracted in form of amalgam, 99 per cent. gold, 91.1 per cent. silver.

All of the results cited above were obtained by direct pan treatment, without returning any solution once passed through the pan.

ANNUAL REPORT OF MINISTER OF MINES FOR BRITISH COLUMBIA, FOR 1911

Reviewed by E. Jacobs, Victoria, B.C.

The Annual Report of the Minister of Mines for British Columbia for the year 1911 has been issued. It shows the mineral production for that year to have been of a total value of $23,499,072, as compared with $26,377,066 in 1910. The report intimates that the decrease in total value was due to the shutting down

of coal mines of East Kootenay for eight months owing to labour disputes, otherwise there would have been an increase to record.

The quantities and value of the several mineral products are shown in the following table:—

Gold, placer	$ 426,000
Gold, lode, 228,617 oz.	4,725,513
Total gold	$ 5,151,513
Silver, 1,892,364 oz.	958,293
Lead, 26,872,397 lb.	1,089,521
Copper, 36,927,658 lb.	4,571,644
Zinc, 2,634,544 lb.	129,092
Total metallic	$11,880,063
Coal, 2,193,062 tons of 2240 lb.	7,675,717
Coke, 66,005 tons of 2240 lb.	396,030
Miscellaneous (building materials, etc.)	3,547,262
Total value of mineral production	$23,499,072

Summary—	Value.	
Metalliferous minerals		$11,880,063
Non-metalliferous minerals—		
Coal and Coke	$8,071,747	
Building materials, etc.	3,547,262	
		$11,619,009
Total		$23,499,072

Early in the year the Department published a "Preliminary Review and Estimate of Mineral Production" for 1911, in which the estimate of the Provincial Mineralogist, Mr. Wm. Fleet Robertson, was that the total value of the mineral products was $23,211,816. The revised figures show that this amount was $287,256 short of the actual value. There was, however, considerable variation in totals of value of separate minerals. Notwithstanding this, the usefulness of having an estimate published months before the revised returns were available is demonstrated, since in a general way it indicated, approximately, what last year's mineral production had been.

The Statistical Tables.

The various statistical tables included in the Report under review give much information to those interested in the mineral production and progress of the mining industry of British Columbia. Table I. shows the gross value of each of the more important of the minerals produced, and that the aggregate value for all years is $397,696,722, in the following proportions:—

	Value.
Placer gold	$ 71,639,103
Lode gold	65,536,580
Total gold	$137,175,683
Silver	32,055,895
Lead	25,715,126
Copper	65,315,049
Other metals (zinc, etc.)	1,212,264
Total metallic	$261,472,017
Coal and coke	$122,084,343
Building, stone, bricks, etc.	14,140,362
Total non-metallic	136,224,705
Total production	$397,696,722

Table II. shows the value of each year's total production over a period of 20 years—1892-1911. It is seen that the total for 1911 was the lowest in any year since 1905, which fact is attributable to the labour difficulties above-mentioned.

Table III. exhibits the quantities and value of production for three years, 1909, 1910 and 1911. The figures for the last year, shown above, are taken from this table. There was a general decrease in production as compared with 1910, excepting only in miscellaneous products, which showed an increase of $2,047,262, and to that extent offset the total decrease in other minerals of $4,925,256, of which latter $3,036,588 was in coal and coke, this making plainly evident the bad effects of the long-continued strike at the coal mines and coke ovens of Crow's Nest district.

Production of Districts.

Table IV exhibits the output of minerals by districts and divisions for three years. Omitting divisions and taking that of districts only for two years, for purpose of comparison, the figures of 1910 and 1911 are as under:—

Districts.	Value of Production. 1910.	1911.
Cariboo	$ 239,000	$ 180,000
Cassiar	283,807	293,442
East Kootenay	6,121,832	2,475,056
West Kootenay	5,088,186	4,343,912
Boundary	6,998,519	5,621,109
Lillooet	9,832	6,467
Coast	7,635,890	10,579,086
Totals	$26,377,066	$23,499,072

It will be observed that the greatest loss in production was in East Kootenay, which district not only had a largely decreased output of coal and coke but, as well, a considerable decrease in lead owing to the exhaustion of known ore-bodies in the St. Eugene mine, only partly compensated for by an increase in output of the Sullivan mine. West Kootenay's decrease was largely in silver and lead from Ainsworth and Clocan, and lode gold from Nelson mining division. Trail Creek's (Rossland's) proportion of the total decrease was comparatively small. The smaller production in Boundary district was due to the enforced suspension of operations at the Granby Company's mines and smeltery, consequent on the cutting off of the coke supply during about five months of the year. The increase in the Coast district was due chiefly to larger production of copper and building materials—the former to an amount nearly $1,000,000 greater than in 1910. It may be mentioned that in both East Kootenay and the Coast district the coal mines contribute much to the total of mineral production, and in the latter building materials is a product of steadily increasing total value. In other districts the production is to a very large extent of metalliferous minerals only.

Various Mineral Products.

Table V. is a new table, shown for the first time in the 1911 Report. It is an endeavour to give details of the miscellaneous products included in the year's mineral production, mostly of the various kinds of building materials, such as cement, lime, building stone, rock, clay products, etc., which in previous reports were summarized in one total. While the figures given in this table are not complete, they are at least approximate, and show what an important branch of mineral production miscellaneous products has become.

Tables VI., VII. and VIII. are the customary record of yearly totals of placer gold, lode metals and coal and coke, respectively. Table IX., which is the most elaborate in the Report, and which was changed to some extent the previous year, has been further altered, to the extent of transferring from it "miscellaneous products" and showing in it only the details of metalliferous production for four years, 1908-1911, and the districts in which such production was made. Tonnage of ore mined and its metallic contents and market value are shown in this table.

Comparison With Other Provinces.

Table X. presents in graphic form the facts shown in figures in other tables, and demonstrates to the eye the growth of mineral production and the fluctuations to which it has been subject. Table XI. compares graphically the output of certain mineral products of British Columbia with the combined output of similar products in all the other provinces of the Dominion. An analysis of the figures gives the result that British Columbia produces more lode gold, copper and lead than all the rest of the Dominion combined, and is to be credited with nearly one-third of the coal and coke production of Canada.

Men Employed in Mining.

A summary of the figures showing the number of men employed in several classes of mines follows:—

There were 80 mines that shipped ore in 1911 (45 of them more than 100 tons each, but only 33 more than 1,000 tons each), and there were employed in these a total of 3,241 men—1,008 above and 2,233 below ground. The non-shipping mines numberd 67, of which 46 were idle and 21 working; in the latter 353 men were employed—151 above and 202 below ground. The total number employed at metalliferous mines was, therefore, 3,594 men.

The coal mines gave employment to a total of 6,873, this number including 230 boys among the 6,146 whites, and the following other classes of labour:—Japanese 184, Chinese 530, Indians 13; total, 727. There were employed underground 4,818 white men, 149 white boys, 171 Japanese, 71 Chinese and 3 Indians. This shows that of the total of 5,212 employed underground, 4,967 were whites and only 245 were of other races.

From the foregoing it will be seen that there were employed at metalliferous mines 3,594, and at coal mines 6,873; total, 10,467. It may be taken for granted that men engaged in prospecting were not included, and probably the figures omit as well men employed at smelting works, but of this there is not any mention.

Quantity and Sources of Ore Mined.

The total quantity of ore mined in 1911 was 1,770,755 tons, which compares unfavourably with a total of 2,216,428 tons in 1910. The cause of this decrease, however, was simply that the requisite supply of fuel could not be obtained while the Crow's Nest miners were on strike, so at some important properties ore could not be mined and smelted until supplies of coal and coke were received. The percentage of tonnage of the various districts was as under:—

	Per cent.
Boundary district	70.30
Trail Creek mining division (Rossland)	14.35
Coast district	8.09
Slocan district	2.56
Nelson mining division	2.25
Ft.Steele mining division (E. Kootenay)	1.73
Other divisions	0.72
	100.00

Taking the Province as a whole, there was 546 tons of ore mined in the year for each man employed about the shipping mines. The figures ranged from 1,201 tons to the man in Boundary district down to 113 tons a man in Slocan.

Output of Coal and Coke.

The gross output of coal mined in 1911, that is, including the coal made into coke, was 2,297,718 tons (of 2,240 lb.), as against 3,139,235 tons in 1910. The net tonnage of coal in the two years was 2,193,062 tons in 1911 and 2,800,046 tons in 1910. The coke figures for the two years are: for 1911, 66,005long tons, and for 1910, 218,029 tons. The net decrease in 1911 as compared with 1910 was, therefore, 606,984 tons of coal and 152,024 tons of coke.

The gross production of the several collieries was as follows:—

		Long Tons.
Vancouver Island—		
Canadian Collieries (Dunsmuir), Ltd.	788,911	
Western Fuel Company	575,177	
Pacific Coast Coal Mines, Ltd.	208,116	
Vancouver-Nanaimo Coal Mining Co., Ltd.	72,918	
		1,625,122
Nicola Valley—		
Nicola Valley Coal and Coke Co., Ltd.	191,290	
Inland Coal and Coke Co.	10,883	
Diamond Vale Collieries	4,970	
		207,143
Similkameen—		
Princeton Coal and Land Co., Ltd.		23,396
Crow's Nest—		
Crow's Nest Pass Coal Co., Ltd.	320,940	
Corbin Coal and Coke Co.	81,718	
Hosmer Mines, Ltd.	39,399	
		442,057
Gross production of coal		2,297,718

Of the 66,005 long tons of coke, the Crow's Nest Pass Coal Co., Ltd., produced 54,160 tons and the Hosmer Mines, Ltd., 11,845 tons.

Where Bulk of Metals is Mined.

Of the total of $426,000 of placer gold, $225,000 is from Atlin division, and $170,000 from Cariboo and Quesnel divisions of Cariboo district.

Rossland mines contributed nearly $2,412,000 of the total of lode gold, Boundary mines (including Hedley) nearly $1,814,000, those of Nelson division $365,000, and of the Coast district $120,000. Small amounts from other parts made up the remainder of the total of $4,725,513.

Slocan district mines, including those of Ainsworth, produced silver to the value of $441,000, East Kootenay $167,000, Boundary $166,000, the Coast $51,000, Rossland $45,000, Nelson $39,000, Lardeau $34,000, and smaller amounts from Portland Canal and elsewhere. The total was $958,293.

Lead production was of a total value of $1,069,521, of which Fort Steele division of East Kootenay produced $683,000, Slocan and Ainsworth $278,000, Nelson $77,000, Lardeau $20,000, and nearly $10,000 from Portland canal.

The chief output of copper was from Boundary mines, with a total value of $2,764,000, while Coast mines came next with $1,362,000, followed by Rossland with $425,000, and several small amounts to make up the remainder of the total value of $4,571,644.

The production of zinc, valued at $129,092, came from the Van-Roi and Hewitt mines, near Silverton, Slocan Lake, chiefly from the former.

Some Noteworthy Features of Report.

In addition to much interesting and valuable comment by the Provincial Mineralogist, under the head of "Progress of Mining," there are features of the Report that are noteworthy. These include the reports of the Provincial Assayer and the Secretary of the Board of Examiners for Coal-Mine Officials, respectively, those of the gold commissioners for Cariboo, Atlin, Queen Charlotte, Omineca, Nelson, Grand Forks, Osooyoos, and others, and the several special reports and compilations by the Provincial Mineralogist.

Among subjects of interest concerning which there is information are the following: Notes on Iskut river, Unuk River district, a special report on Alice Arm camp, Observatory inlet, including a description of the Granby Company's Hidden Creek mines, by Mr. Donald G. Forbes (under instructions from the Hon. the Minister of Mines); lengthy notes on the new coal field at the headquarters of Skeena River, north of Groundhog mountain (compiled by the Provincial Mineralogist), and of coal areas in the southern part of Skeena district; a long report on mineral claims in Hazelton district, and another on Slocan mining division, both by the Provincial Mineralogist; notes on "French's Process for Separation of Zinc and Lead," and others on an investigation made by the Department in connection with the reported discovery of platinum in the vicinity of Nelson, the result being that not a trace of platinum was found in the guaranteed samples supplied by interested parties; notes on demonstrations of smelting copper ore at Van Anda with an oil-fired furnace; notes on the Britannia mine, Howe Sound, by the Provincial Mineralogist; and one report on mines on Texada island and another on the "Limestone Deposits of the Coast," both by Mr. Herbert Carmichael, Provincial Government Assayer. A comprehensive review of coal mining in the Province, and the reports of the inspectors of mines also add greatly to the value of the Report.

Report is Well Illustrated.

Reproductions of photographic views are numerous in the Report, many of the half-tones being excellent, and well-printed. Zinc-line cuts and lithographs are also used for illustrative purposes; among these are two maps of Skeena district, drawn by Mr. H. T. Nation, of the provincial mineralogist's office. The flow-sheets of concentrating mills are great improvements on the old-style plans, for these show the jigs in profile instead of by plan, this improvement being an invention, several years ago, by Mr. W. F. Robertson, and one now freely used in Canada and the United States; further, the shape of the concentrating tables is shown, and generally the mill arrangements are shown in a more graphic way than has been the custom in other official reports.

Illustrations in the text show the oil-fuel blast furnace; and the profile, plan and installations of high-carbon steel plates and manganese rails at the Quesnelle Hydraulic Gold Mining Co.'s mine, Quesnel division.

A full index makes the Report complete. Altogether, this Report is about the best, on the whole, issued in late years by the Provincial Department of Mines, and it reflects much credit on the Provincial Mineralogist, who did the chief work in its preperation, on the officials who assisted him and on the Government printing office for its excellent printing and press work.

PERSONAL AND GENERAL

Mr. W. G. Ross, president of the Asbestos Corporation of Canada, accompanied by other members of the directorate, left Montreal on July 9th to inspect the company's property.

Mr. E. A. Vajda, of Buda Pesth, representing the Society of Engineers of Austria-Hungary, is visiting Ottawa with a view to gathering information concerning the methods adopted by the Department of Mines to develop the peat industry in this country.

At the last meeting of the Council of the Canadian Mining Institute, fourteen candidates were admitted to full membership; ten to associate membership; and two to student membership. The new members are: L. D. Adams, of Weedon, Que.; H. C. Anchor, of South Porcupine, Ont.; Thos. J. Brown, of Sydney Mines, N.S.; Victor H. Emery, of Schumacher, Ont.; Stanley O. Fillion, of Ottawa, Ont.; J. M. Gordon, of Glace Bay, N.S.; Geo. M. Guess, of Toronto, Ont.; Wm. Kelly, of Vulcan, Mich., U.S.A.; Arthur J. Merrill, of Winnipeg, Man.; P. A. Robbins, of Timmins, Ont.; H. Y. Russel, of South Porcupine, Ont.; Chas. G. Titus, of Cobalt, Ont.; J. C. Watson, of South Porcupine, Ont.; and Wm. H. Wylie, of St. Catharines, Ont. Associates, F. C. Annesley, of Toronto, Ont.; Hugh Boyle, of South Porcupine, Ont.; James E. Boyle, of South Porcupine, Ont.; Arthur I. Davis, of Toronto, Ont.; Thos. B. Dunkin, of Toronto, Ont.; John Gray, of Toronto, Ont.; Henry B. Haigh, of New York City, U.S.A.; W. W. Newman, of

Huntsville, Ala., U.S.A.; and H. A. Proctor, of South Porcupine, Ont. Students: P. E. Hopkins, of Toronto, Ont.; and A. J. McLaren, of Toronto, Ont.

The Hon. Frank Cochrane and Major R. W. Leonard are on their way to Prince Rupert.

Mr. Edgar L. Mocatta, of the firm of Mocatta & Goldsmid, London, was a guest of Mr. Samuel Cohen at the Crown Reserve mine, Cobalt, for several days early in July.

Mr. C. F. Beamer, formerly general manager of the Cobalt Power Co., is now chief electrical engineer to the Government of Mysore, Bangalore, India.

Mr. G. C. Mackenzie, of Ottawa, is in charge of drilling operations to test the depth of the iron sands at Natashquan, Que.

Mr. Charles Brent, president of the Canadian Homestake Mine, at Kenora, was in Montreal recently.

Mr. Alex. MacKay, a mining engineer of London, is examining coal mines near Banff on behalf of English investors.

On Friday, July 13th, Miss Clara McCall, daughter of Mrs. D. McCall, 163 Spadina Road, Toronto, and Mr. G. H. Gillespie, Madoc, Ont., were united in the holy bonds of matrimony. Mr. and Mrs. Gillespie are spending their honeymon in New England. The bridegroom is known to our readers as the organizer of the talc-grinding industry in Ontario and as an occasional contributor to these columns. This event makes the ninth or tenth serious defection from the ranks of bachelordam in the mining profession.

Mr. R. B. Lamb is sailing for England on July 20th, and will be absent for about a month.

Peter McLaren, of the Scottish Ontario Goldfields, sailed on the S.S. Grampian for England on July 5th last, and will remain abroad for some weeks.

When in Montreal recently, Mr. J. H. Plummer, president of the Dominion Steel Company, announced that it was the intention of the Canadian Steel interests to again submit their views to the Government respecting the tariff in iron and steel products.

The following gentlemen were elected to the directorate of the Asbestos Corporation of Canada: President, Mr. W. G. Ross; Vice-President, Mr. Howard E. Mitchell; and Messrs. W. McMaster, H. J. Fuller, Thomas McDougall, W. N. McCarter, and C. W. Colby.

The death occurred at Toronto on July 2nd of Mr. Cecil B. Smith, the eminent hydro-electrical engineer, at the relatively early age of 48 years. Mr. Smith was a graduate of McGill University, for a term president of the Canadian Society of Civil Engineers, and the author of several text-books on engineering.

SPECIAL CORRESPONDENCE

ONTARIO.

Cobalt, Gowganda and South Lorrain.—If the No. 9 vein of the Coniagas continues to the 200-ft. level in the Keewatin it has been heavily faulted. So much exploration work has conclusively shown. Some months ago, when it was found that the No. 9 vein crossed the contact into the keewatin and held its values, hopes were entertained that it might not be a solitary example of the rule that veins found in the conglomerate lost their value when the contact was reached. For one hundred and fifty feet to the west on the upper level the drift continued in rich ore, and when a winze was put down ten feet the results were still good. Then it was determined to run a crosscut from the 200-foot level of the mine and demonstrate conclusively the value of the new discovery. So far the vein has not been picked up. It may be that the vein has been faulted and still contains good ore.

In the new shaft which Sir Henry Pellatt and his associates have sunk on the Ophir a very strong vein of smaltite and niccolite has been followed down. It is between six and seven inches wide, and the hope of the new management is that the silver values will increase with depth. The adjoining property, the John Black, is also working again on their big smaltite vein. So far in this section, while the veins have been wide and strong, the silver values have been too low to permit of work. Mr. Chas. A. O'Connell, who succeeded Mr. George McNaughton as manager of the Trethewey mine a little more than a year ago, has resigned his position. His place is to be taken by Mr. Horace Young, once manager of the Temiskaming and Hudson's Bay mine, who has therefore a good working knowledge of conditions as they apply to that particular section of the West Ridge.

The Buffalo mill report for May shows a recovery of 109,295 ounces, as compared with 91,542 ounces for the previous month. A total of 4,553 tons were milled, while the ore ran 28.22 ounces. The company has paid in dividends to date $1,457,000.

Dividends paid by the Cobalt mines for the first six months of the year shows a net loss of but $8,376 in comparison with the first six months of the previous year, and as the gains are to all intents permanent and the losses temporary or long ago discounted, the report is better than its face value would appear. The payments in the last six months were:—

	Per cent. of issued capital.	Amount paid.
Beaver	3	$59,892
Buffalo	16	160,000
Townsite	15	150,000
Coniagas	15	600,000
Crown Reserve	30	530,640
Hudson Bay	900	69,849
Kerr Lake	10	300,000
La Rose	4	337,500
McKinley - Darragh	20	224,693
Nipissing	15	900,000
Temiskaming	3	75,000
Trethewey	10	100,000
Wettlaufer	10	70,825
		$3,578,399

The Steindler Syndicate, which purchased the assets of the defaulting Nova Scotia Cobalt Silver Mining Company, has decided not to trade under the old name and will henceforth be known as the Dominion Reduction Company. They are at present operating the mill on

ore which comes to them on the aerial tramway from the Crown Reserve and are at the same time making such additions to their mill that the conglomerate and Keewatin rock can be treated so that a profitable extraction can be made.

With the last two and a half per cent. dividend announcement of the La Rose Consolidated, this company will have paid and declared 42 per cent. of the issued capitalization, or $2,954,185.

Owing to the fire in the centre of the town, the City of Cobalt is now able to do surface trenching for veins, exploration previously denied to the company owing to the fact that the land was covered with buildings. So far no veins of any importance have been located. The City of Cobalt has now a level cut at the 400-foot level. One of the exploratory drifts at the 200-foot has been pushed right across from the Buffalo boundary to the spot where the Cobalt Hotel used to be before the fire. Ore is still being carted out to the King Edward mill and there concentrated.

Porcupine, Swastika, and Other Gold Sections.

No official figures are as yet available as to the production of the Porcupine camp, but making all allowances for interruption of practice owing to readjustments to be made in the Hollinger and Vipond mills, it is certain that in the month of July the four plants will earn between $40,000 and $50,000. The Dome, Hollinger, Vipond and McIntyre are crushing at least 615 tons per day, and if an average of $10 a ton be allowed for 28 days in the month production will amount to $172,000. The Dome is now treating 300 tons every day in the week and running quite smoothly. Clean-ups are made every shift and shipments once every three weeks. The extraction is all that can be desired and contrary to prevailing reports the cyanide process is more than paying for its installation. The Hollinger cannot expect to get a duty of more than six tons per stamp for the next month if thirty stamps are dropped. The McIntyre is paying running expenses and more with the little ten-stamp mill, and is treating about 60 tons per day, and the Vipond has demonstrated that the Hardinge principle of crushing will give big tonnage. The guaranteed tonnage can easily be reached and operations so far have demonstrated that extraction should be satisfactory. The tailings will be run into a swamp already dammed up and they will be available for future treatment. All the saving will be made by amalgamation.

After a carefully planned campaign of diamond drilling the Porcupine Lake Mines Company has decided to put in a plant large enough to conduct operations on a considerable scale. The company owns the Hunter claims, which include a considerable portion of the north end of Porcupine Lake and the east side running right into the settlement of Porcupine. Last summer from the shore and last winter on the ice two diamond drills were almost continuously operated with uniformly satisfactory results. The gold is very fine, but in many cores it was visible to the naked eye and the assays from the cores taken out gave an average which should leave a very good margin for profitable mining. To discover the throw of a vein which appears to be faulted a shallow pit was put down on the vein and some very pretty specimens of ore were taken out, though on the surface there was no visible enrichment. The Hunter claims were staked a full year before Porcupine became known as a mining camp and operations have been conducted with commendable caution and economy.

The copper property owned by the McKinnon Syndicate, about four miles from Dane, on the Larder Lake road, is attracting considerable attention. One shaft is down 120 feet in a quartz vein ten or twelve feet wide, carrying about two per cent. of copper. This vein appears to be fairly continuous and promises to yield a good tonnage of ore. The other vein is of chalcopyrite and the ore appears to occur in lenses. These lenses are about six feet wide, three feet of massive and three feet of disseminate ore. The massive ore runs no less than seventeen per cent. in copper.

The Tough Oake claims in Lebel Township, six miles north of Swastika, have attracted a considerable amount of attention to what is known locally as the Hyland Lake section. About six months ago claims were staked all round Hyland Lake, a small sheet of water four miles from Swastika, over an excellent trail. The Tough brothers went further afield to the north, and eventually found quartz veins in a bald dome of porphyry rising above a swamp. Here they did assessment work and eventually uncovered a native gold in quartz veins scattered through a reddish porphyry. This dyke of porphyry appears to be of considerable width, and as it is exposed to-day it is from twelve to fifteen feet wide, but only the most superficial trenching has been done. The visible gold is associated with streaks of tourmaline.

Another vein of quartz in the porphyry will certainly not average more than four inches wide, but for 250 feet it is very well defined and extremely spectacular in a number of places. The porphyry is heavy in fine sulphides, which, according to the report of Mr. A. A. Cole to the T. & N. O. commission, carries values. Quite a number of men acting as scouts for the large interests operating in Northern Ontario, have been to the property and have sampled it. It is reported that the properties are for sale at $125,000, the vendors allowing a considerable time in which to make payments. Considering the spectacular character of the find there are not many prospectors in the district and nothing but bare assessment work has been carried out.

On the premises that Ontario, south of Cochrane, has been so far explored that no large field is likely to be found, prospecting this year is very busy with Labrador, Ungava and Hudson's Bay.

Both the Lucky Scott and the Munn expeditions have sailed and both appear to have good chances of success. Both are adequately financed and have good and reliable men acting as guides and in the direction of the party. Gold, diamonds, even furs may be the incentive. Captain Munn, who has just sailed from Sydney, C.B., in charge of the s.s. Algerine, is well-known in Porcupine and Gowganda, where he has both owned and operated properties. He is acting for the Porcupine (Canada) Mining & Development Company, the English syndicate, which recently acquired options, and purchased so much moose pasture in the Porcupine camp. Captain Bartlett, who is acting as navigator, is a Newfoundlander with a life's acquaintance of the Labrador coast. He was well known in Porcupine where he was in charge of the Achilles property for some months. With the party also is "Bill" Woodney, acknowledged to be one of the most experienced and keenest prospectors in the country. The party will have the good wishes of all North Ontario.

Excavating for the ten-stamp mill to be erected at the Swastika mine has commenced. The mill is to be placed below the main shaft right on the edge of Otto

Lake, an ideal location. A station has been cut at the 400-foot level and the vein is at least twelve feet wide of quartz. Some visible gold is to be seen, but no assays have as yet been made public.

BRITISH COLUMBIA.

The information received in Spokane, Washington, at the end of June from Mr. W. E. Zwicky, manager of the Rambler-Cariboo Mines, Ltd., to the effect that an 18-inch vein of high-grade galena had been cut in the 1400-foot level of the company's mine in McGuigan Basin, Slocan District, is particularly gratifying, since this is the greatest depth at which payable ore has been found in that district. It is stated that this is thought to be a new vein, for it was encountered about 100 feet short of the distance at which it had been calculated the ore-shoot opened on the 1200-foot level would be reached. Further, it is said to occur in a formation quite different to that in which ore was found on the levels above, so that it looks like a parallel vein not met with at less depth.

Mining, on what is known as the Rambler-Cariboo group, has been carried on under various ownerships over a period of about 19 years. The group has been owned since the spring of 1899 by the Rambler-Cariboo Mines, Ltd. The total value (gross) of ore taken from the property may be roughly estimated at $1,750,000 to $2,000,000. In earlier years a total of $230,000 was paid in dividends, but so much development work has been done during the last eight years that the proceeds of all ore shipped have been expended in opening the mine for later production, and this at much lower cost than was practicable before the scheme of deep-level development was adopted.

Mr. Zwicky took charge of the mine in 1902. After a thorough study of its known ore bodies, from which up to that time silver-lead ore having a gross value of about $800,000 had been extracted, he concluded that they continue down to considerable depth, but it was difficult to instil similar confidence in their permanence into the minds of those having to finance the costly undertaking of driving a long adit to a low level. Eventully, however, it became plainly evident that as greater depth was reached in sinking from No. 3 level in the old workings costs increased considerably, every additional 100 feet of depth involving an increase of 20 to 30 per cent. in working costs. Under these difficult conditions, Mr. Zwicky's recommendation that an entirely different plan of development be adopted at last found favour with the directors, and he was authorized to proceed with the work of driving a cross-cut tunnel a distance of between 4,000 and 5,000 feet, with the object of cutting the vein at a depth of 1,400 feet below the outcrop, or 600 feet below the lowest level of the old workings. "We had reached the limit of our power plant," said Mr. Zwicky, in June, 1904, "and we had to decide to either drive the long tunnel or put in a new and larger plant so that we could go deeper. To do the latter and sink to the level where the tunnel will cut the vein would cost as much as, or more than, driving the tunnel, beside which our expenses each year would be enormous for pumping alone, as the deeper we got and the more ground we opened, the more water we would have to contend with."

Work on the deep-level adit was commenced on July 9, 1904. By May, 1906, a distance of about 4,500 feet had been driven. Several small veins of ore were cut but not the main vein, so as funds were low a raise was commenced. At about 200 feet up it entered the vein, giving a depth of 400 feet below the old bottom level and 1,200 feet from the outcrop. Thence up to the 800-foot level the raise was made large enough for later use as a three-compartment main working shaft, 12 feet by 4 feet 6 inches in the clear.

The following description of the property has been taken from "Notes on Slocan Mining Division," printed in the "Annual Report of the Minister of Mines" for 1911:

"The Rambler-Cariboo group includes the Rambler, Cariboo, Antelope, Humprey, Keno and Best Fraction, situated well up in McGuigan basin, at an altitude of 6,000 feet. McGuigan basin drains into the Middle fork of Carpenter creek, about three miles below the Bear Lake summit. The Kaslo & Slocan railway grade from Kaslo to Sandon is on this hillside of the Middle fork, at an elevation of about 3,500 feet; this railway formerly supplied transportation to the mine, but since the railway was destroyed by fire in 1910, and has not yet been rebuilt, the only outlet for the mine has been by wagon road down the Middle fork to Three Forks, a station on the Canadian Pacific Railway. The C.P.R. is, however, this summer engaged in extending its tracks from Three Forks up to Bear Lake, the grading being nearly completed, and by the end of the summer it should afford railway service to the mine.

"The mine is now held by the Rambler-Cariboo Mines, Ltd., a company with an authorized capital of $1,750,000, and the head office at Kaslo, B.C. A. F. McLaine, of Spokane, is president, and W. E. Zwicky, Kaslo, general manager. This property has, under various ownerships, been one of the largest shippers in the district. The following is a rough estimate of the total shipments, including the crude ore and concentrates, made by the mine to the end of 1910: Shipments since 1893 have been about 23,384 tons, containing 2,216,800 oz. of silver and 13,676,885 lbs of lead; these figures show the average realized assay of shipments to have been about 95 oz. of silver to the ton and 30 per cent. lead. In addition, the ore contains from 10 to 14 per cent. zinc.

"The rock formation of the district is slate, through which a great boss of granite has been forced up, the whole being much cut by porphyry dikes. A well-defined quartz vein cuts through both the slate and the granite, crossing the contact, and has been traced on the surface for a long distance, in a north-east-by-north direction, with a dip to the south, or into the hill.

"The mine was originally opened by three-cross-cut tunnels, connecting with levels about 100 feet apart. No. 3 is the main working tunnel, and has a cross-cut 510 feet long to the vein, and drifts to the extent of more than 1,200 feet; above this level all the ore, except a few small bunches, was extracted some time ago. From this No. 3 level a shaft was sunk 500 feet, with levels Nos. 4, 5, 6, 7 and 8 at intervals of about 100 feet, and here the recent productive mining has been done. From the shaft, drifts have been driven at No. 4 level to the north for 63 feet and to the south for 350 feet (most of which ground has been stoped); at No. 7, to the north 231 feet and to the south 324 feet, of which 250 feet has been stoped; and at No. 8, to the north 94 feet and to the south 101 feet. From this shaft and levels some very good ore was obtained, and it is reported by the management that the ore body is strong in the bottom of the shaft and is continuing with depth.

The expense of hoisting from this shaft to a higher level, together with the cost of keeping it unwatered, added so much to the cost of mining that the company decided to abandon the workings temporarily, and to drive a long cross-cut tunnel to the vein at the 1,400-foot level, putting up a raise in continuation of the shaft, thus reaching the known ore body from below. Mr. Zwicky said he felt sure he had sufficient ore in sight on levels 7 and 8 to liquidate any loan obtained to complete the new work.

"The portal of the new tunnel is located on Dardanelles creek, about halfway between McGuigan Station and the old mine-workings, and near the wagon road. The tunnel is 9 feet 6 inches high by 7 feet wide (7 feet 6 inches by 7 feet in the clear) and about 4,500 feet long, cutting the vein at more than 1,400 feet deep, or 600 feet deeper than No. 8 level.

"The contract price at which the first 2,500 feet of this tunnel was driven was between $10.50 and $11.50 per lin. foot, the company supplying only the compressed air for drills, the contract price covering everything else; the remainder of the tunnel was driven by day work. The gross cost of the entire tunnel, including management and all expenses, was $14.60 a lin. foot, and the rate of progress made was 7 feet 3 inches a day of 24 hours.

"This lower tunnel is about 4,500 feet from the portal to the intersection of the vein on the 1400-foot level. The vein at this part of the 1400-foot level was, for some reason, so tight that when the tunnel was driven through it, it was not recognized and the tunnel was driven 90 feet past the point where the projection of the vein indicated it should be; consequently it was determined to reach the vein at the nearest point under the old shaft, and a diagonal drift was made, from which a raise was started in country rock; when this raise had been put up for 200 feet, at the 1200-foot level, a cross-cut was made, and, after having driven 47 feet, cut the vein, which was here found to be 8 feet wide, and showed several streaks of clean galena. From the 1200-foot level upwards, raising was continued, on the vein, to the 800-foot level.

"Subsequently, a second raise was put up from the 1400-foot level, so as to connect and be in line with the raise from the 1200-foot up to the 800-foot level. The ore shoots above the 800-foot level have been nearly all exhausted, and this raise and its levels constitute a new mine.

"From the raise, various levels have been driven on the vein; at the 1400-foot level, for 390 feet to south and 140 feet to north; at the 1200-foot level, for 600 feet to south and about 140 feet to north. Levels were also started at the 1050-foot and 900-foot levels, and have been driven some distance.

"The ore bodies in the old workings were chiefly to the north of the line of the raise; one ore shoot on the 700-foot north level was 60 feet long in the level, and this same shoot was also cut by the 900-foot north level, but it has not, as yet, been found on the 1050-foot north level, although some scattered ore was encountered. The 1200- and 1400-foot north levels have not been driven far enough to find the ore shoots which, it is thought, probably exist in that ground.

"To the south of the raise a first ore shoot extends from the 700-foot south level, down past the 900-foot level, but this shoot has not been reached by the 1050-foot south level, although cut by the 1200-foot level; the top of another shoot, or lens, appears on the 1050-foot level and is cut by the 1200-foot level, on which it extends on the level for some 60 feet, and contains ore, from 8 to 16 inches in width, of the usual grade.

"A little farther in on these south levels the south ore shoot extends from the 700-foot level downwards to the 1200-foot level; at the 800-foot level it is 75 feet long; at the 900-foot, 160 feet long by about 5 feet wide; at the 1050-foot level it is about 60 feet long by 7 feet thick; while, at the 1200-foot level, this level, in September, had been driven on the shoot for about 100 feet and the face was still in ore. (Later reports from Mr. Zwicky say that since then the tunnel has been driven another 100 feet in ore, with ore still in the face, and that the clean ore was, in places, as wide as 7 feet.) At the time the mine was visited (September, 1911), this face showed about 4 feet wide of clean ore and about 3 feet of milling ore. This ore-face was one of the finest showings seen in the Slocan; the ore aws usually rich in silver, containing much 'grey copper.' Both the shoots on the 1200-foot south are strong in the floor and evidently continue downward, but they had not at that time been found on the 1400-foot level.

"No attempt was made to estimate the tonnage of the ore already blocked out, but it is large, and more is being opened each day as the development progresses. The development work in progress provides enough ore at present and no stoping is being done.

"The success met with in these deeper developments more than fulfils Mr. Zwicky's expectations, and justifies his judgment in driving the long tunnel at such a depth and the difficult raise, an undertaking which it must be admitted, was considered at the time to be at least risky, and calling for much pluck on behalf of the directorate of the company.

"This successful attempt at deep mining, in addition to its effect on this individual company's prospects, has had a marked effect on the future of the Slocan in general, giving encouragement to other companies to develop to a greater depth. Several other of these later attempts have also been successful, which has increased the confidence that deeper mining here has not only possibilities, but probabilities.

"The long tunnel has been driven absolutely straight, and is equipped with a single track with necessary turnouts at the inner end, over which track one horse has no difficulty in hauling a trip of four to six mine cars, each carrying from 2½ to 3½ tons of material. The workmen are taken in and out through the tunnel on specially designed cars, propelled by hand power.

"The ore from the levels is sent in a chute down the raise to the 1400-foot level, where suitable bins are provided, from which the ore is run into the tunnel cars and transported to an ore house of temporary construction, where it is roughly sorted and clean ore shipped by four-horse teams to Three Forks, a team being able to make the round trip in a day."

It may be added that the erection of a concentrating mill in Middle fork valley, close to the new railway line from Three Forks to Bear Lake, and the construction of an aerial tramway from the portal of the 1400-foot adit level down to the mill, are in hand, while steel is being laid on the railway, so it would appear probable that late in the ensuing autumn shipment of ore and concentrates in much larger quantity than in the past will be undertaken.

COMPANY NOTES

SWASTIKA.

The Swastika's Company has just circulated an interim report to shareholders, which states that levels are now opened at 100, 200, 300 and 400 feet. The main shaft has reached a depth of 420 feet, and for the present sinking will be discontinued. A station has been cut at 400 feet and the shaft timbered and the cages running to that level.

Development on the 300-foot level to the extent of 450 feet of cross-cutting and drifting has been done. Ore on this level has been developed for a length of approximately eighty feet.

On the 400-foot level a cross-cut has been extended west to meet the ore body.

The directors feel that sufficient development work has now been accomplished to proceed with the erection of a 10-stamp mill, complete but without cyanide equipment. It is estimated that the cost of the mill when finished, including engine, will be about $18,000.

The directors expect milling to begin in September.

MOND NICKEL.

The accounts of the Mond Nickel Company, Ltd., show that the net profit for the year ended 30th April last amounted to £154,364, out of which the directors recommended a dividend of 16¼ per cent. on the ordinary shares and 10s. 5d. per share on Deferred shares, placing £35,000 to reserve and carrying forward £41,381.

LE ROI NO. 2.

The directors of Le Roi No. 2, Ltd., have declared a dividend of 1s. per share, free of income tax.

STATISTICS AND RETURNS

B. C. COPPER.

The British Columbia Copper Co. reports its output of copper for the month of June at 996,000 pounds, which is an average production. Reports indicate that the production for the current month will be larger.

COBALT ORE SHIPMENTS.

The following table shows the Cobalt ore shipments for the past week and for the year to date:

	Week.	To Date.
Beaver	.....	361,756
Buffalo	48,600	1,227,503
Can. Gowganda	.....	15,967
Casey Cobalt	.....	724,708
Chambers-Ferland	.....	461,500
City of Cobalt	.....	291,712
Cobalt Lake	.....	683,199
Cobalt Townsite	64,140	1,522,363
Colonial	.....	83,200
Coniagas	21,078	2,021,671
Crown Reserve	.....	618,981
Drummond	.....	682,595
Hudson Bay	62,967	752,417
Kerr Lake	121,107	839,080
La Rose	151,066	3,761,136
Lost and Found	30,001	30,001
Man (Gowganda)	.....	40,000
McKinley	21,776	2,645,593
Millerett	.....	196,000
Miller Lake-O'Brien	.....	145,500
Nipissing	18,826	2,229,779
O'Brien	.....	589,393
Provincial	.....	44,440
Right-of-Way	.....	290,296
Temiskaming	.....	1,153,882
Trethewey	85,300	545,972
Wettlaufer	.....	216,470
Totals	604,860	22,207,823

The ore shipments in tons since the discovery of the camp follow:

1911	26,763	1907	14,000
1910	39,977	1906	5,136
1909	30,096	1905	3,144
1908	25,463	1904	153

The above record does not include the silver bullion shipments, which have increased materially of late. The actual production of 1911 was $16,500,000, or over a million dollars ahead of 1910. The total output of the camp from 1904 to January 1st, 1912, was $64,918,752.

B. C. ORE SHIPMENTS.

Ore production and smelter receipts for the week ending June 29th, are as follows:—

	Week.	Year.
Slocan and Ainsworth.		
Standard	211	4,602
Van Roi	31	1,511
Rambler-Cariboo	31	641
Reco	43	99
Meteor	27	27
No. 1	25	401
Standard, milled	400	7,800
Van Roi, milled	1,100	30,600
Other mines	.....	2,514
Total	1,868	48,195
Rossland Production.		
Centre Star	3,557	77,581
Le Roi	956	23,760
Le Roi No. 2	369	13,859
Le Roi No. 2, milled	300	7,600
Other mines	.....	79
Total	5,182	122,879
Nelson.		
Arlington, Erie	46	770
Queen	36	259
Queen, milled	300	6,300
Granite-Poorman, milled	250	6,750
Molly Gibson, milled	300	1,500
Mother Lode, milled	350	1,350
Other mines	.....	4,504
Total	1,282	21,433
East Kootenay.		
Sullivan	845	16,084
Monarch	77	380
Monarch, milled	200	4,800
Other mines	.....	1,029
Total	1,122	22,293

SHARE MARKET

SILVER PRICES.

	New York cents.	London pence.
June 7	60¾	28
" 8	60¾	28
" 10	60¾	28
" 11	61⅛	28⅛
" 12	61⅛	28⅛
" 13	61⅛	28 5/16
" 14	61⅛	28 5/16
" 15	61⅛	28⅛
" 17	61¼	28 3/16
" 18	61¼	28 3/16
" 19	61⅜	28¼
" 20	61⅝¼	28⅜
" 21	61¾	28 7/16
" 22	62	28 9/16
" 24	62	28 9/16
" 25	61¾	28 7/16
" 26	61½	28 5/16
" 27	61⅝	28⅜
" 28	61⅜	28¼
" 29	61¼	28 3/16
July 1	61¼	28 3/16
¼ " 2	61⅛	28⅛
" 3	61⅛	....
" 4	Holliday	28 3/16
" 5	61⅛	28⅛

TORONTO MARKETS.

July 9 (Quotations from Canada Metal Co., Toronto).—
Spelter, 6.50 cents per lb.
Lead, 5¼ cents per lb.
Antimony, 8 to 9 cents per lb.
Tin, 48 cents per lb.
Copper, casting, 17¾ cents per lb.
Electrolytic, 17½ cents per lb.
Ingot Brass, 7 to 12 cents per lb.

July 9—Pig Iron (Quotations from Drummond, McCall & Co., Toronto).—
Summerlee No. 2, $23.50 (f.o.b. Toronto).
Midland No. 1, $19.75 to $20.50 (f.o.b. Toronto).
Midland No. 2, $19.75 to $20.50 (f.o.b. Toronto).

GENERAL MARKETS.

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

Coke.

July 5—Connellsville Coke (f.o.b. ovens)—
Furnace Coke, prompt, $2.50 to $2.60 per ton.
Foundry Coke, prompt, $2.50 per ton.

July 5—Tin, Straits, 45.75 cents.
Copper, Prime Lake, 17.35 to 17.45 cents.
Electrolytic Copper, 17.30 to 17.40 cents.
Copper Wire, 18.75 cents.
Lead, 4.75 cents.
Spelter, 7.20 cents.
Sheet zinc (f.o.b. smelter), 8.65 cents.
Antimony, Cookson's, 8.12½ cents.
Aluminum, 22.50 to 23.00 cents.
Nickel, 39.00 to 40.00 cents.
Platinum, ordinary, $45.50 per ounce.
Platinum, hard, $47.00 per ounce.
Bismuth, $1.80 to $2.00 per lb.
Quicksilver, $40.50 per 75-lb. flask.

SHARE MARKET.

(Courtesy of J. P. Bickell & Co.)

July 9th, 1912.

New York Curb.	Bid.	Ask.
Braden	7.00	7.12½
B. C. Copper	5.50	5.62½
Giroux	4.87½	5.00
Greene Cananea	8.75	8.87½
Inspiration	18.50	18.75
Yukon Gold	3.62½	3.87½
Goldfield Con.	4.00	4.62½
Nevada Con.	20.00	20.62½
Miami.	27.50	28.00
Ray Con.	20.62½	20.87½
Chino.	31.50	31.87½
United Copper	.50	1.00

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02¼	.02⅝
Beaver Con.	.43	.43½
Buffalo	1.45	1.50
Chambers-Ferland	.19	.20
City of Cobalt	.21	.21½
Cobalt Lake	.28½	.29½
Coniagas	.07¼	.....
Crown Reserve	3.30	3.40
Great Northern	.08¾	.09
Gould Con.	.01	.02¼
Gifford.	.04	.04¼
Green Meehan	.01	.01¾
Hargraves.	.03½	.04
Kerr Lake	2.70	2.80
La Rose	3.25	3.40
McKinley-Darragh	1.75	1.80
Nipissing.	7.40	7.70
Ophir.	.07	.12
Otisse.	.01	.01¼
Peterson Lake	.06	.08
Right of Way	.05¼	.08
Silver Leaf	.04¾	.05
Silver Queen	.03½	.04
Temiskaming.	.36½	.37½
Tretheway	.47	.55
Wettlaufer	.54	.57

Porcupine Stocks.

	Bid.	Ask.
Apex	...	.03½
Dobie	.15	.30
Crown Charter	.12½	.13
Dome Extension	.20	.20½
Eldorado.	.02	.06
Foley-O'Brien	.15	.20
Hollinger	13.15	13.35
Jupiter	.26	.28
Moneta.	.08	.10
Northern Ontario Exp.	2.00	2.50
North Dome	.25	1.00
Pearl Lake	.23	.25
Porc. Imperial	.02	.02¼
Porc. Tisdale	.02¼	.02⅝
Preston East Dome	.03	.03¾
Rea Mines	.25	.35
Standard	.01	.01¼
Swastika	.10½	.11¼
Vipond	.31	.39¼
West Dome	.15	.20
United	.01	.02

Sundry.

	Bid.	Ask.
Island Smelters	.05¾	.06¼
Can. Marconi	5.50	6.00
Amer. Marconi	7.87½	8.25