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# MINING RECORD

ESTABLISHED 1895

VOL. XIV.

FEBRUARY, 1907.

No. 2

## BRITISH COLUMBIA MINING RECORD

E. JACOBS.....Managing Editor

Devoted to the Mining Interests of the Pacific Northwest.

PUBLISHED MONTHLY BY

THE BRITISH COLUMBIA RECORD, LIMITED

VICTORIA, B. C.

Office—Province Building. Telephone 243. P. O. Drawer 615.

### ADVERTISING AGENCIES:

London, England : E. Henderson & Co., Billiter Square Buildings.  
Denver, Colorado : National Advertising Co., 423-424 Quincy Building.  
San Francisco, California : E. C. Duke's Advertising Agency, 1001 Masonic Avenue.

### SUBSCRIPTIONS PAYABLE IN ADVANCE :

Canada and the United States, per year - - \$2.00  
Great Britain and Foreign, per year - - - \$3.50

Advertising copy should reach Victoria office by 5th of each month  
Rates on application.

Correspondence to be addressed to the Managing Editor.

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## NOTES AND COMMENTS.

Two companies are actively engaged in developing coal properties in the Nicola district.

Hydraulic mining under favourable conditions is the cheapest method of gold mining known.

The diamond drill work at the B. C. mine in Summit Camp, Boundary district, has revealed the presence of additional ore bodies.

"Coal is mighty but does not prevail," observed the Greenwood *Ledge* during a recent period of scarcity of that fuel in the Boundary district.

On February 25 Ralph Smith, M. P., addressed the members of the Canadian Club in Ottawa on the subject of "Proper Relations Between Labour and Capital."

The British Columbia Copper Company has leased the Morrison mine, situated in the same camp as its Mother Lode mine. Morrison ore, having a high sulphur content, is required at the company's smelter.

At the Crescent mine, near Greenwood, no breaks in the vein have occurred from the surface to the present depth, 240 ft., which the *Boundary Creek Times* claims "is something to brag of in Greenwood camp."

Ore is being taken out of the Providence mine, north of the porphyry dyke at the 300-ft. level. The Greenwood *Ledge* remarks that this is the first ore encountered north of the dyke, and may prove continuous.

The Daly Reduction Company at Hedley is looking for more Princeton coal, being anxious to secure some 500 tons immediately, but owing to the condition of the road the *Similkameen Star* thinks it is not likely to get it.

Tenders are called for moving from Ashcroft 113,000 lb. of freight for Quesnel dam. This will be mostly hay and grain and is the first move towards the commencement of an extra busy season at Cariboo's big hydraulic mine.

The managements of several Slocan mines—the Surprise, Last Chance and American Boy—are stated to have boycotted Sandon owing to the antagonistic attitude of the local miners' union towards the employment of Chinese cooks in the Slocan.

Two ore shoots of considerable size and of good grade have been located on the 800-ft. level of the White Bear mine, Rossland. The management is much pleased over these finds and feels confident that the White Bear will yet develop into a valuable mine.

The Ashcroft *Journal* is of opinion that everything indicates that this season will see a large number of men in the hills hunting for copper ore. The development and strikes of last season have attracted attention to the Ashcroft district as one of the promising copper areas of the province.

"The Prince Henry has passed the speculative point in mining," states the *Boundary Creek Times*. "At 200-ft. depth the vein has straightened up and the ore is now 6 to 8 in. wide and solid." This property is one of the most promising of the Boundary high-grade silver-gold mines.

It is reported that the smelter buildings at Pilot Bay are to be taken down and as much as possible of the material in them will be used at the Blue Bell mine, situated a few miles higher up Kootenay Lake. The construction of a 250-ton concentrating mill at the Blue Bell should shortly be making good progress.

The Dominion Copper Company is doing some underground prospecting on its Crown Silver claim, which adjoins the Mother Lode in Deadwood camp. No work had been done on this property for several years, not since the Montreal & Boston Copper Company sank a shaft 262 ft. and opened levels at 150 and 250 ft. depth.

"With the approach of spring there will be an inflow of miners and prospectors to Southeast Kootenay," is a prognostication of the Cranbrook *Prospector*, which says further: "The fame of this section has gone abroad, and mining men who keep in touch with the development of the different mining camps of this district will come here."

February 16 was pay day for January at the collieries of the Crow's Nest Pass Coal Company, and the largest amount in the history of the company with the exception of the months of June and August, 1906, was paid to the employees in the following proportions: Coal Creek, \$96,862.30; Michel, \$53,254.90. Total, \$150,117.20.

Recently the Queen Victoria mine near Beasley siding, seven miles west of Nelson, made its first shipment since the purchase of the property by James

Cronin and associates. The ore was sent to the Consolidated Company's smelter at Trail. An aerial tramway, 2,500 ft. in length, has been constructed for the purpose of transporting the ore from the mine to the railway.

The shaft of the Prince Henry, one of the small high-grade mines near Greenwood, has been deepened to 225 ft. and drifting at that level commenced. The pay streak is 6 to 8 in. wide and the ore assays up to \$200 to the ton. On the E. P. U., another of the Boundary high-grade properties, a cross-cut, already in 65 ft., is being driven from the end of the 320-ft. adit previously put in.

The Northport smelter resumed operations on February 28, after a shutdown of several weeks, says the *Rossland Miner*. For some days coke has been coming in from Fernie, and now there is large enough a supply to keep the furnaces in operation for a considerable period. The management feels confident that there will be no cessation of operations for a considerable period, unless the unexpected happens.

The *Slocan Mining Review* calls attention to the fact that the "misleading advertising" of the British-American Copper Mines and Smelter Company, some of the published misstatements of which the *Mining Record* last month exposed, has since been advertising its "absolutely false statements" in the *Vancouver World*, and suggests that "this is a good case for the post office authorities to investigate, and that without delay."

The Dominion of Canada *Labour Gazette* says: It was stated by the general secretary of the Lord's Day Alliance that a number of leading mining firms in British Columbia were engaged in erecting and improving the bunk houses of the men in view of the fact that Sunday labour along general lines is now prohibited and the necessity of the men having more sanitary and more pleasing Sunday quarters is thereby emphasized.

The ore-loading arrangements provided at the shipping point for the Mt. Andrew mine, situated on Prince of Wales Island, southeast Alaska, are described as the best yet made in Alaska. The present full capacity of the aerial tramway from the mine to tide-water is only 200 tons per day, but there is ore-bin storage capacity for 3,000 tons, which quantity, with the aid of the loading devices above alluded to, could, it is claimed, be loaded for shipment in about eight hours.

The *Anaconda News* has reported the discovery of a 2-ft. vein of galena ore on the Ruby fraction claim near Boundary Falls. This discovery is regarded as of importance for the reason that no high-grade silver ore had previously been known to occur so far south along Boundary Creek. Three or four miles south-east, on the Kettle River slope of the Boundary

mountain range, galena occurs in the City of Paris mine, but none had previously been found between Boundary Falls and Anaconda on the eastern side of Boundary Creek.

At the Lone Star and Washington mine, Boundary district, a short distance south of the International boundary line, a force of 16 men is steadily employed by the British Columbia Copper Company. Considerable development work has been done, with very satisfactory results. More than 400 tons of ore have been shipped from the property to date, the ore having been hauled a distance of four and one-half miles by horse teams to a siding on the Kettle River railway, near Danville, Washington, and taken thence by rail to the company's smelter at Greenwood.

The following press despatch has been sent out from Vancouver: A fine body of ore has been struck in the Copper Queen, Texada Island. Mr. Cox, of Seattle, and associates are now working the Copper Queen under a bond, with promising results. What makes the find remarkable and most promising is that it dips towards the Marble Bay lead. In the 800-ft. level of the Marble Bay mine, the lead changed from the southwest to the southeast, a most remarkable fact, which was contemplated by none of the numerous experts who have examined the mine. The lead continues to produce a fine body of ore.

Mail advices from Whitehorse, Yukon Territory, say: The Yukon will during 1907 have the best season in its history. If only half the number of dredges ordered arrive the output of gold will be enormous. It is expected, though, that all the dredges ordered will be here in time to begin operations in the spring. It is understood the Guggenheims of New York will order additional dredges for working on their placer grounds. Conditions in the Yukon are now such that there is little use in continuing primitive gravel-washing methods, consequently the era of the gold dredge has set in.

The following is from the *Nelson Canadian*: Most welcome news is that of the reconstruction of the Ymir Mines Company and the securing of ample capital for development and operation on a large scale. The Ymir mine was handicapped for many successive years by frequent changes of management and uncertainty of the policy of the directors. The discovery of large new ore-bodies requiring considerable capital to open and develop them made reconstruction imperative. This has now been perfected and H. G. Nichols, the new manager, announces that he will begin work in March with a clean sheet.

The Nanaimo, B. C., correspondent of the *Dominion of Canada Labour Gazette* has reported to that journal that a bonus of five per cent. on the gross earnings of its employees during January was granted by the Western Fuel Company of Nanaimo. From February 1, the bonus amounted to 10 per cent., and

is to remain at that rate while present conditions in the coal trade continue. The Wellington Colliery Company granted an advance of 10 per cent. from January 15. The increase amounts to about \$1.50 per week in the case of drivers and labourers, \$1.80 per week in that of skilled artisans, and about \$2 per week to miners on contract work.

"Extensive repairs have been going on in the Daly Reduction Company's stamp mill, getting ready for the resumption of work a few weeks hence, when water becomes more plentiful," says the *Hedley Gazette*. "Last year the mill and works generally were allowed to run down, little or no attention having been given to keeping things in a state of repair. The severity of the weather this winter, which necessitated the temporary shut-down, afforded an opportunity of rectifying matters, and not an hour has been lost in having the works thoroughly overhauled and put in better running shape to commence work as soon as the power is turned on."

Shareholders in the Rosella Hydraulic Mining and Development Company, which during two or three recent working seasons has been endeavouring to get into shape for profitable hydraulic mining its placer gold claims situated in northeastern Cassiar, were lately informed at a meeting held at Nanaimo that: "In 1906, shortage of water was largely responsible for the small returns. This condition cannot occur in 1907, for two reasons: First, the construction of a reservoir, which was completed last season. Second, the very heavy fall of snow this winter. Shareholders can therefore look with confidence for large returns at the end of 1907."

The *Kamloops Standard* states that the Tenderfoot Mining Company's property at Copper Creek has been bonded to Henry Croft and H. G. Ashby, and so far as is possible, until an examination has been made of the property by Mr. Croft, the deal is closed. Mr. Croft will be in Kamloops by the middle of April, and if, after examination, he confirms preliminary reports, the cash will be paid on or before May 10 next. Arrangements will also be made during Mr. Croft's visit for the reopening of the Pot Hook property, for which purpose he has been successful in securing working capital to an amount which will insure development for some time.

After mentioning the recent visit of the vice-president of a dredge-building company to Big Bar, Fraser River, and stating that the object of his visit was to arrange for the installation of two gold dredges, the *Ashcroft Journal* remarks: This intimation of an intention to place a dredge to work on these leases is the first assurance that the boring operations conducted last year by the Burns syndicate's engineer, W. Kirkwood, have turned out well. Of course it was taken for granted that everything was all right, for all the indications pointed that way, still the fact that the syndicate is ready to build

dredges shows that the result of the tests of last summer must have been very satisfactory.

Wishing to ascertain authoritatively the purport of the United States treasury ruling *re* duties on zinc, the *Nelson Daily News* telegraphed the secretary of the treasury at Washington for the full text of the new ruling. The following reply was received: Decision relative to calamine and other zinc ores covers four and one-half pages and is to effect that carbonate and silicate of zinc are duty free as "calamine" under paragraph 514 of the Act of 1897, and sulphide of zinc is free of duty under paragraph 614 of said Act except as to lead contents thereof, which are dutiable at the rate of one and one-half cent per lb. under paragraph 180 of said Act. Appeal has been taken from said decision. Copy of decision and tariff mailed you today.

George F. Beardsley, acting manager for the British Columbia Copper Company in the absence on sick leave of the manager, J. E. McAllister, has been reported in the press to have said: The British Columbia Copper Company's mines are yielding about 1½ per cent. of copper, two of the properties going higher, out of which is recovered 85 per cent. of this metal. The company is selling (in February) its blister copper at 32 cents a lb., 8 cents of this being represented by other than copper values. The old costs of smelting and mining were placed at \$3.50 a ton, but these have been materially cut down by the recent improvements, a profit of \$4 to \$5 gross being now made on each ton of ore.

The president of the Kamloops board of trade, in his annual report, made the following reference to mining in that district last year: While there has not been that progress made in mining circles that we had every reason to expect, it is encouraging to note that outside capital, from entirely new sources, has shown signs of becoming actively interested in the development of our extensive copper ore deposits. Consequent to the desultory and intermittent manner in which the ore-producing mines of the district have been conducted during the past 12 months, the ore shipments showed a reduction from the previous year, those for 1905 having been 343 cars, while in 1906 the shipments aggregated only 128 cars. There is reason to believe, though, that the shipments this year will put last year's figures entirely in the shade.

From a report of the meeting published in the *Nelson Canadian* it is learned that the Nelson board of trade, in a short and very business-like meeting, recently adopted a resolution condemning the proposal to reduce the duty on lead ore and lead products put forward by the paint manufacturers of eastern Canada. The resolution read: "That it is the sense of this meeting that it is unwise to permit any alteration in the tariff on lead and lead products." It was agreed that copies of the following telegram should be sent to several members of the Federal Govern-

ment and Messrs. Galliher and Ross, M. P.'s: "The Nelson board of trade strongly opposes any reduction of the duty on lead or lead products. Any disturbance of confidence already created by the Government respecting the industry would produce serious results." The secretary was instructed to also wire the boards of trade of Kaslo, Rossland, Trail, Fort Steele, Moyie and Cranbrook.

At no other time since it began smelting at its works at Ladysmith, Vancouver Island, has the Tyeo Copper Company received such comparatively large supplies of custom ore as at present. This is due largely to its long-continued and persistent enterprise in seeking to purchase such ore, for it has during several consecutive years constantly kept a capable ore-buyer moving among prospective producers, not only along the coast of British Columbia but northward into Yukon Territory and Alaska. One result, among others, of this advanced policy is shown in the following report of statements made by Charles A. Sulzer, general manager of the Alaska Industrial Company, owning copper mines situated on Prince of Wales Island, who returned north about the middle of February. He said: "The steamer 'Haldis' will bring south between 2,600 and 2,800 tons of ore, and for the next few months the Alaska Industrial Company will ship to the Ladysmith smelter about 1,000 tons monthly. We are now equipping the mines with power drills and making preparations for more extensive development than has been carried on in the past. Within a few months the mines will be producing shipping ore at the rate of about 3,000 tons per month. All this ore will be treated at the Ladysmith smelter."

At the deep-drift mine of the Slough Creek, Ltd., drifting in bedrock and tapping the gravel at various points was carried on at intervals during 1906, but only as much work of this nature was done as was necessary to maintain an outflow of water from the gravel sufficient to keep both pumps running at from 70 to 80 per cent. of their capacity. The greater part of the year was occupied in doing construction work. A water lodgment, having a capacity of about 60,000 gal., was driven below the level of the main tunnel and connected to the original sump. The old drain tunnel commencing some 2,000 ft. down the valley and connecting with the gravel shaft, was repaired and retimbered and the tunnel extended upstream for about 260 ft. Pumping at the rate of from 7,000,000 to 8,000,000 gal. per week was steadily maintained throughout the year. In order to increase the outflow, it is proposed to elevate water with bailing tanks. Two additional steam boilers and a pair of 16 by 44-in. direct-acting winding engines are being installed. The various works attending this increase of plant are almost completed. From 20 to 30 men have been regularly employed, and about 60 Chinamen were at work during the fall cutting fuel for the ensuing year's supply.

## SOME NOTES ON THE ECONOMIC GEOLOGY OF THE SKEENA RIVER.

Paper by W. W. Leach.\*

**S**KEENA RIVER DISTRICT is continuing to receive attention from many people who expect it to become an increasingly important part of British Columbia after it shall have been provided with adequate transportation facilities. The following paper on its economic geology has been, with the permission of the director of the Geological Survey of Canada, prepared by Mr. Leach (of the Survey geological staff), who spent the field-work season of last year in the district under notice, for submission to the annual meeting of the Canadian Mining Institute, the secretary of which has courteously supplied the *MINING RECORD* with an advance copy of the paper:

Since the Grand Trunk Pacific railway scheme was first projected, a great deal of interest has been aroused in the potentialities of the country through which this road will pass. Up to the present, however, the attention of the public has been turned chiefly to the eastern and prairie sections, the uncertainty of the route through the mountainous districts of British Columbia having deterred many from exploring that part of the country in the hope of locating valuable minerals, lands and timber in advance of the railroad.

At the present time it seems fairly definitely settled that the road will pass down at least part of the Skeena Valley, and during the past two seasons a number of prospectors have found their way into that district, many coal and mineral claims have been staked, and a great deal of the available arable land taken up.

Although this was one of the first parts of British Columbia to be traversed by the earlier explorers, Sir Alexander Mackenzie having crossed from the Peace River to Bella Coola on the Pacific (passing a short distance south of the Skeena waters) as early as 1793, very little is yet known of the economic geology of the region. The only official reports, known to the writer, dealing with this subject are those by Dr. Dawson, contained in the "Report of Progress of the Geological Survey" for the years 1879-80, and by Mr. William Fleet Robertson, the British Columbia provincial mineralogist (see "Report of Minister of Mines, B. C., 1905"). Dr. Dawson's work consisted of a hurried exploration from Port Simpson to Edmonton, following the main travelled trails and, with the map accompanying it, affords the only reliable information of much of this country today. Mr. Robertson's report, as far as geology is concerned, deals chiefly with a number of prospects in and adjacent to the Bulkley Valley.

Up to the last few years little or no prospecting

has been done in this great district, if we except the placer miners, who have over-run the greater part of it pretty thoroughly but without any very startling results.

The rocks of the Skeena River may be roughly divided into four main divisions to which, in their southern continuation in the neighbourhood of Francois Lake, Dr. Dawson has applied the following nomenclature beginning at the oldest: 1st, the Cascade Crystalline series; 2nd, the Cache Creek group; 3rd, the Porphyrite group; and, 4th, rocks of Tertiary age.

The Cascade Crystalline series extends in a belt along the coast and is crossed, more or less at right angles, by the river, and has here a width of 50 to 60 miles. These rocks consist chiefly of gneisses, granitic rocks and micaceous schists, generally much disturbed and usually found dipping at high angles; they are supposed to be of Palaeozoic age probably Carboniferous or older. Up to the present they have not been found to contain many large or valuable mineral deposits, although various minerals of economic value have been reported as occurring in these rocks at different localities in this neighbourhood, notably, pyrrhotite and chalcopyrite on the Tsimpsonian Peninsula back of Port Simpson, galena and copper pyrites at the head of Kitamat Arm, and iron ore on the Eestall River near Port Essington. It is highly probable, however, that future prospecting will bring to light other occurrences of valuable minerals, as the extremely wet climate of the coast region, with the resultant rank growth of underbrush and heavy covering of moss has deterred many from prospecting this part of the district with any degree of thoroughness. The mountains here, besides, are high and rugged with few trails and less feed, so that the more open country and better climate of the interior has up to the present gained most of the attention.

Of the Cache Creek series little can be said; the rocks composing it are chiefly quartzites, dark highly-altered argillites and crystalline limestone and are supposed to be Carboniferous, though no fossils have been found in them in this region, and this classification must be regarded as only provisional. Their extent is very doubtful and they do not appear to outcrop in the Skeena Valley itself, at least as far up as Kispyox; the only locality in the lower part of the Skeena watershed where these rocks were noted being on the Kitsequecla River, a few miles above its mouth. On the upper Skeena they appear to be more largely represented as they crop continuously along the river from near the fourth telegraph cabin to the mouth of Bear River and beyond. The writer is not aware of any claims having been located in these rocks.

The third of these divisions, the Porphyrite group, covers by far the most extensive area, and is also of most interest to mining men, inasmuch as practically all the recent discoveries of mineral occur in this formation, while the coal-measures may, for the pres-

\*Journal of the Canadian Mining Institute. Part of Vol. X. (Subject to revision.)

ent at least, be also included. These rocks are probably of Cretaceous age and vary greatly in composition and appearance throughout the district. While named by Dr. Dawson the "Porphyrite group" on account of the preponderance of that rock in the Francois Lake district, to the south of the part in question at present, still rocks of volcanic origin are by no means the only ones represented, there apparently having been a gradual change from south to north from beds mainly of volcanic materials to those of purely aqueous deposition.

In and adjacent to the Bulkley Valley these rocks cover a great area, and have been studied in more detail than elsewhere, having been prospected more or less thoroughly and numerous claims located on them. Here volcanic rocks are much in evidence, consisting of porphyrites (andesites), tuffs, agglomerates, etc., often highly amygdaloidal with inclusions of calcite, zeolites, epidote, etc., more often occurring in sheets as volcanic flows, but frequently showing evidences of deposition under water, and all more or less regularly bedded. They vary greatly in texture and appearance, in colour ranging from light greenish greys to dark purplish reds. Dr. Dawson has estimated their thickness, south of Francois Lake, at about 10,000 ft., and while of necessity this will vary greatly, in the neighbourhood of the Bulkley Valley it will probably not fall far short of this.

These volcanics have been cut in various places by intrusive granitic areas which have shattered and metamorphosed them to a great extent. It is along the contacts of these intrusive rocks and the numerous dykes from them with the porphyrites that mineralization has most frequently taken place. The granitic rocks themselves are somewhat variable in appearance, two distinct facies having been noted on the Telkwa River, one consisting of a coarse light-coloured biotite granite shading off into a granite porphyry near its edges, and the other of a pinkish syenite porphyry; both, however, seem to have had the same effect in regard to mineralization. The dykes from them show an indefinite number of types.

In the vicinity of the Bulkley there would appear to be, so far as is known, three main mineral-bearing belts, the most important so far being situated on the Telkwa River near its head, crossing over into the headwaters of the Morice River. The other two have not been visited by the writer, but from description of prospectors and others conditions must be very similar to those on the Telkwa. One of these lies at the head of the Zymoetze or Copper River including Hudson Bay Mountain, and the other is located on the Babine Range between the Bulkley and Babine Lake, near the headwaters of Driftwood Creek. These two latter districts differ from the first-named inasmuch as a number of galena leads have been located in them, whereas on the Telkwa district that mineral is seldom seen.

On the Telkwa River the ores consist chiefly of copper, and occur in a variety of ways. At times they are found occupying fissures where the country rock has been shattered near the intrusive granitic

rocks; this is particularly noticeable in Hunter's Basin at the head of Goat Creek. Replacement along crushed zones is another common form of ore deposition, and again in places the later dykes themselves are mineralized, and in other cases, although the dykes appear to be barren, the porphyrites along their contacts are mineralized; one such case, that of the Black Jack and Dominion claims in Dominion Basin, which came under the writer's notice, showed a strong dyke about 15 ft. wide cutting nearly vertically the porphyrites, themselves dipping at low angles. The brown trap of the dyke seemed to be quite barren, but in certain beds of the volcanics, which were more readily decomposed than others, the country rock had been replaced by quartz, calcite, epidote and ore, which alteration appears to have followed the bedding planes, reaching its maximum intensity near the walls of the dyke and gradually decreasing laterally from them.

It will be seen from the above that uniformity in the manner of ore deposition is not to be looked for; probably the most common form is when the large dykes are themselves mineralized, especially along their walls. In such instances the adjacent porphyrites are in most cases themselves decomposed in part and more or less mineral-bearing.

Practically no work has been done on any of the Telkwa River properties beyond mere surface prospecting, and that to a very limited extent only, so that it is much too early to prophecy as to their continuity and ultimate value. In some of the small fissures high-grade ore is found with values chiefly in silver and copper (the gold contents as a rule being small), the ore consisting of a variable mixture of chalcopyrite, chalcocite, copper carbonates, bornite, and specular iron, the latter at times being highly micaceous. This micaceous iron seems in places to be associated with silver, as a sample of it, carefully separated from the other materials, gave by assay 8 oz. of silver to the ton. The gangue is usually quartz. The following are a few of the most typical claims of this class, the Rainbow, King, Wareco, Idaho, and Russell, all in Hunter's Basin.

It is, however, mainly on the larger and lower grade properties that the future of the district will depend. The most common ore in these is a mixture of chalcopyrite, a little chalcocite, specular iron and iron pyrites in a gangue consisting of quartz, altered country rock, epidote, calcite, etc., which should make a nearly self-fluxing ore. Among the principal claims of this description may be mentioned the Duchess, Evening, and Anna-Eva groups, all on Howson Creek, and the Dominion and Black Jack claims of Dominion Basin.

As a general rule it may be said that, although the greater part of this district is underlain by rocks of the Porphyrite group, no important discoveries of mineral have been made except in the immediate vicinity of the granitic intrusions and the dykes from them, and it would therefore appear conclusive that they were instrumental in the deposition of such ore as has so far been found.



COAL.

Coal has been reported from many widely separated localities in the Skeena watershed, in fact it was known and locations taken up some time before the existence of the metalliferous deposits was noted. To give an idea of the widespread distribution of coal the following localities may be mentioned where it has been found: the lower part of the Telkwa River and its tributaries, the headwaters of the northern branches of the Morice River, the Bulkley River from near its junction with the Morice River to the mouth of Sharp Creek, about 12 miles below Moricetown, Driftwood Creek, the Kitsequeela River near its mouth, the lower end of the Kispiox River, Tzesatzakwa River, the head of Copper River, and near the head of the Skeena River itself.

In not all of these localities have workable seams been found, but it is of interest to note the presence of the coal-bearing rocks with the possibility of future work showing up other and better seams in some places at least.

It seems probable that all these coals are at about the same geological horizon, and are of Cretaceous age, though, towards the south. Tertiary coals may be represented contemporaneously with some of the volcanic flow rocks there found, which are in all probability younger than those of the Porphyrite series.

Besides being widely distributed throughout the district, coals differing greatly in quality have been found, as a glance at the following analyses will show:

No.	Remarks.	Moisture.	Volatiles Combustible Matter.	Fixed Carbon.	Ash.
		Per cent.			
1	2-ft. seam, Driftwood Creek, does not coke	7.90	36.64	42.06	13.40
2	2-ft. seam, Bulkley River near mouth of Sharp Creek, cokes well	1.02	25.70	52.06	20.32
3	Top seam, 10 ft., Cassiar Coal Co., Goat Creek, non-coking, sulphur 0.52 per cent.	3.40	28.80	62.00	5.80
4	6-ft. seam, Transcontinental Exploration Syndicate, Goat Creek, non-coking, sulphur 0.52 per cent.	0.90	9.90	75.80	13.40
5	6-ft. seam, Western Development Co., head of Skeena River, non-coking	5.75	7.34	75.26	11.65
6	4-ft. seam, Telkwa Mining and Development Co., head of Morice River, non-coking	0.58	10.82	82.70	5.90

Of these coals Nos. 1 and 2 are not likely to be of

much economic importance for some time occurring as they do so close to others of better quality; No. 3 is typical of most of the coal on the lower Telkwa and should make a most excellent fuel for steaming, while Nos. 4, 5 and 6 may be classed as semi-anthracite. They are all strong bright coals and should stand transportation well and may some day supply the greater part of the domestic fuel of the Pacific Coast cities.

It is to be regretted that none of these coals make a good coke, No. 2 being the only one that coked well in the laboratory, and it is too high in ash for commercial purposes. In view of the proximity of smelting ores a good coking coal would be of great value, and it is to be hoped that further exploration will bring to light some suitable seams.

It will be seen from the above analyses that the condition of the coal differs widely at points comparatively near together, and it would appear that the proximity of areas of eruptive rocks younger than the coal-measures has been the chief factor in altering it from a lignitic coal to a semi-anthracite.

Among the better known localities the Telkwa River field may be mentioned in more detail. Here the coal-bearing rocks overlie those of the Porphyrite group with probably a slight unconformity, but, as they have subsequently been much folded and disturbed, their relationship to one another is not entirely clear. The coal-measures are the highest horizon represented, being themselves overlain by glacial debris. In a total thickness of not more than 300 ft. of measures, four at least, good, workable seams have been uncovered; the intervening beds consisting of clay shales, often highly nodular with much ironstone, a few beds of soft, crumbly sandstone towards the bottom, and finally a basal bed of coarse loosely-cemented conglomerate composed chiefly of pebbles from the underlying volcanics.

These rocks must have originally covered a much more extensive area than at present, but their soft nature and consequent inability to resist erosion has resulted in detached remnants only remaining in the valleys. As the valleys are wide, and almost invariably heavily drift-covered, the coal is exposed only where the streams have, in a few places, cut through the deep mantle of gravel to the bedrock; elsewhere no natural exposures are to be found until the higher ridges are reached consisting of volcanics, the actual contact being everywhere masked. The strata, in addition to this, are much flexed and very subject to faulting, so that it will be readily seen the task of delimiting the areas and prospecting generally is one of extreme difficulty.

The very small thickness of rocks overlying the coal, and the fact that they are folded in a series of short rather sharp flexures and subsequently been subject to denudation, has resulted at times in the formation of a number of small basins where the seams at no time gain any great depth. It might be possible in such cases to work the coal in a series of open cuts or by stripping the overlying gravel and shales in favourable localities.



Small faults are numerous, and the seams are likewise cut by a number of dykes, usually accompanied by faulting, from the nearby granitic areas.

In regard to the size of the individual seams the following section was measured at the Cassiar Coal Company's property on Goat Creek; this is the most complete section to be found anywhere in the district.

	Feet.
Clay shales.....	
Top seam.....	{
	{ Coal with a few small clay partings.... 12.0
	{ Clean coal ..... 7.7
	{ Clay ..... 2.0
	{ Gray sandy shale and covered, about... 30.00
Middle seam.....	{
	{ Coal ..... 1.5
	{ Clay shale ..... 2.7
	{ Coal with a few irregular clay partings.. 14.5
	{ Shale with ironstone nodules..... 3.3
	{ Coal ..... 2.0
	{ Gray clay shale, with nodular ironstone bands, about ..... 50.0
Bottom seam.....	{
	{ Carbonaceous shale and coal..... 2.0
	{ Coal ..... 1.5
	{ Shale ..... 0.5
	{ Coal with small irregular clay partings.. 9.0
	{ Clay shale ..... —

Several small seams overlie these. A short distance up the creek beyond these exposures, the two upper large seams have been burned leaving thin beds of slaggy material; the overlying clay shales are burned to a brick red, forming a very noticeable feature in the landscape where exposed in a high cut-bank. The burnt area, however, does not appear to be of any great extent.

In the Transcontinental Syndicate's openings, a few miles higher up Goat Creek, five seams 4 ft., 3 ft. 3 in., 4 ft., 6 ft., and 4 ft., respectively, in thickness were cut in about 130 ft. of measures; while on the property of the Telkwa Mining, Milling and Development Company on the head of the Morice River at least four seams of the following thicknesses—4 ft. 2 in., 4 ft. 6 in., 4 ft. and 7 ft. 3 in.—have been stripped.

Practically all the coal land in this vicinity is controlled by four companies, the three above-mentioned and the Kitamat Development Company.

On the Bulkley River, from a short distance above Moricetown to Sharp Creek (about 12 miles), coal outcrops at intervals, but no workable seams have as yet been uncovered. At Sharp Creek nine small seams were stripped varying from 15 to 40 in. in thickness, but they all proved too high in ash to be of value (an analysis of one of these is given above).

Near the head of the Skeena, about 150 miles north of Hazelton, is situated another important coal field which has been prospected in some detail by the Western Development Company, controlling about 16 sq. miles of coal lands here. In this field the coal-measures occur near the top of a great thickness of sedimentary rocks which probably represent the porphyrites to the south. The rocks here are not so highly disturbed, and there is apparently a greater thickness of overlying strata than at the Telkwa areas. The coal-bearing rocks occupy the trough of

a syncline with gentle dips on either side, the Skeena cutting diagonally across it. At the southern edge of the basin, however, the strata are more disturbed, being often tilted at high angles. At least one seam of good coal, from 5 ft. 6 in. to 6 ft. thick, has been opened up at several places; an analysis of this has already been quoted. Other and smaller seams are known to exist and it is quite possible that the larger one does not represent all the workable coal in this area. The physical qualities of this coal are all that could be desired, it being extremely hard, resists weathering well and is bright and lustrous in appearance. Although no recent volcanic rocks are known of in this neighbourhood, still evidences of volcanic action are not wanting, as the rocks of the coal-measures and the coal itself are found in places to be cut by small quartz veins sometimes more or less mineralized with iron pyrites.

In most of the other coal districts mentioned no workable seams have as yet been found, the coal being either too thin or too highly disturbed to be economically worked. Taking into consideration, however, the difficulties of prospecting already alluded to, there is no reason to suppose that larger and more favourably situated seams do not exist, at least in some of the localities in question.

Although placer miners were the first to prospect the Skeena country, the results so far have not been encouraging, Lorne Creek being today about the only producing locality. This creek has afforded annually a small output of gold since about 1884.

The Omineca country to the east, and reached via the Skeena and Hazelton, has long been a producer of placer gold. The old diggings are now nearly all abandoned to Chinamen, but there is said to be a large amount of ground there which can be profitably hydraulicked when transportation facilities shall have been improved and the cost of working lessened correspondingly. The presence of argentiferous galena in that district has also been known for some years as well as that somewhat rare mineral arquerite, a native amalgam of silver, which has been found in the creek gravels.

In the neighbourhood of Kitsilas Canyon, a number of quartz claims holding gold and copper have been located, but the writer is ignorant as to the conditions prevailing there.

In conclusion, it may be said that lack of transportation facilities has prevented the exploitation of a country rich in possibilities, and until the advent of the railway, nothing can be done to open up and develop its latent resources. The present means of communication are highly unsatisfactory, Hazelton, the distributing point, being reached either by pack trail, 400 miles from Quesnel on the Cariboo road, or by river steamer from Port Essington, and as the Skeena is navigable only at certain stages, and then only with difficulty, this route cannot always be depended on. Away from the river, trails are few and bad, and much trail- and bridge-building will have to be done before even the best known camps will be made easily accessible.

## ON SURVEYS IN NEW WESTMINSTER DISTRICT AND TEXADA ISLAND.

By O. E. LeRoy.\*

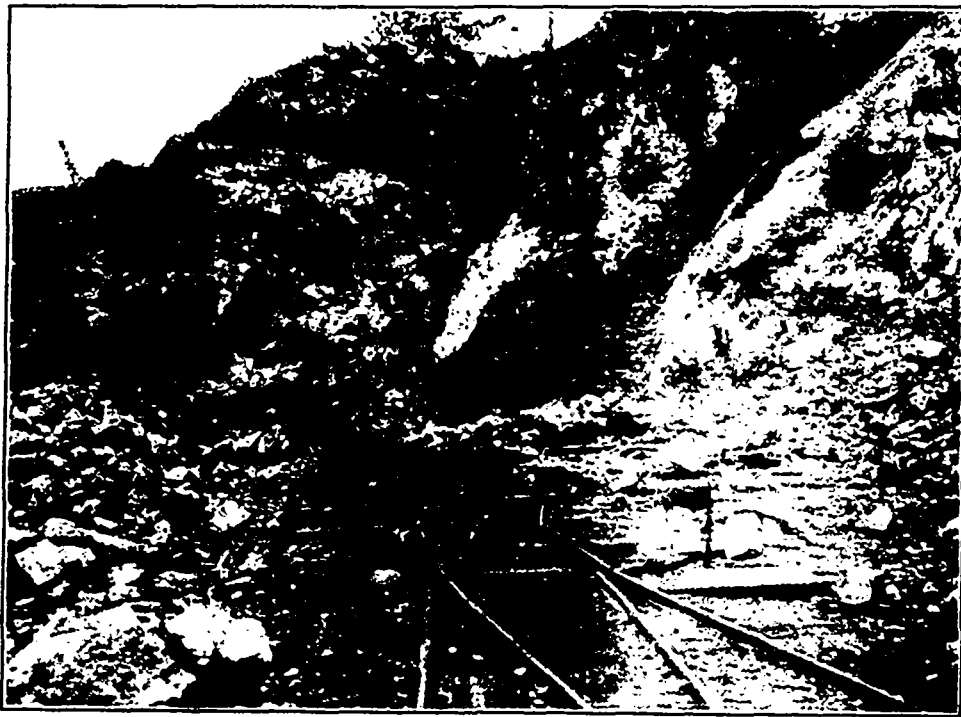
**T**HE AREA comprised by this season's work extends from the 49th parallel to the mouth of Powell River, a distance of more than 90 miles along the main coast of British Columbia. This includes Burrard Inlet, Howe Sound, Jervis Inlet, the island adjacent to the coast, and Texada Island.

From Burrard Inlet to the International Boundary the country is underlain by conglomerates, sandstones and shales of Miocene age. These rocks

3,000 to 5,000 ft., with individual peaks of 1,000 to 3,000 ft. higher.

A dense forest growth occupies the gentler slopes and the relatively narrow valleys, the principal woods being the Douglas fir, cedar, hemlock and spruce. The steeper slopes are either bare or support a sparse growth of stunted pine.

The streams are nearly all steep grade, and will furnish power as local conditions demand. The stream draining the Clowhom lakes into Salmon Arm and Powell River are of special importance. The former has a fall of more than 60 ft. and the estimated horse power is 12,000; the latter has a total fall of about 120 ft. and it is estimated that 30,000 h. p. could be developed.



Showing Contact of Magnetite with Lime—Texada Iron Mine.

are but slightly disturbed and have low dips to the south. In a few of the sandstone beds small irregular seams of lignite coal are found, but so far no bed of any value has been discovered. The whole area is covered to a considerable depth by glacial and alluvial deposits, and it is only along the south shore of the inlet that the rocks outcrop. In Stanley Park and on Fairview heights, Vancouver City, these sedimentaries are cut by dykes of basic lava, but are of very limited extent.

North of Burrard Inlet lies the Coast Range, and in its northern extension as far as Powell River it is composed of a series of subordinate ranges which run approximately at right angles to the trend of the main coast. The elevation of these ranges is from

\*In 'Summary Report of the Geological Survey of Canada for 1906.'

The coast range is an enormous batholithic mass of plutonic rocks which vary in composition from the most acid granite to a basic gabbro.

Lying on this batholith and usually occupying depressions are areas of older rocks. These consist of a great variety of massive and schistose rocks of igneous origin, together with limestones, conglomerates, quartzites, and slates representing remnants of the ancient roof of the batholith. These areas are of great economic importance, as nearly all the mineral deposits of any value are either in them or along their contact with the batholith. Both the granite-gabbro batholith and the associated rocks are cut by a large series of dykes which are mainly diabases.

Thormanby, Merry, and Texada Islands are underlain by rocks of the Vancouver series, consisting of

two formations. The lower is largely volcanic and is made up of altered ash rocks, chlorite and hornblende schists, porphyrites, and agglomerates. The upper formation is limestone and has a limited distribution along the northeast shore of Texada Island, between Van Anda and Blubber Bay. It has a length of seven and a half and a maximum width of two miles. Both formations are of economic importance, especially the limestone. The Vancouver series is cut by numerous dykes of porphyry, greenstone, felsite and garnetite, and also by larger bodies of granite, which are extensions from the coast range batholith. Sandstones of Cretaceous age occur along the shore of Gillies Bay on the south side of Texada Island.

of North Vancouver. It has an area of five square miles, and about 35 claims have been staked. The rocks are banded siliceous and massive hornblende and epidote schists surrounded by syenites and granites. The ores are zinc blende, pyrite, chalcocopyrite, molybdenite and magnetite. Very little development work has been done beyond the actual assessment work required by the provincial mining regulations.

#### HOWE SOUND.

The Britannia mineral zone lies on the east side of Howe Sound 23 miles from the entrance. The zone has a width of one and one-half miles along the shore and extends inland about eight miles. The rocks are conglomerates, quartzites, slates and



Open Quarry Face—Texada Iron Mine.

Sandstones also occur on the mainland east of Grief Point, between Wolfsohn and Seow Bays. From information received it would seem that the formation has a considerable distribution inland. Small seams of impure lignite coal have been found but no beds of any value have been discovered.

Glacial deposits are of limited extent in the coast range. Boulder clays occur at the head of Howe Sound on the east side, on Anvil Island, where they are used in the manufacture of brick, on Gambier Island, and in the vicinity of Gibson landing.

In the region embraced by this season's work there are, in addition to numerous isolated mineral claims, three areas of special importance. They are the Lynn Creek camp, the Britannia mineral zone and Texada Island.

#### LYNN CREEK.

The Lynn Creek camp is about eight miles north

sericite schists. The mineralization is confined almost wholly to the silicified sericite schists. The ores are mainly chalcocopyrite and pyrite, the former occurring in lenticular areas and masses while the latter is finely disseminated through the schist and quartz. Both carry appreciable values in gold and silver. On the western half of the zone there are three principal groups, the Goldsmith, Britannia and Empress.

The Britannia Copper Syndicate's mines are 3.8 miles from the beach, and 3,300 ft. above sea level. The company has 8,500 ft. of lode which has a maximum width of 600 ft. The deposit is essentially a low grade proposition, but the enormous amount of ore in sight, and its situation, present most favourable advantages for economic mining and large output. At present the ore is mined only on the Jane claim at the Jane bluff and Mammoth

bluff. The method of mining is by tunnels, cross-cuts and stopes, and glory holes. The ore is conveyed to the beach by a Riblet aerial tramway, the shipping ore going directly to the bunkers and the concentrating ore to the mill. About 350 tons a day are mined at present, but it is the intention of the company to greatly increase the output at an early date. The ore is shipped to the Britannia Smelting Company's smelter at Crofton, Vancouver Island.

The Empress mine lies east of the Britannia, across the divide, in South Valley. Development work, principally by tunnelling, is being carried on with a view of reaching the shipping ore as soon as possible.

The Britannia West Copper Company's property is situated on the west side of the sound and almost

greenstone and diorite dykes, and also in brecciated zones in the limestone.

At the south end of the limestone band, along its contact with granite, porphyrite and chlorite schist, there are about 20 outcrops of magnetite distributed over half of one square mile. The surface showings indicate extensive ore bodies. A considerable part of these deposits, especially along their borders, is largely impregnated with pyrite and chalcopyrite, and in places the magnetite could be mined for the copper content.

The contact between the magnetite and chlorite schists and the limestone is marked by a series of small but high grade deposits of chalcopyrite and copper carbonates. They are, however, only superficial and have been nearly all worked out.



Cornell Mine, Texada Island.

due north of Britannia Beach. The ore body is 1,500 ft. square and consists of an impregnated zone in granite porphyry. Small quartz veins are numerous and carry bornite.

At present the company is engaged in building a tram line from the mine to the beach, and in constructing a concentrating mill and other mine buildings, and no ore will be mined until these are completed.

#### TEXADA ISLAND.

On Texada Island the more important ore deposits are either in the limestone formation, or along its contact with eruptives or with the schists of the underlying series.

High grade bornite and chalcopyrite associated with felsitic and garnetite dykes occur in shoots in the limestone. Smaller bodies of these sulphides, together with those of lead and zinc, are found along

In the volcanic series underlying the limestone the ores occur principally in fissure veins in porphyrites and chlorite schists. Galena, chalcopyrite, zinc blende, pyrite and magnetite associated with quartz and calcite gangue are the principal ores. Many of these deposits lack permanence in depth, and their gold and silver values are very much lower than in the similar sulphides in the limestone.

At present the only producing mines on the island are the Marble Bay, owned by the Tacoma Steel Company, and the Cornell, operated under lease by a Seattle syndicate. The Puget Sound Iron Company's magnetite deposits, and the Copper Queen mine, both of considerable promise, have not been worked this (1906) season. The Loyal and Commodore mines are still engaged in development work, and have not yet reached the shipping stage.

The Marble Bay mine is now 760 ft. deep, and the ore shoot at that level is more than 40 ft. long, with a maximum width of 20 ft. The ore is mainly bornite, which is disseminated through green felsite and garnetite. The copper, gold and silver values have steadily increased with depth. About 1,100 tons a month are mined and shipped to the smelter at Tacoma.

In the early part of the summer the Cornell mine was pumped out down to the 260-ft. level. The ore on the 160 and 260-ft. levels is being stoped out and shipped to the smelter at Ladysmith. The present output is between 500 and 600 tons a month. The ore and its mode of occurrence are similar to those of Marble Bay.

#### STONE QUARRIES.

The limestones of Texada and some of the coast

of the outcrops a little farther inland will permit a more economical development.

At the head of the North Arm, Burrard Inlet, two quarries are being operated by the Vancouver Quarry Company and the Coast Quarries, Ltd., respectively. At present no building stone is quarried, the granite being used solely for concrete work and road metal. On Fairview heights, Vancouver, a basic lava is quarried for road metal.

The Denver, Colorado, *Mining Reporter*, states that the Arizona Territorial Board of Equalization appears to have stirred up called-for dissatisfaction among both large and small companies when it recently raised the valuations of patented mining properties. In some instances valuations are said to



Granite Quarry, Granite Island, New Westminster Mining Division.

granites afford good stone for structural and ornamental purposes. Marbleized areas in the limestone have been quarried in the past and some good grade stone produced. The Tacoma Steel Company has quarries and limekilns on Marble and Limekiln Bays. A lime of excellent quality is produced which is in much demand both in the home market and at Java. The granite quarries on Granite and Nelson Islands, at the entrance to Jervis Inlet, are both producing excellent building stone. The former is owned by Kelly and Murray, of Vancouver, and the latter by the Ellis Granite Company of Seattle.

Work has recently been resumed at the slate quarry on Deserted Bay, Jervis Inlet. A good grade of slate has been produced in the past, but the amount of waste that had to be handled was one of the serious drawbacks. It is stated, however, that some

have been raised 300 per cent and 400 per cent.

It is estimated that there were produced in the United States in 1906 approximately 335,700,000 tons of bituminous coal and 71,000,000 tons of anthracite. The former showed an increase of about 25,500,000 tons over 1905 and the latter a decrease of 7,700,000 tons.

"The right thing and the courageous thing for legitimate mining papers to do, whenever possible," remarks the *Los Angeles Mining Review*, "is to name companies that are operating dishonestly. This cannot be done often, because evidence must be conclusive. In lieu of this, it is possible to give favourable mention to such companies as are operating legitimately and to ignore those that are not."

SUMMARY OF THE MINERAL PRODUCTION OF CANADA FOR 1906.

Annual Preliminary Statement of Mines Section of Geological Survey of Canada.

CANADA'S MINERAL PRODUCTION in 1906 is estimated to have been nearly \$10,500,000 higher in total value than that of the immediately preceding year. With a production of \$69,525,170, 1905 was a record year with a total value \$3,721,000 in excess of the highest previous record. Now 1906 is shown to have made a much larger increase, its production having reached a total value of, approximately, \$80,000,000. The particulars of this comparatively large output of mineral are given in the following "annual preliminary statement of the mineral production of Canada for 1906," prepared by Mr. Elfric Drew Ingall, M. E., mining engineer to the Geological Survey, and his assistant, Mr. J. McLeish, B. A., statistician. In his letter of transmittal Mr. Ingall remarks:

"Although the figures given herewith are subject to revision, they may still be taken as a very close approximation to those which will be given in the final report.

"The completed Annual Report will follow later and, besides containing a revise of the general table of production, will include other details relating to exploration, development, exports, etc.

"Much of this information is not available till several months after the close of the year; the compilation and printing necessarily occupy some time; the Annual Report therefore cannot be completed till well on in the year following the one covered."

SUMMARY OF MINERAL PRODUCTION IN 1906.

(Subject to Revision.)

Product.	Quantity.	Value.
	(a)	(a)
<b>Metallic—</b>		
Copper (b) .....	57,029,231 lb.	\$10,994,095
Gold, Yukon .....	\$5,600,000	
" all other .....	6,423,932	
		12,023,932
Iron ore (exports).....	Tons. 74,778	149,177
*Pig iron from Canadian ore "	" 104,660	1,724,400
Lead (c) .....	Lb. 54,200,000	3,066,094
Nickel (d) .....	" 21,490,955	8,948,834
Silver (e) .....	Oz. 8,568,665	5,723,097
Cobalt, zinc and other metallic products .....		350,000
<b>Total metallic .....</b>		<b>\$42,979,629</b>
<b>Non-Metallic—</b>		
Asbestos .....	Short tons. 59,283	\$ 1,970,878
Asbestic .....	" 20,127	17,230
Chromite .....	" 8,750	92,100
Coal .....	" 9,916,177	19,945,032
Peat (f) .....	" 250	750
Corundum .....	" 2,274	204,973
Feldspar .....	" 15,873	38,740
Graphite .....	" 447	18,780
Grindstones .....	" 5,545	61,624
Gypsum .....	" 417,755	591,828

Limestone for flux in iron furnaces .....	"	366,015	286,632
Manganese ore (exports) .....	"	93	925
Mica (exports) .....	"	913	581,919
<b>Mineral pigments—</b>			
Barytes .....	"	4,000	12,000
Ochres .....	"	6,837	36,955
Mineral water .....			100,000
Natural gas (g) .....			528,868
Petroleum (h) .....	Bbl.	569,753	761,760
Pyrites .....	Tons.	39,611	157,438
Salt .....	"	76,387	327,150
Talc .....	"	1,234	3,030
			<b>\$25,738,612</b>

<b>Structural Materials and Clay Products—</b>			
Cement, natural rock.....	Bbl.	8,610	6,052
" Portland .....	"	2,139,164	3,164,807
Sands and gravels (exports) .....	Tons.	256,550	139,712
Sewer pipe .....			446,790
Slate .....			24,446
Building material, including bricks, building stone, lime, etc. ....			7,200,000
<b>Total structural materials and clay products .....</b>			<b>\$10,981,807</b>
<b>Total all other non-metallic, as above .....</b>			<b>25,738,612</b>
<b>Total non-metallic .....</b>			<b>\$36,720,419</b>
<b>Total metallic, as above.....</b>			<b>42,979,629</b>
Estimated value of mineral products not returned .....			300,000
<b>Total, 1906 .....</b>			<b>\$80,000,048</b>

The value of the total yearly production reported for 20 years past has been as follows:

1887.....	\$11,321,331	1897.....	\$28,661,430
1888.....	12,518,894	1898.....	38,697,021
1889.....	14,013,913	1899.....	49,584,027
1890.....	16,763,353	1900.....	64,618,268
1891.....	18,976,616	1901.....	66,339,158
1892.....	16,628,417	1902.....	63,885,999
1893.....	20,035,082	1903.....	63,226,510
1894.....	19,931,158	1904.....	60,073,897
1895.....	20,648,964	1905.....	69,525,170
1896.....	22,584,513	1906 (estimated)	80,000,048

REMARKS.

The total value of the mineral production in Canada in 1906, as detailed in the foregoing table, was

\*The total production of pig iron in Canada in 1906, from Canadian and imported ores amounted to 598,411 short tons, valued at \$7,823,020, of which it is estimated 104,660 tons, valued at \$1,724,400 should be attributed to Canadian ore, and 493,751 tons, valued at \$6,098,620, to the ore imported.

- (a) Quantity or value of product marketed. The ton used is that of 2,000 lb.
- (b) Copper contents of ore, matte, etc., at 19.278 cents per lb.
- (c) Nickel contents of ore, matte, etc., at 41.64 cents per lb.
- (e) Silver contents of ore at 66.791 cents per oz.
- (f) Additional returns place the output at 479 tons, valued at \$1,422.
- (g) Gross return from sale of gas.
- (h) Deducted from the amount paid in bounties and valued at \$1.337 per barrel.

\$80,000,048, as compared with \$69,525,170 in 1905, an increase of \$10,474,878, or over 15 per cent. The statistics show a very healthy condition of growth throughout the mineral industries of Canada. Increases are shown in nearly every item, the only exceptions of importance being gold and petroleum. The decrease in the former is due to the continued falling off in the output of the Yukon placers which reached a maximum production in 1900, while for petroleum the decreased output probably indicates a tendency towards the working out of some of the older fields.

On the other hand specially large increases are shown in the output of silver, nickel, copper and Portland cement, while amongst the other mineral products, both metallic and non-metallic, considerable and general increases in quantities are shown and the total valuations of these are enhanced as well, particularly in the metals, by the higher prices realized in 1906 as compared with 1905.

The following table shows the principal increases and decreases in values:

Product.	Increase.	Decrease.
Copper .....	\$ 3,496,435	.....
Gold, Yukon .....	.....	\$2,727,200
“ all other .....	140,737	.....
Pig Iron (from Canadian ore) .....	692,284	.....
Lead .....	389,462	.....
Nickel .....	1,398,308	.....
Silver .....	2,105,422	.....
Other metallic products..	83,977	.....
Asbestos .....	484,849	.....
Chromite .....	.....	1,201
Coal .....	2,424,769	.....
Corundum .....	55,820	.....
Gypsum .....	5,660	.....
Natural gas .....	149,307	.....
Petroleum .....	.....	94,268
Natural cement .....	.....	4,222
Portland cement .....	1,251,067	.....
Other net increases .....	623,672	.....
	\$13,301,769	\$2,826,891
Total increase .....	\$10,474,878	

The mineral products which have shown the greatest growth in output in 1906 are as follows in order of their importance: Portland cement, pig iron from Canadian ore, silver, corundum, etc.

The following table shows the percentage of increase or decrease of the more important products constituting over 90 per cent. of the total production:

Product.	Quantity.		Value.	
	Increase. Per cent.	Decrease. Per cent.	Increase. Per cent.	Decrease. Per cent.
Metallic—				
Copper .....	18.58	.....	46.63	.....
Gold .....	.....	17.70	.....	17.70
Pig iron (from Canadian ore only) .....	53.50	.....	67.07	.....

Pig iron (from both home and and imported ores) .....	13.91	.....	20.81	.....
Lead .....	.....	4.68	14.54	.....
Nickel .....	13.85	.....	18.52	.....
Silver .....	42.95	.....	58.20	.....
Non-metallic—				
Asbestos and asbestic .....	16.33	.....	32.25	.....
Coal .....	14.40	.....	13.83	.....
Corundum .....	38.32	.....	37.42	.....
Feldspar .....	35.66	.....	65.55	.....
Gypsum .....	.....	5.52	.96	.....
Petroleum .....	.....	10.14	.....	11.01
Portland cement .....	58.86	.....	65.37	.....

The study of the figures of the proportional growth or decline of the various leading industries as compared with 1905 will show to what extent the increases or decreases in value exhibited in the previous table were due to the higher prices ruling in many cases. It will be noticed that in nearly every case the effects of increased output were much enhanced by the much higher prices ruling for the product and that in more than one case the effect of an actual decrease in quantity was reversed for this cause.

The following table is intended to convey an idea of the relative importance of the various industries as contributors to the total mineral output of the country. There is but little difference in the relative importance of the various mineral products in 1906 as compared with 1905. It will be seen also that the metallic minerals, together with coal, account for about 80 per cent. of the total output:

1905		1906	
Products.	Per cent.	Products.	Per cent.
1. Coal .....	25.20	1. Coal .....	24.93
2. Gold .....	21.01	2. Gold .....	15.03
3. Nickel .....	10.86	3. Copper .....	13.74
4. Copper .....	10.78	4. Nickel .....	11.19
5. Brick, stone, lime	9.37	5. Brick, stone, lime	8.00
6. Silver .....	5.20	6. Silver .....	7.15
7. Lead .....	3.85	7. Cement .....	3.96
8. Cement .....	2.75	8. Lead .....	3.83
9. Asbestos .....	2.16	9. Asbestos .....	2.49
10. Iron and iron ore (Canadian) ..	1.74	10. Pig iron (from Canadian ore) ..	2.16
11. Petroleum .....	1.23	11. Petroleum .....	.95
12. Gypsum .....	.84	12. Gypsum .....	.74

Gold.—The total output of gold as estimated shows a falling off of more than \$2,500,000 or nearly 18 per cent. This is due mainly to the continued shrinkage in the shipments from the Yukon, which district fell short of its last year's output by about \$2,750,000. British Columbia showed an increase. For the rest of Canada, which, however, contributed only about 2.5 per cent. to the total, the figures as far as at present available, show practically a stationary condition of affairs.

All the gold production of the Yukon and about 15 per cent. of that from British Columbia is obtained from placer deposits, the whole from this source amounting to 77 per cent. The remaining 23 per cent. represents the gold contents of the sul-



phuret and quartz ores worked in British Columbia and in Eastern Canada. The placers as a source of the metal have for some years showed a continuous falling off, which, however, is more than neutralized by expansion in the lode mining branch of the industry. Recent consolidations and the inauguration of extensive enterprises for working the poorer gravels, which exist in large quantities in the Yukon Territory and in British Columbia, are likely in a few years to produce marked results in this line.

Silver.—In 1906, Ontario, British Columbia, Yukon Territory and Quebec contributed to make up the total production of silver which reached 8,568,665 oz., valued at \$5,723,097. This is an increase, in quantity, of 2,571,373 oz., or 42.95 per cent. over the previous year. The average yearly price of the metal on the New York market was 66.791c. per oz. for 1906, as compared with 60.352c. in 1905. This brings up the increase in value of the Canadian production in 1906 over that for 1905, to 58.20 per cent.

Ontario has assumed first place in Canada as a silver producing province, owing to the rapid development of the Cobalt camp, which has attracted the attention of the whole mining world. As is well known, the silver occurs mostly in the metallic condition associated with numerous other minerals, the most prominent of which are cobalt and arsenic. The veins are narrow, but the ore is exceedingly rich. Some shipments are reported to have returned \$100,000 per car load.

The figures of silver in the ores shipped from Cobalt, adopted in this report have received corroboration from data kindly furnished by Mr. T. W. Gibson, deputy minister of the Ontario Department of Mines, who puts the production at 5,500,000 oz. of the metal, when complete returns shall be available. This closely agrees with our own estimate of 5,485,000 oz., which taken at the market price would give a value of \$3,663,486.

British Columbia, on the other hand, shows a slight decrease in 1906 as compared with 1905, owing to the output of the Slocan district having fallen off much below expectations; but this was offset to a great extent by an increased production from the St. Eugene and the Sullivan mine, both in East Kootenay. The falling off of the Slocan, however, is only temporary, and there is every indication of a resumption of activity, more especially if the expected developments take place in the zinc industry. This would permit of mining the large bodies of zinc-lead ores, which are, as a rule appreciably argentiferous.

Copper.—Stimulated by the enhanced price of the metal the production shows a very large increase in quantity, which expansion, together with the higher values obtained is shown in the increase of nearly \$3,500,000, or nearly 47 per cent.

British Columbia and Ontario are as formerly the two main contributors, the former supplying about 79 per cent., the latter about 18.5 per cent.

The average New York prices for the metal for

the years 1905 and 1906 were 15.59c. and 19.278c. per lb., or a rise in 1906 of over 23 per cent.

In British Columbia the mines of the Boundary district are estimated to have contributed about three-quarters of the output of the province; Rossland being the second in importance with the mines operated along the Pacific coast making up the balance. The rest of the Dominion output is represented by the copper contents of the nickel-copper mattes shipped from the Sudbury mines, with a small contribution from Quebec, representing the copper contents of the pyrites ores shipped from the mines of the Eastern Townships district. Throughout the whole country the much higher prices ruling for this metal have stimulated the search for new deposits, and the re-opening of old mines, some of which can be expected to contribute to next year's production.

Cobalt. The production of this metal is represented by the amounts contained in the shipments of ore made from the camp of that name in Northern Ontario. It is stated by some operators that in selling the ores value has been received for the cobalt contents; whilst others have claimed to get no return for this metal. As processes of treatment for these complex ores are perfected, however, it is hoped that this unsatisfactory state of affairs will be remedied.

Nickel.—The production of nickel from the ores of the Sudbury district in Ontario has made a very rapid growth during the past two years, the output in 1906 having been more than twice that of 1904. The ore is smelted at Copper Cliff and Victoria Mines to a matte carrying from 78 to 80 per cent. of the combined metals, copper and nickel. The resulting matte is shipped to the United States and Great Britain for refining.

The following were the aggregate results of operations on the nickel-copper deposits of Ontario in 1906:

	Tons of 2,000 lb.
Ore mined .....	343,814
Ore smelted .....	340,059
Matte produced .....	20,364
Matte shipped .....	20,310
Copper contents of matte shipped..	5,264.6
Nickel contents of matte shipped..	10,745
Spot value of matte shipped....	\$4,629,011

According to customs returns, exports of nickel in matte, etc., were for twelve months ending December 31, as follows:

	Lb.
To Great Britain.....	2,716,892
To United States .....	21,252,444
<b>Total</b> .....	<b>23,969,336</b>

The price of refined nickel, according to the *Engineering and Mining Journal*, of New York, remained fairly steady from January 1 to September 8, quotations for large lots, New York delivery, being from 40 to 45 cents per lb. From September 8 to the end of the year quotations were from 45 to 50 cents per lb, according to size and condition of

order, while for small quantities prices were from 50 to 65 cents per lb.

Although nickel is one of the minor constituents of the rich silver ores of the Cobalt district, the buyers of these ores have made no allowance for the nickel contents, and statistics of its output have not been obtained.

Lead.—The figures of production of lead show a slight decrease in tonnage this year as compared with 1905; but owing to an increase of 20 per cent. in the average yearly price of this metal on the New York market the value is very sensibly greater. The total quantity produced in 1906 was 54,200,000 lb., valued at \$3,066,094, whereas in 1905 a quantity of 56,589,703 lb. was recorded, valued at \$2,676,632.

The average yearly price of lead in the New York market for 1906 was 5.657 cents per lb., as compared with 4.309 cents for the previous year.

About 95 per cent. of the above figure of production is to be credited to British Columbia, the great bulk being derived from East Kootenay district. However, when arrangements shall be completed which will permit of mining the bodies of zinc-lead ores of the Slocan district there is no doubt that a much larger production will be recorded.

Zinc.—Throughout the year great hopes were entertained that the problem of utilization of the zinc ores of British Columbia was drawing very near to a solution. The Federal Government had appointed a commission to study the question of the sources and of the market for these ores, and a large zinc smelter was being erected at Frank, Alberta, through the enterprise of a group of French capitalists. The conclusion of the commission was that a satisfactory supply of zinc ores could probably be obtained in the Kootenays. The Frank smelter was put in operation and several tons of spelter were turned out from ores derived mainly from the Slocan district, but owing to defective apparatus the plant will require extensive and costly alterations before it can be run on a remunerative basis.

Iron.—The total production of pig iron in Canada in 1906 from both Canadian and imported ore amounted to 598,411 short tons, as compared with 525,306 tons in 1905, or an increase of over 13 per cent. in quantity. This production represents the output of nine companies operating 15 blast furnaces. Of these furnaces, three use charcoal as fuel, and 12 are run on coke.

The ore charged into the blast furnaces totalled 1,204,473 short tons, of which 921,733 tons were Canadian ore, and the balance, or 982,740 tons, was imported. The production of pig iron attributable to Canadian ore amounted to 104,660 tons, which is a marked increase over the previous year, when the production amounted to only 68,170 tons.

Beside the above quantity of Canadian iron ore charged into the furnaces, 74,778 tons were exported, which brings the total of iron ore produced in Canada in 1906 to 296,511 tons. This is only a slight increase over 1905, but the interest which seemingly was taken in Canadian iron ore deposits in 1906,

presages a great improvement, in a near future, in this industry. There is apparently no reason why the mining of iron ore in Canada should not take a much greater development than it has in the past.

Asbestos.—The production of asbestos from the Eastern Townships of the Province of Quebec, divided into crude and mill stock, was as follows:

	Tons.	Value.
Crude . . . . .	3,793	\$ 626,895
Mill stock . . . . .	55,490	1,343,983
Total asbestos . . . . .	59,283	1,970,878
Asbestic . . . . .	20,127	17,230
Total products . . . . .	79,410	\$1,988,108

Exports of asbetus, according to customs returns were 59,864 tons valued at \$1,689,257.

The special features of interest regarding the asbestos mining industry during the year have been a general increase in output, a marked improvement in plant and machinery in some of the older mines, the opening up of new and promising properties, and a tendency toward the consolidation of a number of mines formerly separately owned, under one management and ownership.

Coal and Coke.—The provinces of Nova Scotia, British Columbia, Alberta, Saskatchewan, New Brunswick and the Yukon Territory contributed to the total coal production, their relative outputs being in the order named. Nova Scotia figures in the coal returns for more than 60 per cent. of the whole Canadian production, and British Columbia for slightly over 20 per cent. As far as the figures now available will permit us to compare, the output for 1906 shows an increase of 1,248,229 tons over 1905.

The coal output is growing steadily and for the past 12 years each year has shown an increase over the preceding one. The salient feature of the Canadian coal industry in 1906 is the great development which coal mining has assumed in the western provinces, more particularly in Alberta. In this last province there were in 1901 only two mines which produced over 100,000 tons each per year. In 1906 not less than six collieries had an actual production greater than this figure; and several others, whose output did not quite reach the 100,000 tons mark are equipped to easily handle this quantity.

In Nova Scotia and in British Columbia the increases of the past few years have been due mainly to the development of comparatively old established collieries.

An appreciable proportion of the coal of both eastern and western provinces was converted into coke for metallurgical purposes. At the end of the year there were about 800 coke ovens in operation in Nova Scotia, and somewhat over 1,000 in Alberta and British Columbia.

The main features of the coal industry in 1906, as well as special notes on new discoveries both in the east and in the west, have been published in the "Summary Report of the Geological Survey of Ca-

nada for 1906." (See "Summary Report," page 192).

**Petroleum and Natural Gas.**—The production of petroleum is practically all derived from the Ontario peninsula, the only exception being a very small quantity obtained in New Brunswick in the Memramcook field. Beside the old established fields of Lambton and Kent counties, some new oil-pools were brought in in 1906, mainly those of Merlin in Tilbury township and of Moore township.

In the western provinces there has been great activity displayed in search for petroleum and natural gas; large sums have been spent in boring operations both in Alberta and Saskatchewan, but so far we have no production to record from these.

The figures of production of natural gas show a substantial increase over those of 1905, resulting mainly from the development of new gas-pools by the Dominion Natural Gas Company, in Brant, Haldimand and Norfolk counties. This company and the Provincial Natural Gas and Fuel Company are now the largest Canadian producers. The Medicine Hat field, in Alberta, has also produced very satisfactorily, and shows no perceptible sign of diminution.

**Cement.**—The total quantity of portland cement made in Canada in 1906 was 2,152,562 bbl., as compared with 1,541,568 in 1905, an increase of 610,994 bbl., or 39.6 per cent. The total sales of portland cement were 2,119,764 bbl., as compared with 1,346,548 bbl. in 1905, an increase of 773,216 bbl. or 57.4 per cent. Additional details will be found tabulated below.

Fifteen companies were operating plants during 1906, with a total daily capacity of about 10,500, viz.: one in Nova Scotia, two in Quebec, eleven in Ontario, and one in British Columbia. At least four plants were under construction during the year of which the total initial daily capacity will be about 4,700 bbl.

Detailed statistics of production in 1905 and 1906 are as follows:

	1905 Bbl.	1906 Bbl.
Portland cement sold.....	1,346,548	2,119,764
Portland cement manufactured . . . . .	1,541,568	2,152,562
Stock on hand 1st January.	111,446	269,558*
Stock on hand 31st December	306,466*	302,356
Value of cement sold.....	\$1,913,740	\$3,164,807

The imports of portland cement into Canada in 1906 were:

	Quantity.	Value.
Six months ending June..Cwt.	945,157	\$319,021
Six months ending December . . . . .Cwt.	1,485,573	459,685
<b>The year 1906.....Cwt.</b>	<b>2,430,760</b>	<b>\$778,706</b>

\*Note—Some companies do not take stock at the end of the calendar year, consequently their estimates of stock on hand do not always agree from year to year.

This is equivalent to 694,503 bbl. of 350 lb. each, at an average price per bbl. of \$1.12. The duty is 12½ cents per 100 lb.

The imports in 1905 were equivalent to 917,558 bbl., valued at \$1,138,548, or an average price per bbl. of \$1.24.

There is very little cement exported from Canada. The consumption is therefore practically represented by the Canadian sales, together with the imports.

Following is an estimate of the consumption of portland cement in Canada for the past six years:

Year.	Canadian. Bbl.	Imported. Bbl.	Total. Bbl.
1901 .....	317,066	555,900	872,966
1902 .....	594,594	544,954	1,139,548
1903 .....	627,741	773,678	1,401,419
1904 .....	910,358	784,630	1,694,988
1905 .....	1,346,548	917,558	2,264,106
1906 .....	2,119,764	694,503	2,814,267

**ENLARGEMENT OF B. C. COPPER CO.'S SMELTER AT GREENWOOD.**

Particulars of Progress of This Important Work.

**B**OUNDARY COPPER SMELTERS have attracted the particular attention of metallurgists by reason of the low cost of smelting at these works. In calculating the profit-earning capacity of these important industrial establishments it is now customary to assume that with their modern equipment and large treatment capacity the copper they produce should cost as low as between 8 and 9 cents per pound. With copper at the average market price of recent months this, of course, leaves a large margin of profit.

Recognizing the advantage of being in a position to produce much more largely than under the then existing conditions of having a comparatively small plant the directors of the British Columbia Copper Company adopted the recommendations of their manager, J. E. McAllister, and authorized him to design a modern smelting plant to have a treatment capacity of about 2,000 tons *per diem*. In due course the plans were completed and approved, and about a year ago the requisite work preliminary to installation was commenced at the site of the old plant, situated at Greenwood, Boundary district.

Recently the *Anaconda News*, the youthful editor of which has from the time of the installation of the company's first plant taken a deep interest in the construction and later operation of the works, published an illustrated account of the work of enlargement and re-equipment. This narrative (with trifling alteration) and several of the accompanying illustrations are reproduced, as follows:

During the greater part of the past year the work on the enlargement of the B. C. Copper Company's smelting works has been steadily prosecuted and now the finishing touches are being put on the new plant.

A start was made on the extensive excavations for the foundations of the buildings and machinery on

February 27. The first work was done on the site for the new power house, and grading for the machine shop and converter building extension was commenced shortly afterwards. The force employed on construction was increased until, by the end of March, a large number of men, teams and dump carts were engaged.

Work on the stone foundations and on the rebuilding of the ore bins was begun about March 15. Toward the end of March a gang of men began taking



B. C. Copper Co.'s Smelter.

Showing Furnace Floor Level before erection of New Furnace House, etc.

down the old ore bins, beginning with the extreme western section. Work was also started on the overhead traveller, for carrying heavy timbers to different parts of the ore bin floor. This device, which has only recently been removed, after having been in use more than seven months, consisted of two very heavy timber towers supporting a 1-in. wire rope, secured at the ends much after the manner of a suspension bridge cable. The cable was provided with a "traveller," operated by a hoist at one end, and was capable of handling singly the heaviest timbers used in the new bins, and lighter timbers several at a time.

Two cars of timber having arrived, work was commenced on the new water tank. This is located end to end with the old tank, and both are of the same capacity (about 90,000 gal. each). After the furnaces were blown out, in June, the old tank was emptied and raised some 8 or 10 ft. to the same level as the new; thus affording two separate water units, and making it possible to clean or repair either tank without stopping the furnaces; also providing a larger water reserve.

In April a number of carpenters began framing timbers for the new ore bins; however, this work was much delayed throughout by the slow arrival of material. More than 1,330,000 ft. of lumber were used in the construction of these bins. Work at excavations on the converter and ore bin floors was rushed during this month, and, as well, on numerous stone foundations.

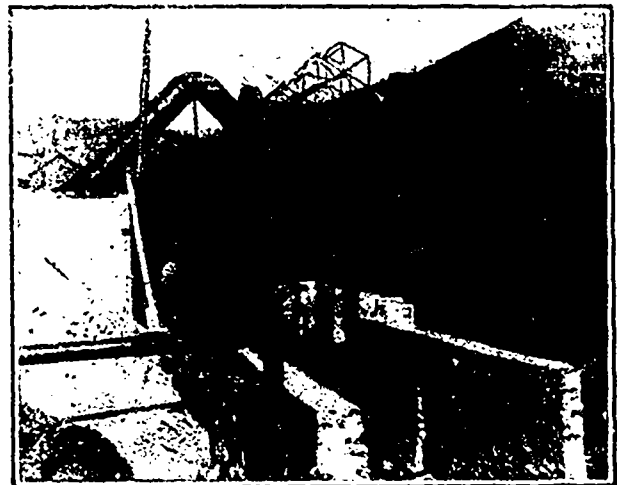
Shipments of machinery for the new smelter began to arrive about May 1, the first carload to be received

having been a drive wheel for one of the new blowers. This wheel was cast in two sections, and alone occupied an entire flat car. A week later another blower wheel arrived, and about the middle of the month, the power tools for the new machine shop.

During May construction was steadily carried forward, with the greatest activity on the furnace floor, where excavations for the building containing the machine shop, blacksmith shop, store room and carpenter shop were completed and the erection of the building started. Toward the end of the month a considerable force was put to work on the stone retaining walls on this floor, and also on the foundations for the new furnaces. Up to May 15 both the old furnaces were kept running full blast. The last furnace was not blown out until June 4, by which time the greater portion of the old bins had been torn down, and a large part of the foundations for the new ones erected.

As soon as the last furnace was shut down, work was started on the dust flue, the lower section of which was deepened over 12 ft. At a point opposite the blower room the flue was doubled in width, thus forming a large dust chamber. Between the flue and the furnace foundations an excavation about 12 ft. in depth and 15 ft. in breadth was dug for the new slag railway, and a retaining wall built on each side of it; the wall on one side forming the outer wall of the flue.

Toward the end of June large quantities of machinery and material began to arrive, including the structural steel for the addition to the converter building and the new furnace building; the blower plant; several cars of furnace material; electric motors, etc. With the first shipments of machinery was a 10-ton travelling crane, which was set up so as to run directly over the lower (converter) spur of



B. C. Copper Co.'s Smelter.

Showing Retaining Walls, Furnace House (incomplete), and Downtake from one Blast Furnace.

the Canadian Pacific railway, and is used in unloading cars.

During July the framework for an extension of the south end of the converter building was erected, and

a start made on the steel furnace building, also on setting up the first of the new furnaces. In the power house an electric compressor was installed about this time; this is being used to supply air for the operation of a tamping machine used in lining the converter shells.

The only change in the sample mill has been the installation of a belt conveyor, which carries the ore from the mill bin to the nearest spur and dumps it into railway cars, which are afterward unloaded into the main bins. This arrangement obviates hand tramping in this part of the works.

By September 1 the first furnace had been set up, and much work done on the second. The foundations for the ore bins were finished, and the greater part of the framework raised into place; however, work on the bins was almost at a standstill during a portion of the month, owing to shortage of lumber. The first of the 25-ton slag cars arrived at the smelter September 1, after having made the journey from the factory in Pennsylvania, where it was built, to Green-

trains are drawn by electric locomotives, of which there are five. The cars are run directly under the chutes from the bins to receive their loads, and are weighed on scales beneath the bins, of which there are 18. The furnaces are provided with doors operated by air hoists, which, being lowered after each charge, keep the feed floor unusually free from fumes.

From the furnaces the slag runs into settlers,  $15\frac{3}{4} \times 8\frac{1}{4} \times 3\frac{1}{2}$  ft. in size, from which the matte is tapped directly into a trough leading to ladles, which are then conveyed by the 40-ton crane to the converter. From the settler the slag runs into the 25-ton cars, which are handled by electric motors, and dumped by electrically-operated worm gears. An ingenious device is employed to prevent slag from spilling on the floor while the filled pot is being exchanged for an empty one. A "spoon" of large capacity is swung under the slag spout before moving the full pot; this receives the flow of slag until the empty car is in place.

The plant, taken as a whole, is the most compact



B. C. Copper Co.'s Smelter.  
General view of Works after enlargement.

wood, a distance of 3,000 miles, on its own wheels.

The first of the new furnaces was blown in on October 2 and the second on October 31. However, it was soon found impracticable to run two furnaces until the trestle carrying the tracks for the mechanical feed trains, which are to run in a complete loop under the bins and past all three furnaces, was completed. This work is now finished, and the lining of the remaining bins nearing completion. A roof of corrugated iron is also being built over the entire new section of the bins.

A brief description of the working of the new portions of the plant follows, in conclusion:

The new bins are so built as to be parallel to the railway tracks above, of which there are four, thus allowing every bin to be filled directly from railway dump cars. The bins are raised some 6 ft. from the ground, furnishing room for the tracks of the mechanical feed trains, which run beneath. The feed trains are made up of from three to six side-dumping steel cars holding about three tons of ore each. These

and at the same time the most economical to operate of any yet built in the Dominion. Inasmuch as the construction of the new plant was controlled somewhat by the permanent features of the old, some portions of the former are not altogether as efficient as they might have been had it been possible to build everything new. Still, the work as a whole reflects the greatest credit upon Mr. J. E. McAllister and his able assistant, Mr. George Williams, and is a plant of which the residents in the Boundary district may well be proud.

"Arrangements are being made for shipping a car-load of ore from the Aberdeen group of mineral claims on Ten-Mile Creek," says the *Nicola Herald*. "Joseph Graham, of Coutlee, who has the matter in hand, and who has done much to develop the property in question, reports very good showings. If the results are satisfactory a further shipment will probably be made, and thus furnish a reliable index of the value of the ore taken from this property."

## OCCURRENCE OF COPPER ORE ON THE NORTH PACIFIC COAST.\*

By Wm. I. Brewer, M. E., Victoria, B. C.

**C**OPPER ORE DEPOSITS on the North Pacific Coast have for years had the attention of Mr. Brewer who in the course of his long-continued observations and enquiries has obtained much information concerning them. In the August, 1906, number of the *MINING RECORD* (pp. 308-312) there was reprinted a paper entitled "Some Observations Relative to the Occurrence of Deposits of Copper Ore on Vancouver Island and Other Portions of the Pacific Coast," written by Mr. Brewer for the annual meeting of the Canadian Mining Institute held in the City of Quebec. This year, additional information having been meanwhile acquired, the subject is further dealt with by Mr. Brewer, as follows:

Since submitting the paper read at the Quebec meeting of the Canadian Mining Institute in March, 1906, I have had further opportunities of investigating this subject. The result of these observations has confirmed more fully the view that the classifications of the various deposits of copper ore as noted in the previous paper, are substantially correct. They are as follows:

1. Bornite ore accompanied by some carbonates, chalcocite, and, at the deeper levels, chalcopyrite, which occurs in contact deposits between crystalline limestone and igneous rocks, usually felsite associated with which is garnetite.

2. Chalcopyrite ore which occurs sometimes with magnetite but often in a quartz matrix in deposits of lenticular structure in fissures in the basic igneous rocks.

3. Chalcopyrite ore usually in a magnetite matrix which occurs as contact deposits between crystalline limestone, slate or schist, and igneous rocks.

4. Chalcopyrite ore occurring in association with iron pyrites, barite or heavy spar, and a small percentage of lime which up to date has only been found in a schist country rock.

5. Pyrrhotite ore carrying low copper values sometimes in a gangue composed of a high percentage of epidote, garnet, amphibolite and some calcspar, which occurs either in fissures in basic igneous rocks, or else at the contact of crystalline limestone and the igneous rocks.

As I stated last year the examples of the first of this series were confined (so far as known at the time) to a portion of Texada Island, a few locations on Sidney Inlet on the west side of Vancouver Island, Gribbell Island, all in British Columbia, and the vicinity of Whitehorse in the Yukon, as well as a few points on Gardner Canal in the neighbourhood of

Gribbell Island. To these localities should now be added, it is believed, the Rainy Hollow camp about 40 miles northerly from Haines' Mission on Lynn Canal. These last deposits I have not personally examined, but from descriptions afforded by men familiar therewith, they should clearly be classed under the first of the series referred to. Moreover, on the evidence of recent information, it seems that the copper deposits in the vicinity of Copper River and the headwaters of the White River should also be so classified.

In respect to the last-mentioned copper belts, a reference to a map of that district will show that a line drawn in a northwesterly direction from the Whitehorse copper belt would pass through the head of the White River and thence into the heart of what is known as the Copper River copper belt. In fact, it would pass only a comparatively short distance north of the Rainy Hollow copper deposits; consequently, without any great stretch of imagination, it may be concluded that there is some relationship between the Whitehorse, Rainy Hollow, head of White River, and Copper River copper deposits; but whether it will be discovered eventually that there is any actual connection between these various belts of copper-bearing formations, or each one is distinctly isolated, is a question that can be settled only by further exploitation.

During the past summer serious effort was made in the development of copper-bearing deposits on Hetta Inlet, on the west side of Prince of Wales Island, which undoubtedly belong to this first class; but like the examples of this class on Sidney Inlet, Vancouver Island, the occurrences are confined to a comparatively limited area, the formation covering possibly two miles square. The geology is practically identical with that on Texada Island, the only noticeable difference being that the granite is more closely associated with the ore bodies than is usually the case either on Texada Island or in the Whitehorse copper belt; but the structure of the ore bodies and the character of the ore, as well as the gangue material, are almost identical with the other examples belonging to this class.

The occurrences on Texada Island are more extensively developed than any of the other deposits of the same class. During the past year development work and shipment of ore has been carried on continuously, especially at the Marble Bay mine, where the lowest depth reached is, today, about 900 ft., and the lowest level where stoping is done, 760 ft. From reliable information I am of the opinion that further prospecting along the contact of the limestone and felsite on these deeper levels will demonstrate the occurrence of other ore bodies. In fact, on the 680-ft. level of the Copper Queen mine, on Texada Island, such has been the case, while at the Marble Bay the ore body shows every indication of trending more directly toward the ore body on the adjoining claim, the Copper Queen, than it did when an examination of both properties was made by me some four years ago.

In the Whitehorse copper belt, there has been con-

\*"Further Observations Relative to the Occurrence of Deposits of Copper Ore on the North Pacific Coast and Adjacent Islands, from the Southern Boundary of British Columbia to the Alaskan Peninsula"; being a reprint of a paper prepared for submission to the Ninth Annual Meeting of the Canadian Mining Institute.

siderable development work done during the past year, and some ore shipped both from the Copper King claim and the Carlisle adjoining it to the east. The most extensive development work has been done, however, on the Pueblo mineral claim situated about a mile and one-half south-westerly from the Copper King, and on the opposite side of an enormous mass of granite. This was one of the concessions located in 1899, and bonded, at that time to the British-America Corporation, one of the Whittaker Wright creations, which also purchased the Le Roi mine in southern British Columbia.

Under that bond an incline shaft was sunk about 85 ft., and a drift driven from the bottom for something like 100 ft.; but the showing from this work was poor; the material extracted from both the shaft and the drift having been principally red hematite iron ore, which carried an average of possibly about 2 per cent. copper, although the material taken from the surface was of higher grade. Notwithstanding that the outcroppings covered an area of about 200 ft. square, no other attempt was made to even prospect, and the property reverted to the original owners in the fall of 1900. From that time until last summer nothing was done on the property, although some shallow prospecting was done on an adjoining claim. However, in the spring of 1906 Byron N. White, who had been a successful operator in the Slocan silver-lead district of British Columbia, purchased this concession together with the Carlisle and Tamarack, which, alone of the 20 concessions originally located and bonded to the British America Corporation, remained in good standing. Mr. White proceeded at once to thoroughly prospect the surface of these extensive outcroppings, and, within a short time, had demonstrated that the work done by the British America Corporation had been on the leanest portion of the entire outcrop; for from other portions he mined, by surface work, ore which yielded from sorted samples as high as 12 to 14 per cent. copper, and in September last, he had mined about 1,000 tons, which would yield an average, without sorting, of about 5 per cent. copper.

It is worthy of note that this capital, together with that furnished by the British America Corporation in 1900, are the only instances on record where any outside investment has been made in the Whitehorse copper belt; but as a result of Mr. White's work on the Pueblo and Carlisle, considerable activity was shown during the late fall, by the representatives of capital sent in to examine the belt. In short, until recently so little was known of the district abroad, that not long since reports were published in the eastern papers of interviews with Mr. Cairnes, of the Dominion Geological Survey, in which appeared the statement that the Whitehorse copper belt had been discovered in the fall of 1906, notwithstanding that as early as the fall of 1901 I had in an article contributed to the *Engineering and Mining Journal*, fully described the camp, together with the principal mining claims—notably the Copper King, Carlisle, Pueblo, Arctic Chief, Grafton, and Rabbit's Foot.

The views expressed in this article were based on observations made previously on Texada Island, the Whitehorse deposits at that time being merely undeveloped prospects; but the general correctness of the opinions then expressed has since been demonstrated.

The present high price of copper, in connection with the good showings exposed by development, is stimulating capitalists to carry on heavy operations in the districts where this class of copper ore deposits occurs. I do not anticipate, though, that any very big mines will be opened in such camps, but when the grade of the ore is considered, together with its persistency in depth and continuity as well as regularity of structure, although lenticular, I am of the opinion, and the past records support that opinion, that such properties can be made commercial successes provided the operations are carried on with proper conservatism by experienced engineers who are not prejudiced or biased before commencing operations.

This last remark is particularly pertinent to this class of ore deposits, because, about five years ago, no less than four prominent mining engineers advised the then owner of the Marble Bay mine, on Texada Island, to stop the ore from above the 140-ft. level, and abandon the property. He subsequently sold the mine for \$150,000, and the present owners realized this sum from the net returns on ore mined, and made their full payments 12 months before they were due; in addition to purchasing and installing an entirely new machinery equipment capable of carrying the work to 2,000 ft. or deeper, and the mine is now paying regular dividends.

Referring to the second class of ore deposit, that in which the chalcopyrite ore occurs sometimes with magnetite but often in a quartz matrix in deposits of lenticular structure in fissures in the basic igneous rocks, there is little to add to the remarks contained in the paper submitted a year ago, for no development work of consequence has been performed on any of these occurrences.

However, in addition to the districts already mentioned, namely, those of Vancouver and Prince of Wales Islands, this class of ore deposits is found in southwestern Alaska, in the Prince William Sound district—especially in the mountains surrounding Landlocked Bay and on Knight Island. In the first-mentioned camp several veins filling fissures in basic igneous rocks, generally described as greenstone, may be noted. The ore in these veins occurs as lenses sometimes having quite considerable lengths and at other times of inconsiderable lengths, with the lenses separated by sheared and brecciated material, which lacking a better name, may be termed "ledge matter," but which, rarely, if ever, carries commercial value, although usually showing low copper values.

The development on these occurrences had, up to the time of my visit last summer, been confined to open-cut work and shallow prospect holes, to represent "assessment" work. In some instances, how-



ever, notably on a property known as the Putz, Steinmetz & Egan, where the ore in the fissure apparently maintained continuity for a distance of 400 ft. along the line of strike, which fact had been partially proven by open cuts and surface stripping made at irregular intervals for that distance; and on another property—the Montezuma, owned by Dickey and associates—as well as on an adjoining group of claims owned by Hemple and associates, indication was found that the ore-bearing fissure maintained continuity for a considerable distance along the line of strike.

The factor, though, referred to in my former paper, as being doubtful in this class of ore bodies, *i. e.*, the maintenance of continuity with depth, is equally doubtful in respect to Landlocked Bay and Knight Island occurrences of copper bearing ore, as, also, in reference to the same class of ore deposits along the coast to the south, and until more development work shall have been done, an opinion, in either direction, is not justifiable. Nevertheless during the present year this question of maintenance with depth on this class of ore bodies will be to some extent solved in the Prince William Sound district, where active operations will doubtless be carried on at properties recently acquired under bond. Meanwhile prospects on Knight Island have, during the winter of 1906-07, been bonded by Seattle, Pittsburg, and New York speculators, but it will not be possible for an examination of these claims to be made until next summer.

During the past season my attention has been called to some occurrences of highly silicious copper ore in the mountains bordering Portland Canal, on the British side. These occurrences, although no magnetite is found as the matrix of the ore, should be classed with the second of the series. The ore is a combination of iron and chalcopyrite in a quartz gangue occurring as filling well-defined veins in the greenstone country rock. These veins are very persistent and can be easily traced for several hundred feet. The grade of the ore is so comparatively low that it is doubtful if previous to the advance in the price of copper, successful operations could have been carried on, except by using the ore as a flux for the treatment of heavy iron ores, such as are found on Prince of Wales Island.

The width of these ore bodies is a variable quantity; it ranges from 2 to 17 ft. of quartz ledge matter with grains and kidneys of pyrite scattered through the quartz, but only forming a small proportion of the entire vein filling.

Of the third class of ore bodies, that in which chalcopyrite ore occurs usually in a magnetite matrix as contact deposits between crystalline limestone, slate or schist, and igneous rocks, there is much more known today than a year ago, as a result of development work; and the largest tonnage of ore shipped during the past year has been from this class of mines.

In British Columbia, along the coast and adjacent islands, little has been done to properly develop this

class of occurrence, but on Prince of Wales Island in Alaska, also in Prince William Sound district, the efforts made to develop such properties have been earnest and attended with gratifying results in some instances, especially so on La Touche Island, where the ore occurs at the contact between a graphitic slate and an igneous rock resembling an andesite, but which has never been microscopically examined, and consequently is known locally by several different designations, often even being called quartzite, due to the fact that the rock is extremely quartzose in character and the crystals of hornblende so minute, to be recognized only with difficulty by the aid of an ordinary lens.

The main cross-cut on this ore body has proved it to be 205 ft. in width, averaging about 5 per cent. copper, of which 55 ft. will produce ore carrying an average of 10 per cent. copper. Drifting on the same level has opened up the body along the strike for a length of about 240 ft., with high-grade ore in the face of the drift towards the north, and with a fault in the formation shown in the face of the drift towards the south. This ore body has not yet been developed to any great depth for the reason that the outcroppings form a high bluff, from which ore has been quarried to a depth of 85 ft. below grass roots, and shipments are confined to the product from this bluff, while the main cross-cut is on a level about 40 ft. below the floor of the quarry. Another cross-cut adit is being driven 100 ft. lower, and recent reports were that the ore body was met with at a point about 40 ft. further westward than in the upper adit. It was expected that by the action of erosion, which had caused a considerable portion of the face of the bluff to be carried off, the adit on the lower level, which is below the zone to which erosion has acted, would demonstrate that the ore body was of considerably greater width than was shown in the upper adit.

La Touche Island, although only about 15 miles in length, and an average of about six miles in width, promises to be one of the greatest producers of copper ore on the Pacific Coast. There is here a zone carrying mineral and showing contact between the graphitic slate and igneous rock almost the entire length of the island. Apparently this mineralized zone has attained its maximum extent on the Robertson-Beatson property, which is described above. It is doubtful whether any such extensive body of copper ore of good average grade will be found elsewhere along the Pacific Coast. Another property which belongs to this same class is the Ellamar on the coast of Prince William Sound, where the country rock formation is very similar to that on La Touche Island, but the ore body itself occurs between slate walls, and the outcrop shows below the high-tide mark on the beach. This fact would prevent an examination to determine whether or not the same contact exists as on La Touche Island.

In developing this property a depth of 600 ft. has been attained, but the length of the ore body is comparatively short and until last year no serious efforts

to prospect along the line of strike of the copper ore-bearing formation had been made. This mine has been a producer of high-grade copper ore since 1902, as also has been the Robertson-Beatson mine; but on the former stoping has been carried on from each level, while on the latter shipments have been made from the surface quarry work only.

More extensive exploration than has been done so far in the Prince William Sound district is necessary before a comprehensive description of the occurrences of copper-bearing ore, and the relationship, if any, that they bear to each other can be made.

The ore bodies of this class on Prince of Wales Island,—and these have been thoroughly exploited during the past season,—are the Stevenstown, Mamie, and Mt. Andrew, on Kasaan Peninsula, from each of which a considerable tonnage of ore has been shipped. The deepest work done has been on the Mamie, where a depth of some 300 ft. has been attained, and this work has demonstrated that the lenticular structure so general along the line of strike of this class of ore bodies is also apparently the rule when they are considered perpendicularly.

The theory, sometimes advanced, that there is a relationship between the length and depth of ore bodies of lenticular structure does not hold good, so far as my observations go, in the occurrences of copper-bearing ore on this coast. Hence, although as in the case of the Mamie mine, a deeper development has shown that the lenses of ore, which outcropped on the surface, may be, and in many cases will be, repeated at variable depth below, even though the surface lens should be apparently cut off entirely at the bottom,—no theory can be advanced regarding the tonnage of ore contained in a lens, unless the four sides are exposed.

The presence of garnetite having a dyke structure is especially noticeable on the Mamie property, and regarding this there is a very interesting problem not yet solved. This is in respect to the origin of the garnetite, usually associated with a rock locally designated as felsite, and classified by some petrographists as augite-porphyrite. Another opinion has been advanced with regard to this rock, that it is not igneous, but only a formation evolved from the contact of limestone and granite. Doubtless the members of the United States Geological Survey, who have taken specimens of the various classes of the country rocks, will have these properly classified within a short time, and if that classification corresponds with the classification of similar rocks made by the geologists of the Geological Survey of Canada, then a scientific question will have been settled definitely.

There is one feature connected with all the contact occurrences of copper ore, where limestone is one of the contact rocks. No ore occurs except associated with more or less garnetiferous felsite (the local designation) and, so far as observed, there is apparently no association between the granite and the deposition of the ore.

At the Mamie mine it has been demonstrated to

some extent how difficult the development of this class of property is at depth; for the reason, that little if any connection can be shown between the different lenses of ore; also it is noticeable that the lines of contact are so irregular that it is difficult to follow them, even where a thoroughly systematic method of development is followed.

The future of this class of ore occurrences depends almost entirely on the extent and grade of the lens that outcrops at the surface; because in a case where this is of sufficient importance from a commercial standpoint for ore to be mined and treated at such cost as will leave a substantial margin to pay the expense of prosecuting further exploitation, then a systematic and thorough method of prospecting at deeper levels can be carried out. On the other hand, if the surface lens is limited in tonnage, and the ore comparatively low-grade in value, there would be little encouragement for an operator to attempt such thorough exploitation at deeper levels.

The other properties belonging to this same class (the third in the series) situated on Prince of Wales Island, on which development has proceeded during the past year are the Rush & Brown on the coast of Karta Bay; the Mammoth, near the head of Kasaan Bay; the Cymru on the shore of the north arm of Moira Sound, and some prospects near the south end of Prince of Wales Island; but on none of these properties has development been carried to so great a depth as on the Mamie.

So far as the fourth class of ore bodies is concerned, that in which chalcopyrite ore occurs in association with iron pyrite, barite or heavy spar, and a small percentage of lime, it is noticeable that this class of ore has not yet been discovered anywhere on the Coast except on Mt. Sicker, where mining operations on several claims have been conducted since 1899. The principal mines opened are the Tyec, from which about 200,000 tons of ore have been mined and treated; the Lenora, which has produced some 50,000 or 60,000 tons of ore; and the Richard III, now being actively operated after having remained idle for about two years. Of these mines the Tyec has been the most important. It has been in continuous operation since 1900, and the development has been carried on to a depth of 1,250 ft.

The occurrences of ore on Mt. Sicker in the schist country rock afford an interesting study to the geologist, as well as to the metallurgist; to the former, because notwithstanding the large extent of the ore bodies, especially in the Tyec mine above the 300-ft. level, no other ore was discovered until the 1,000-ft. level was reached so far as exploitation has shown, and this has been carried on very thoroughly between that level and the 1,250-ft. level; to metallurgists, because of the high percentage of barium sulphate (about 40 per cent.) that occurs in the gangue.

Below the 1,000-ft. level in the Tyec mine, ore of practically the same character, but of lower grade than in the upper levels was exposed down to the 1,250-ft. level. At present development work is being carried on at these levels, while the main shaft

is being sunk to the 1,400-ft. level and ore mined from above the 300-ft.

The development of the Richard III mine is being prosecuted vigorously, work on the Tyee having shown that the ore body maintained continuity along the line of strike into the Richard III ground.

One noticeable feature of the Mt. Sicker ore bodies is that the outcroppings are of comparatively limited extent; in fact the major portion of the ore bodies do not outcrop at all along the line of strike. The country rock, in which the ore bodies occur, is a schist; but whether of aqueous or igneous origin has never been definitely settled. Owing to the presence of graphite and from the general appearance, I have always been of the opinion that this schist is sedimentary, having become more or less metamorphosed by reason of the intrusion of masses and dykes of volcanic rocks of the diorite class; but some geologists, who have visited the district, are inclined to the opinion that the schist is merely an alteration of the volcanic rocks caused by the shearing movement, which has produced a zone where the schistosity is extremely marked. The fact that the schist, even where closely associated with the ore, carries no barium sulphate, and again, that the line of demarcation between the schist walls and the ore is so well defined,—in mining the transition from barren country rock to ore of shipping grade is sudden and complete—precludes the theory that the origin of the ore is from lateral secretion. In fact from a consideration of all the conditions surrounding these ore bodies it would appear as though the ascension theory would best explain their origin.

Class 5 refers to pyrrhotite ore carrying low copper values, sometimes in a gangue composed of a high percentage of epidote, garnet, amphibole and some calc spar, either in fissures in basic igneous rocks, or else at the contact of crystalline limestone or igneous rocks. Examples of this class of ore deposits are relatively numerous, and, apparently, the ore bodies are of much greater extent, although lenticular in structure, than those belonging to any other in the series under discussion in this paper. Whether any of these ore bodies will be proved to be of commercial value has yet to be determined. The values contained in the pyrrhotite at or near the surface have almost invariably been so low that operators have hesitated to carry on developments to any considerable extent; and I am not aware of any ore body of this class on the Coast or the islands adjacent thereto, on which development has been carried to a point to demonstrate commercial value. The old theory that values improve with depth has been so thoroughly exploded, especially with regard to the occurrences of copper ore, that, at the present day, capitalists will scarcely consider a property unless the outcroppings carry fair values. I do not wish to be included among those who hold to the theory that ore bodies increase in value at depth, when this hypothesis is advanced to establish a rule, but there are occurrences, and one of those is the Robertson-Beatson property on La Touche Island, where a zone of secun-

dary enrichment occurs at a depth of about 70 ft. below the apex of the outcroppings, and this zone is known to extend to over 100 ft. deeper.

There is one rule noticeable in all the occurrences of pyrrhotite outcroppings, *viz.*, that surface waters percolate through the pyrrhotite freely and where this ore carries even low copper values on the surface, it does not require any great stretch of imagination, to conclude that values have leached out and been carried downward with the percolating waters.

Extensive bodies of this class of ore are known to occur on the west coast of Vancouver Island; on the mainland near the head of Jervis Inlet, British Columbia; as well as on the mainland along the Alaskan Coast; on Prince of Wales Island and Knight Island and Prince William Sound. The same condition in respect to lack of development is applicable to all these localities; but the time is not distant when a market for this ore will be created by the smelters for fluxing purposes, and possibly by powder works for the manufacture of sulphuric acid. This should result in a settlement of the question whether the copper values in this class of ore increase at some depth below the zone to which the surface waters percolate.

One feature in connection with pyrrhotite ore on the Pacific Coast is worthy of note, *i. e.*, that unlike the pyrrhotite found in Sudbury district, Ontario, it carries no nickel values, and, unlike the pyrrhotite ore in Rosslund district, British Columbia, no appreciable gold values. Owing to these deficiencies and the low copper contents carried by the outcroppings, it is not surprising that so little development has been attempted on this class of ore bodies, notwithstanding their apparent great extent.

There are meanwhile certain characteristics general to all the occurrences of copper-bearing ore along the Pacific Coast. These are as follows: Garnets and epidote are almost always found associated with the copper ore and the presence of these minerals in the gangue is a sure indication of an occurrence of copper-bearing ore. It is not intended, however, to intimate that wherever garnet and epidote occur copper ore will be found, but that I have observed that wherever copper ore is found these minerals accompany it. Especially is this the rule in the case of bornite and chalcocite ores.

Another characteristic, very general with regard to occurrences, is the lenticular structure of the deposits and the absence of what may be termed "true leads." Even where copper ore occurs in veins, it is almost always found that the solid ore is in lenses in the vein matter. Of course, there are exceptions to this latter rule; in fact an occurrence at Maple Bay on Portland Canal, in British Columbia, may be taken as one, the chalcopyrite being there disseminated through the quartz ledge matter in small grains and crystals. About the same condition also occurs on a portion of the Britannia mine on Howe Sound, British Columbia, but there the mass of quartz carrying the mineral has itself lenticular structure.

## LUCKY JIM MINE, SLOCAN DISTRICT.

An Expert's Description of One of the Largest Zinc Mines in British Columbia.

**Z**INC ORE MINING in British Columbia in 1905 was active enough to lead the provincial mineralogist to state, in his report on the "Progress of Mining" in the Province during that year (*vide* "Annual Report of the Minister of Mines for 1905," p. J 22): "This year, for the first time, have any important sales of zinc ore to be recorded;" and to report further that: "Approximately 9,413 tons of zinc ore or zinc concentrates were sold, having a value at point of shipment of about \$139,200." From the "Report of the Zinc Commission," (p. 13), appointed by the Dominion Government "to undertake the investigation of the zinc resources of British Columbia, and their utilization," it is learned that in 1905 8,561 tons of zinc ore were shipped from the Province to the United States and that the actual production for that year was possibly 3,000 to 4,000 tons more than the shipments, but this additional quantity was largely held for treatment by magnetic separation for the enrichment of its grade in zinc.

Unfortunately this new and, for the time, growing industry was not long permitted to flourish, for early in 1906 the United States market was practically closed against its zinc product by an order of the secretary of the United States treasury, who ruled that foreign zinc sulphide and carbonate ores, previously admitted free, were dutiable at the rate of 20 per cent. *ad valorem*. This ruling has been reversed by the board of general appraisers so that, unless this recent decision shall be successfully appealed against, the United States market will hereafter be open to foreign zinc ores, included in the term 'calamine,' as used in the tariff and held as free of duty.

While there are numbers of mines in the Province, chiefly in West Kootenay, in which zinc occurs in association with lead, there are as well several which are essentially zinc mines. The best examples of these, according to the chief commissioner, W. R. Ingalls, are the Lucky Jim in Slocan mining division, and the Blue Bell in Ainsworth division. The accompanying description of the former, by Philip Argall of Denver, Colorado, U. S. A., to whom was entrusted charge of the field work in connection with the investigations of the Zinc Commission, is from the latter's published report, pp. 200-206. In view of the fact that the Lucky Jim has been, and will probably for a time again be, the largest producer of zinc ore of a shipping grade in British Columbia, the information herein given will doubtless be of interest to many. Mr. Argall reported as follows:

This property, situated at Bear Lake, is owned by G. W. Hughes and associate. It consists of 12 mining claims and fractions, aggregating about 350 acres. The Lucky Jim vein was discovered in 1892 and worked irregularly for some years for silver-lead ore; during the years 1896-1899 concentrating ore

amounting to 5,641 tons was produced, from which 1,600 tons of zinc blende averaging 50 per cent. zinc was sorted out. The remainder, a zinc-lead product, was sold to the owners of the Pilot Bay concentrating and smelting works. The 1,600 tons of zinc ore assaying about 6 oz. of silver per ton, 3 per cent. lead, and 50 per cent. zinc, was shipped partly to Antwerp and partly to the Fry Process Works on the Manchester Ship Canal, England, a freight rate of \$14.50 per ton having been secured from the mine to those works, but unfortunately the works, the process and its inventor all came to grief about the time the ore arrived in England and the shippers gained nothing but experience by the transaction.

During 1901-2 the property was shut down, but it was reopened in 1903 by Mr. Hughes, the present owner, who has declared dividends of \$100,000 as the result of zinc ore shipments during 1904 and 1905.

The production under Mr. Hughes' management up to the end of 1905 amounted to 5,345 tons of zinc blende averaging 54 per cent. zinc, a small portion of the tonnage being concentrates from a trial shipment to the Payne concentrator at Sandon.

Development.—The property is developed by five tunnels, the uppermost (worked exclusively for silver-lead ore and now abandoned) being situated at an elevation of 4,551 ft. above sea level. The Slide tunnel, so called because its portal is situated on the side of the gulch, in the track of a large snowslide, is at an elevation of 4,474 ft. A second tunnel (Safety tunnel) was driven in at this same elevation from a sheltered point on the side of the mountain and connected with the workings of the Slide tunnel, so that the men can enter or leave the mine in safety when slides are running in the gulch.

Two tunnels, one on the east and one on the west side of the gulch, have their portals at an elevation of 4,366 ft. These tunnels (called No. 2) are connected with the Kaslo & Slocan railway by a gravity tram 1,300 ft. long, with a fall of 830 ft.; together with the branch levels they aggregate 3,000 ft. of drifts.

Geological.—The Lucky Jim ore deposit differs so much from the general run of the Slocan vein series, that a short note on the geological conditions is necessary to a clear understanding of the ore occurrence at this very interesting mine. In a word, the ore is found in a zone of limestone and calcareous slate where penetrated by fissures, and invariably in the purer crystalline limestone of the zone. The foot-wall of the limestone zone is a hard dark-green fissile slate, more or less pyritiferous near the plane of contact with the limestone. Impure quartzite beds occur in the foot-wall slates, but not in the vicinity of the ore deposits. The hanging-wall country, as seen in No. 2 tunnel, appears to be the average graphitic slate of the Slocan series. The foot and hanging country is separated by about 100 ft. of calcareous slates, limestone, *etc.*, that make up what I shall call the limestone zone. The pay ore occurs in chimney-like columns in the purer limestone, in-

variably along some line of fissuring, or extending along the fissure in vein-like form, where limestone forms one or both fissure walls. The fissuring, like most of the Slocan series, is greatest at the present surface and becomes less in depth, the minor fissures often disappearing in less than 100 ft. from surface. These latter, however, are confined to the limestone zone, and are more properly called incipient fissures. The key to this ore deposit is, however, the east-west fissures crossing the strike of the limestone zone, and this fact should not be lost sight of in prospecting at the Lucky Jim, or other properties along the strike of the limestone zone to the south.

The Mine.—The Safety tunnel follows very closely the strike of the slates from its portal to the turn. The main fissure of the mine was intersected at this turn and followed westerly through the slates until the contact plane was reached. This fissure is a clear break in the slates, averages about 2 ft. in width and stands vertical. I could not observe any mineralization in the slates, the fissure being for the most part open, though here and there blocked by crushed slate. The drift followed the open fissure westerly until the limestone zone was reached, where ore was at once discovered in a chimney-like mass which was followed up to surface along the contact and stoped out, producing considerable lead ore. This upper stope extends near the surface from the main fissure across the Slide tunnel, and connects with one of four subsidiary fissures that occur in the west drift of this tunnel.

The Slide tunnel enters slate at its portal and continues in same until the limestone is reached. At this point a drift runs back in a northwesterly direction along the foot-wall contact plane, intersecting four parallel fissures in the limestone. These are small and usually tight, incipient fissures, which do not extend into the slate foot-wall, although they carry ore in the limestone, and in some places quite good bunches of ore. The first fissure is small and tight on the levels, but has been followed up by a stope which connects with the surface stope previously noted. The second fissure is also very tight in the drift, but as followed west, opened out, and from 20 to 32 ft. west of the drift contained good concentrating ore for a width of 12 ft. mostly a high-class blende. The third fissure intersected in this side drift is very small and apparently unimportant, while the fourth and last is the strongest of all. It has been followed through limestone 60 ft. from the foot-wall, at which point the hanging-wall slates are met with. Galena with some zinc blende occurs in this fissure for a length of 50 ft., and has been stoped in one place up to surface. These four fissures occur at intervals of 15 ft., making a definite though incipient fissuring or sheeted zone, confined, however, to the limestone which here has a proven thickness of 50 ft. A fifth fissure occurs at the junction of this drift with the main Slide tunnel, and the sixth and main fissure, previously traced through the Safety tunnel, is intersected at a distance of 110 ft. from the portal of the Slide tunnel.

The main ore chimney on the tunnel horizon has an elliptical shape measuring 50 ft. along the fissure by about 30 ft. greatest width. The sides of the stope show some galena and considerable blende disseminated in limestone, all of which would pay well to concentrate. A winze connects with No. 2 tunnel 100 ft. below, and some stoping has been conducted around the winze. The workings were, however, filled with concentrating ore and inaccessible. It looks as if the high-grade lead and zinc ore had been stoped, in part, leaving the concentrating ore to be removed later. This ore chimney, as represented by the stope, commences at surface with a thickness of about 6 ft., swelling to 30 ft. on the Slide tunnel level. The limestone is also thin at surface, about 20 ft., while at the Slide tunnel it is 50 ft. and on No. 2 tunnel about 30 ft. This ore deposit is undoubtedly a replacement of the pure semi-crystalline limestone, occurring near the foot-wall of the limestone zone, with high-grade lead ore near the surface, followed by lead and zinc ore of considerable purity, and, as will presently be shown, a considerable development of pyrites in depth, associated with a very fair grade of zinc ore.

This fissure I have previously referred to as the main fissure, because of its great length in the slate and limestone, and furthermore because a winze was sunk on it to the No. 4 tunnel, where it is very well defined and carries ore on its walls in the limestone. The rich ore has probably been very carefully stoped out from this big chimney, though there are, no doubt, many thousand tons of good concentrating ore to be obtained by further working around the periphery. At least, very good blende and galena ore, mixed with limestone and a little slate, can be seen around the workings on and above No. 2 tunnel level, while below that point the chimney is filled with broken ore, stored there until arrangements can be made for its concentration.

There are two adits on the horizon of No. 2 tunnel. I shall first deal with the one driven to intersect the ore chimney, last described.

The tunnel starts in on the southern side of the gulch and intersects the limestone-slate contact 200 ft. from its portal, after passing through slate for that distance. Near the contact the slate contains quite a large development of scattered pyrite crystals, which may be said to extend for about 20 ft. back from the contact. The pyrites is in form of cubes, and is best developed close to the contact. Passing inward along the tunnel, at a distance of 50 ft. from the contact the first fissure occurs. A drift has been opened 15 ft. to the east and a raise put up some distance. This fissure is well-defined here, and would appear to correspond with the most northern of the Slide tunnel series, which has been there drifted on for a length of 60 ft. Where cut on No. 4 tunnel, several good bunches of blende occur in the fissure and iron pyrites is somewhat plentiful in the limey rock adjacent to it.

On the west side of the tunnel at this point a drift was pushed in 10 ft. on a tight fissure. The lime-

stone in this neighbourhood is somewhat massive and dark-coloured, while 18 ft. further in along the tunnel a very distinct open fissure crosses, on the walls of which about an inch of calcite is found. The space between the calcite on the walls varies from half an inch to two inches. It is quite probable that this is a post-mineralization fissure. There is no change from this point until the main fissure of the mine is intersected at 380 ft. from the tunnel portal, along which the tunnel turns to the east and connects with the raise which passes up through the big ore chimney now stored with broken ore, previously referred to. This main fissure has been opened for about 15 ft. east into the slate foot-wall, on which the raise was started, and, so far as I can determine, it closely follows this wall until the winze is reached. In the face of the east cross-cut in this slate foot-wall on No. 2, the fissure appears small and tight, and would scarcely be recognized as the main fissure which passes so persistently through the slates on the Safety tunnel horizon. In the westerly direction, however, the fissure is very strong and has been followed for a distance of 160 ft., for much of the way through calcareous slate and bands of impure limestone, ending in the typical black Slocan slates, where the fissure is again practically closed. Ore occurs for a considerable distance between the points indicated, but to be more precise, at the foot of the main raise on the foot-wall there is 3 ft. of very fair blende next the fissure, with 5 ft. of rather light-coloured pyrites, associated with a little blende, followed by strong developments of calcite which continue southerly in the limestone to the next fissure. A third parallel fissure, small and tight, occurs at the bend of the level, along which no particular mineralization can be noted.

Passing westerly along the main fissure, the No. 2 tunnel was driven through the fissure and extended on its last course 40 ft. beyond it, ending in black Slocan slates. A raise was also put up in the main fissure, at this place, but was in no condition for examination. The ore in the fissure, however, gives the same section as at the foot-wall raise—3 ft. of blende and about 5 ft. of mixed pyrites and blende. The pyrites appears rather massive, and some of it looks like pyrrhotite, but on the whole, it would make good concentrating ore. Continuing westward along the main fissure, toward the hanging-wall of the limestone zone, the drift passes mostly through slate from the point of intersection of the main tunnel to the winze, though in this slate there are a few small beds of impure limestone. The left-hand side of the drift is deeply marked with striae, showing movement toward the hanging-wall at about 40 deg. dip. Limestone again occurs at the winze for a width of 15 ft., and in it there is a very fair development of pyrites, zinc blende and galena, the blende being more abundant toward the hanging, and indeed extends back along the northern side of the drift for 14 ft. from the winze, the blende being of the usual high-grade character of the Lucky Jim ore. This winze has not been unwatered since Mr. Hughes

purchased the property, but he informed me the drift inside of the winze was full of good concentrating ore when he took hold of the property, and he believes this ore was taken out of the winze, though it is just as likely to have been obtained from the raise. The ore, he stated, contained considerable galena and was a first-class concentrating ore. Beyond the winze the drift is entirely in slate, and ends, as previously noted, in dark Slocan slates, softer considerably than those passed through in other portions of the tunnel. Returning to the main raise on the foot-wall, it will be noted that the level after passing through the sheeted zone, previously described, makes a southerly bend and enters the slate. Passing onward for a considerable distance, the level was very hurriedly examined and the face found to be in slate, but near the face some impure limestone occurs. A westerly cross-cut passes through this band in the slate, and one to the east also ends in slate. One or two cross fissures occur in this drift, but no mineralization of moment was observed. From one fissure quite a stream of water was issuing, giving a black deposit, probably manganiferous.

While this drift south of the main fissure was not carefully examined, yet the irregular occurrence of the limestone and the fact that No. 2 tunnel, after intersecting the main fissure, passed through the limestone and into the slate, that between this point and the winze in the main fissure another slate mass exists, it becomes evident that the limestone is of irregular occurrence and is probably best understood, in part at least, as an accretion or segregation of limestone in the slates, the larger mass following closely one particular stratum of slate now represented as the foot-wall; in this limestone segregation mineral has been deposited in the main fissures of certain sheeted zones. The strike of the limestone zone at the surface can be followed for about 250 ft., when it passes under wash and debris and is lost from sight, but again crops on the point of the hill almost opposite the portal of No. 2 tunnel east. Here an open-cut was made and considerable lead and zinc ore shipped therefrom. In the sides of this open-cut three well pronounced fissures are observable, each one well mineralized.

Tunnel No. 2 west passed in through hard slate, which on nearing the ore deposit is pyritiferous and the slate greenish, but on the tunnel horizon I was not able to observe any of the fissuring, the ore having been completely stoped out, one stope taken out below the tunnel and the place filled with water. I was informed, however, that a winze was sunk about 70 ft. and followed ore for the entire distance, but at the bottom the ore was narrowing and following a distinct fissure. I believe the principal shipments from the Lucky Jim during 1905 came from this chimney, which roughly measures 65 ft. in length by 35 ft. greatest width, having the shape of a flat ellipse. The ore is very clean zinc blende, containing only a few stringers of iron pyrites, easily sorted out. Some of the crystalline blende has a resinous colour and occurs in very large crystals. Very little



hand sorting is required, as the ore is singularly free from waste or impurity, whole car-loads running 54 per cent. zinc as broken down in the stope.

No. 2 tunnel west, on passing through the slate-limestone contact plane, broke into solid zinc ore and followed along the basset edge of a very rough jagged slate, forming the northern boundary of the limestone and the ore chimney, which are practically coterminous, while the face of the drift is in slate which terminates the limestone in that direction. The slate is of dark green colour and pyritiferous. Here we find the curious phenomena of a pure crystalline limestone apparently interbedded with the slate, suddenly and abruptly terminating against a jagged slate wall, being as it were cut off on its strike. This could be more easily explained as due to faulting, but no fault fissure could be observed along the northern boundary of the ore deposit, while the limestone 2 in. from the slate assayed 53 per cent. CaO with no silica or magnesia present. On the south side of the chimney the ore has been stoped back into the crystalline limestone, while a drift passing almost at right angles to the general strike of the formation, shows the limestone zone to be 60 ft. thick at a point 70 ft. south of the centre of the ore chimney.

The shipping ore on the tunnel horizon and above is stoped out, and the workings in places are filled with concentrating ore, while the stope below the level was full of water, hence no thorough or satisfactory examination of the ore chimney could be made. However, it looks to me as if the limestone in which this ore chimney occurs is a sort of segregated deposit, or possibly a cavity in the slates filled with pure crystalline limestone. The limestone enclosing the other large chimney in No. 2 tunnel east appears to conform to the strike of the slates, at least adjacent to the chimney. It is also crystalline and a sample taken at the foot of the main raise, south side, gave on analysis CaO 53.4 per cent., SiO<sub>2</sub> 0.8 per cent, MgO nil.

The Lucky Jim ore deposits occur in a limestone zone in part interbedded with the slates. This zone consists of crystalline limestone of great purity, calcareous slates and dark impure limestone bands which in some places follow the strike of the slates and in other places are of irregular form, more particularly the crystalline limestone in which the two developed ore chimneys occur. The ore deposits occur in association with a system of vertical fissures crossing the zone at about right angles to its strike. The fissuring is best and largest near the surface and does not continue very strong in depth. Future prospecting should therefore take the form of developing the cross fissures at a shallow or moderate depth in the limestone zone. Moreover the shallow deposits carry galena and very clean blende, while in the deepest workings a fine grained pyrites and zyrhotite occur in quantity, mixed with the blende, and hence the deep ores will require a concentration mill and magnetic separator to handle them effectively. The Lucky Jim mine should produce large

quantities of concentrating ore as well as the high-grade zinc for which it is famous. Further development along the strike of the limestone will in the fissured zones undoubtedly result in the discovery of other deposits of high-grade blende.

#### ON OPERATIONS IN THE ROSSLAND, B. C., MINING DISTRICT.

Official Report by R. W. Brock.

**R**OSSLAND MINING CAMP has during two field-work seasons been under detailed examination by R. W. Brock and associate officials of the Geological Survey of Canada. In the June, 1906, number of the *MINING RECORD* (pp. 219-239) there was published Professor Brock's "Preliminary Report on the Rossland, B. C., Mining District." As supplementary to that interesting and valuable report the following, giving further information relative to the mines of the camp and the work done by the Survey party in and about them, is reprinted from the "Summary Report of the Geological Survey Department of Canada for 1906":

The past field season was spent at Rossland continuing the survey of the camp begun last season, described in the "Preliminary Report on the Rossland, B. C., Mining District." The division of the work made last year was adhered to during the present summer, viz.: W. H. Boyd took charge of the topographical survey; G. A. Young mapped the areal geology, while the writer's attention was given to the veins and ore deposits. Six student assistants were attached to the party, all of whom advanced the operations by willing and intelligent services.

The instructions were to complete, if possible, the work in the Rossland district. Mr. Young succeeded in completing his task. Mr. Boyd finished his map of the area embracing the town and working mines, on a scale of 400 ft. to the inch, with 20-ft. contours, and the main portion of the map of Rossland and vicinity on a scale of 1,200 ft. with contours at 40-ft. intervals. He was forced to suspend operations for the season, with two or three weeks' work still uncompleted. This, however, can be finished next spring without delaying the publication of the map. My own work will require the same time to complete.

Operations were commenced early in May and suspended in the middle of October. The geological work was not confined strictly to the areas covered by the map sheets of Rossland but was extended in various directions, in the hope that some of the problems might be more easily solvable outside than within the complicated area in the immediate vicinity of Rossland, and in order to compare the outlying veins with those of the camp itself. With few exceptions all the workings that could be found, and that were sufficiently free of water to be entered, were examined, as well as a number of mineral claims lying outside.

Nothing was found to greatly alter the conception of the geological history of the camp given in the "Preliminary Report," published last year, so it



need not be repeated in this place. One of the most interesting and unexpected discoveries was that of a bed of fossiliferous stratified rock just above the O. K. mine. While considerably altered to calcite it is hoped that some of the fossils collected preserve enough of their original forms to enable the exact geological age of the rocks to be determined.

Exact figures of production cannot be obtained. As nearly as they can be computed Rosslund has produced to January 1, 1906, 2,217,295 tons of ore containing 1,240,331 oz. of gold, 1,723,249 oz. of silver and 60,753,330 lb. of copper, together valued at about \$34,879,239. This year's (1906) production will be seriously affected by the slackening of shipments by the Centre Star while alterations were in progress, which occupied almost half the year, and by a shortage of coke at the smelters occasioned by the strike of coal miners at Fernie. From this cause the Le Roi Company, which had intended to operate its Northport smelter, in addition to shipping to Trail, was obliged to postpone the blowing in of the Northport furnaces.

During the past year, development work in the mines has been pushed more vigorously than formerly with the gratifying result that more ore is now in sight in each of the mines than had previously been for many years.

In the Le Roi work has been largely, but not altogether, confined to the South lode opening up large ore bodies on a number of levels, from the 300-ft. down. Hitherto the workings on the Le Roi had been confined to the ground east of the Josie gulch from about the Josie shaft to the Le Roi stores. Levels are now being extended on the Le Roi west of this dyke and good ore has been encountered. This opens up considerable possibilities in extensive but hitherto untested ground. The winze from the 1,350-ft. level has been extended to the 1,750-ft. On the 1,650-ft., the last developed level, the main drives are almost altogether in heavy sulphides. These lower levels will be extended and worked when the shaft has been sunk to them, which work is now in progress. The North and Main lodes are also receiving some attention.

In ground so extensively mineralized as the Le Roi the whole of a lode from end to end and from side to side is worth prospecting; a narrow drift along it, a narrow stope on it, or a very occasional cross-cut or drill hole, by no means exhausts the possibilities. On the South lode there are large areas as yet totally unprospected and on the Main vein there is a great deal that has not been wholly tested transversely. This with the ground west of the Josie dyke and the deep levels gives a large extent of territory with first-rate possibilities.

The geological work in the Le Roi showed a very large number of the ore shoots to occur along the contact between the augite-porphyrite and the tongue of granitoid rock which lies between the Main and South lodes. A dyke of quartz-bearing porphyry occurs in or near the latter lode on a number of levels of the Le Roi and also on the South

lode of the Centre Star. It might sometimes be useful as an indicator.

The Consolidated Mining and Smelting Company of Canada in addition to work on the upper levels has devoted much attention to the deep levels of the Centre Star and War Eagle. The shaft of the former has been continued from the tenth to the twelfth level. It is encouraging to note that the eleventh level, the deepest developed level in the mine, promises to prove better than any level since the 50-ft. One sill floor had been cut out to a width of 48 ft. in pay ore. On the War Eagle, beside prospecting on the upper levels where some new shoots have been located, work on the newly-found downward continuation of the War Eagle vein has been in progress in the ninth, tenth and eleventh levels. Three cross-cuts from the War Eagle to the Centre Star shaft have been run to enable the two mines to be operated from that shaft.

A new 1,100-h.p. Nordberg hoist, with a capacity of 1,350 tons per ten hours from 3,000 ft. is being installed, and in the new hoist house, a sorting and sampling plant will be placed. The compressors from the War Eagle are being placed with the Centre Star and all will be electrically driven, so that hereafter the two mines will be one with one headworks and shaft.

The Iron Mask mine, lying north of the Centre Star and in the obtuse angle between it and the War Eagle, has been acquired by the Consolidated Mining and Smelting Company and preparations are being made to operate it through the War Eagle.

On the Le Roi No. 2 the most interesting and important development has been the exploration of the Hamilton vein on the 500-ft. level. This vein has been followed continuously for a distance of over 1,200 ft., most of which, it is said, will be extracted, and much of it is good grade ore. Near the surface this promising vein is far below grade and even to the 300-ft. level it is not up to the mark but below this the values come in. This mine is the only one with extensive workings west of the Josie dyke, but from it a large quantity of ore has been extracted. The Poorman vein on the Josie claim is also being operated.

The Jumbo mine, after having been operated several years and having shipped about 30,000 tons, has been shut down, the known ore having been extracted.

The Crown Point was operated for a few weeks and shipped a little ore but as the ore gave out a short distance below the surface, work was suspended.

The White Bear, on the other hand, is again in operation, principally on development work, although ore extracted in this work is being shipped.

There is some prospect of several other properties being re-opened.

Outside what may be termed the central area, that occupied by and adjoining the working mines, there are a large number of veins. In some of them a little high-grade ore has been obtained but the ma-

jority are low-grade or have shown so far as developed only small amounts of good-grade material.

In the stratified rocks, while some veins have good surface showing, they have failed to maintain their strength and values downwards and the numerous slips in these rocks make it difficult to follow them.

Two main types of veins occur outside the central area, which, however, may grade into one another, viz., those that consist largely of pyrrhotite with small amounts of pyrite, chalcopyrite and other sulphides, and those that have as conspicuous constituents some of the minerals arsenopyrite, pyrite, molybdenite, galena, blende, bismuthinite, garnet epidote and quartz. These obtain both to the north and west and in the South Belt. West of Little Sheep Creek quartz veins with some sulphides are common. The O. K. and I. X. L. furnished very rich gold quartz ore from a vein in serpentine but the vein does not reach the lowest level.

The attempt made to map the veins of the camp was not very successful. Veins are too numerous, too much alike, exposures are too frequent, and small faults too plentiful to enable one to interpolate between outcrops. It was decided that it would be more useful to simply mark the exposures with a line sufficiently long to indicate the strike of the vein at that point, except where there can be no doubt as to the identity of the vein. The map will suggest the co-relation of the exposures, and anyone interested may test the verity of his conclusions by trenching. Plotting the outcrops, however, as well as the development work in the mines emphasizes the fact that there is a large number of veins, and that they are more persistent than had been expected. This is true also of the ore shoots to a much greater extent than was formerly supposed.

It is evident from early workings that two mistakes of an opposite character were liable to be made; either too great regularity was expected or none at all. Either of these mistakes was fatal. There is enough regularity to make it safe to conclude that when a well-marked typical vein disappears, it has been faulted, and when an ore shoot fails to appear at the expected spot, a change of dip or a horizontal heave is sufficiently probable to make a thorough search advisable. In early work prospecting was often stopped by a fault of the dyke, or if continued the drive was frequently turned along the fault plane, the worst possible place to look for information.

Almost all the veins strike either nearly east and west or northwest and southeast so that when only a limited exposure is to be seen it may fairly be presumed that the vein strikes it in one of these directions.

It is a noticeable fact that with few exceptions all the claims which have attracted attention in the South Belt as well as in the north, lie very close to the contact of the monzonite or gabbro mass. Ground near this contact would therefore appear to be particularly favourable for prospecting.

Starting with the South lode of the Le Roi-Centre Star, there are at least seven veins that are producing ore—and possibly more. From the War Eagle to the Cliff there are four well-marked ones.

Unfortunately there are few rock exposures south of the South lode, but the monzonite contact lies somewhere south of it. Since the conditions southward seem as favourable as northward of the South lode, it is scarcely likely that the great ore bodies of this lode have so much ore to the north of them and none to the south. It is less unlikely to suppose the Le Roi-Centre Star Main and South lodes are the central and perhaps the most important members of a co-ordinate system of veins. That there is some mineralization in this ground is shown by the Nickel Plate workings, cuttings on the Red Mountain railway, and by the Spitzee veins. The sheared and mineralized rock of a lode would weather and erode more rapidly than unmineralized country rock and might very well be covered with wash in a gulch. The heavy mantle of wash that covers most of the ground has prevented prospecting, so that as yet it is mostly virgin territory. Its prospecting will be costly, but adjoining as it does ground of such proved richness, and possessing so far as may be presaged, favourable geological conditions, the chances for success are sufficiently strong to render its exploitation a good business venture. The most favourable point to test it would be in the neighbourhood of the Josie dyke.

The work on the Le Roi No. 2 west of the Josie dyke proves mineralization to have extended a long distance in this direction. That on the Le Roi proves that the veins east of the dyke may be expected to continue west of it. From about the boundary between the White Bear and Black Bear the contact between the ore-bearing and the stratified rocks extends northward, all west of this being stratified rocks. The workings of the White Bear show the thickness of these rocks to be 500 ft. and that they overlie ore-bearing rocks. There is reason to believe that elsewhere along their eastern border their thickness does not exceed a few hundred feet and that they overlie augite-porphyrite concealed by the mantling stratified rocks. In time other companies beside the White Bear may explore these underlying rocks.

Excepting on the St. Elmo-Cliff vein, little has been done on the veins mentioned north of the White Eagle No. 1, outside of a few prospect shafts. Nothing has been produced and only a few good assays are reported, but it may at least be said that the surface showings are as good as they are on the Hamilton vein of the Le Roi No. 2 which is developing so well on the 500-ft. level.

Some good ore has been taken from the Consolidated St. Elmo, Cliff, Monte Christo, Evening Star, and from C. and K. The main lodes of the Centre Star are mostly drift-covered east of the Centre Star gulch, and have not been prospected except by a shaft on the Enterprise which is in heavy sulphides. Between this and the Monte Christo vein are several

veins with massive pyrrhotite but little chalcopyrite showing.

The South Belt has several veins. The Homestake, Gopher, Celtic Queen and perhaps the Crown Point appear to be on one continuous lead. Some of these South Belt claims had good surface showing, yielding high return, but development work does not seem to have opened up good ore shoots that have continued downwards. Recent work on the Crown Point revealed the disappointing fact that its strong ore body suddenly gave out about 20 ft. below the surface, the transition between ore and unmineralized rock occurring in a space of less than 2 ft. Few of the workings on the South Belt could be entered, and most of it is concealed by wash, so that little can be said of its possibilities. Since the covering of wash which makes prospecting difficult might conceal some good ore, it is unfortunate that the work already done on this belt should offer so little encouragement to prospecting.

While there is ground about Rossland that is well worth prospecting, this does not mean that such ground is worth a high cash price; for the testing of it is very costly and may bring in no return for the money invested. The owner should be willing either to take a small cash payment or if he has so much confidence in his claims, to give a bond on it for a guarantee that the work will be done.

The temperature of the rocks at various levels in some of the mines was taken to determine the increase with depth. Clinical thermometers were fitted with wooden handles 4 ft. long with openings to permit reading and to leave the bulbs free. The measurements were taken in drill holes in cross-cuts where there could be a minimum circulation of air. The thermometer was immersed the length of the handle in the hole, and at first the mouth of the hole was plugged, but it was found that no difference in readings resulted when the holes were left open. The readings for similar levels below the surface agreed remarkably well. From the surface to 150 or 200 ft. the temperatures regularly decreased to 41.75 F. From here the temperature rises rapidly for a few hundred feet, then more slowly, and for the last few hundred feet more rapidly again. The highest temperature—in the 1,750-ft. level of the Le Roi—is 17.6 F. The rate of increase from the lowest temperature to the highest is 1 deg. per 47.7 ft. The lowest increase—between the fourth and tenth levels of the Centre Star—is 1 deg. every 53.7 ft., and the highest rate of increase between the 10th and 11th levels of the Centre Star, 1 deg. every 34 ft. That the temperature should decrease for such an unusual distance below the surface may perhaps be due to the chilling of the rocks by the Cordilleran glacier. If this is so the increment of increase shown below the cold zone will also be affected and be lower than it should be. As it is, the increase 1 deg. in at most 50 ft. is higher than that observed in most regions. The average given by the Commissioner of the British Association in 1889 is 1 deg. for every 64 ft. and this appears high in the light of subsequent observa-

tions. In Grass valley, California, it is 1 deg. in 122 ft.; in the Rand, 1 deg. in 208 ft.; in Michigan, 1 deg. in 223.7 ft. In the Simplon tunnel, 1 deg. in 90 ft., varying from 1 deg. in 210 ft. under mountains to 1 deg. in 60 ft. in valleys. The high rate of increase in Rossland may perhaps indicate comparatively recent hydrothermal activity—or even comparatively recent volcanism.

Dykes at different levels show the effects of heated waters being bleached in much the same way as rocks by the solfataric action of volcanoes. But the present mine waters have a lower temperature than the rocks except in the cold zone near the surface. On the intermediate levels, water entering from fractures or diamond drill holes may be 5 degrees F. lower than the rock temperature. On the eleventh level of the Centre Star about 1,300 ft. below the surface the water is only 1 deg. lower. This is the lowest level on which mine water could be examined. While lower in temperature than the rock, its unusually high content in mineral matter, particularly in the chlorides, and carbonates of alkalis and alkaline earths and in silica, would lead one to expect it had come from a region of higher temperature. There is some evidence of the action of this water on the vein on this level with an unusual development of copper ore at certain places.

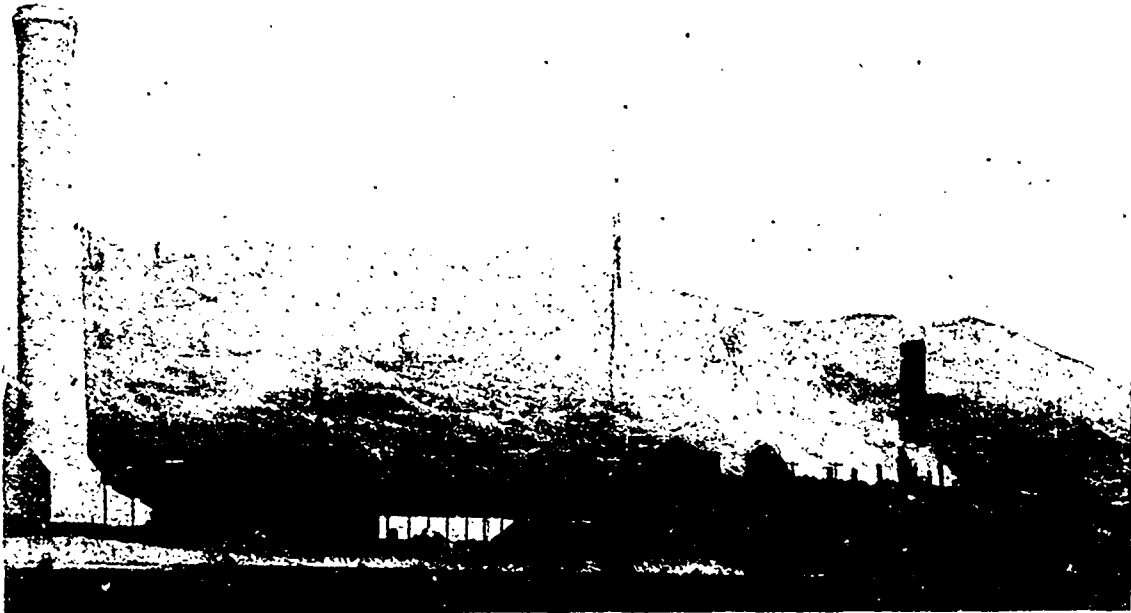
An area of serpentine occurs on Little Sheep Creek on both sides of the valley in the vicinity of the O. K. mine. In some places veinlets of asbestos are developed. The quality is excellent but the veins are too narrow and small to be of any economic interest. With the view of testing this rock for platinum, samples were taken, pulverized and concentrated by panning. In this way a fairly large amount of rock could be tested. The creek bed was also washed at favourable points between Silica and the O. K. mine. Two small nuggets were found which resembled platinum. Others should be found in the concentrates that have not yet been treated. The sample of the creek concentrates assayed by Mr. Connor of this Survey yielded nothing but a little gold (\$37 per ton). Concerning the assay of serpentine concentrates, Mr. Connor reports: "0.0083 oz. gold per ton, 0.0025 oz. platinum (?) per ton. My reason for the question mark after platinum is that the amount is so small that I had no chemical proof of its being platinum. On the other hand the gold and platinum (?) had a greyish or brownish tint instead of the gold colour, and were somewhat brittle. Also on alloying this gold and platinum residue with silver and dissolving again in nitric acid (for solution of the platinum), the residue gold was much more natural in colour and softness and weighed less, as expected. From this loss of weight I have given the figure for platinum."

A few miles north of Rossland, between Murphy and Sullivan Creeks, on the Lord Roberts claim, is a large deposit of magnetite interesting as representing the Boundary Creek type of contact deposit in the immediate vicinity of Rossland. The country rock could not be seen but it must be close to the contact

between the Nelson granodiorites and the Rossland volcanic group augite-porphyrite with stratified rocks including limestone. The deposit has been disclosed by a few open cuts for several hundred feet. Its width must be more than 30 ft. The upper trench shows a fine-grained micaceous syenite porphyry along the hanging wall. Bluish massive magnetite with a little chalcopyrite distributed through it as in the Boundary, pyrite, pyrrhotite, hornblende, epidote, garnet, feldspar and quartz were detected. A small pegmatite dyke was also seen in the ore. The hornblende is soft and black like that found in the Josie and Black Bear shoot of the Le Roi. Magnetite and pyrite are most abundant near the footwall and pyrrhotite and chalcopyrite near the hanging wall but specimens may be obtained showing all four iron-bearing minerals, sometimes arranged in bands.

Specimens and descriptions furnished by prospectors indicate that other deposits of a similar nature are found in the neighbourhood of Rossland, particularly in altered limestone, at the head of Murphy Creek and in Big Sheep Basin.

of construction work to be undertaken during the ensuing summer, viz., the erection of a mammoth steel flue chamber involving the purchase of 250 tons of steel, the order for which has just been placed in the East. Manager A. B. W. Hodges states that he has been considering the matter and the present seems an opportune time for pushing on with this work. There are many reasons for this conclusion. Years ago when only four furnaces were being operated the draught was none too good and although in 1905, when the new 150-ft. smoke stack was built, things were bettered to some extent yet additional furnaces and extra converters have proved that the present flue chamber, which is about 10x10 ft. inside measurement, is not sufficiently large, and Mr. Hodges is determined to solve the question in a manner that will admit of even further furnace enlargement. In addition to the question of draught that of room is a serious one, so it is proposed to elevate the chamber 22 ft. above the feed floor, thus giving ample room underneath for the electric trolley wires which run from the ore bins to the furnaces. For



Granby Smelting Works at Grand Forks, B. C., showing Circular Smoke Stack 150 ft. high and 13 ft. inside diameter, and Flue Chamber 800 ft. long, both built of Brick.

#### A LARGE STEEL FLUE CHAMBER.

Important Improvements to be Made at the Granby Co.'s Smelter.

**A** STEEL FLUE CHAMBER of large size is to be erected at the Granby Consolidated Mining, Smelting and Power Company's smelting works at Grand Forks, Boundary district. The following description is from the *Grand Forks Gazette*:

Scarcely has the erection of the big steel furnace building at the Granby smelter been finished before the announcement comes of a new and costly piece

some time past there has been trouble around the furnaces with gas, smoke and flue dust; a flue of this type will do away with this. Beside considerable economy will be effected in the handling of the flue dust itself; also the top of the furnaces should be kept decidedly cooler.

Under the present arrangement the dust is continually accumulating near the entrance of the down-take pipes and has to be raked out and removed in hand buggies to the briquetting room. In the new flue there will be 28 hoppers and conveyers will run by cable down the length of the flue, with auxiliary conveyers to take the dust to the briquette mill, these

probably handling at the rate of 50 tons per 8 hours.

The new flue chamber will be one of the first of the rectangular type and will be 13 ft. wide by 15 ft. high inside measurement. It will be supported by steel columns resting, on the west side, on the same retaining wall as the existing supports of the steel furnace building, and on the east side on concrete piers. The length of the flue will be about 313 ft., practically the length of the furnace building and it will communicate at each end with the old brick flues which will be enlarged to meet the requirements. A special feature of the design is that all bracing will be on the outside. A light roof will surmount the flue for the purpose of protecting it from moisture, and to aid in bracing the top. The steel for the sides will be  $\frac{1}{4}$ -in. and for the top 3-16-in. Roughly estimated the cost will be about \$25,000.

The downtake pipes from all the furnaces will be taken through the east side of the roof of the furnace building, the highest point of the downtake pipe being higher than the peak of the building, and the pipes will enter the flue chamber at the top. A saving of room will be effected below where the old brick flue will be torn out. It is hardly likely that the steel will be delivered at the works before July and it will take some three months thereafter to accomplish the work planned, but all being well this important new construction should be finished well before the end of the current year.

In the introduction to his official report "On Operations in the Rossland Mining District," R. W. Brock, of the Geological Survey of Canada, who during the field-work seasons has had charge of the survey of Rossland camp, observed: "It is probable the Survey accomplishes most, from a practical standpoint, by furnishing directly to those entitled to it, any information gained regarding a property. Such information, while it may be of value to the individual or company, may not possess any general interest and may therefore not be utilized in a report. While the direct benefit resulting from a survey of a mining camp may lie largely in what may be accomplished in this manner, it is usually of such a nature that the results cannot be made apparent to the public, so are, on this account, likely to be overlooked. Where possible, such information was given to those on the spot. Where this was not done it may be furnished, if applied for by the owners of a property examined."

The Gulf of Georgia Quarry Company intends cutting a considerable quantity of stone this spring. Its new machinery has all been installed at the quarry at Bigg's Point, and active operations will shortly be commenced. The company has an unlimited supply of rock to cut from, says the *Nanaimo Free Press*, and in view of the extensive building operations going on in the Province, rock will be in demand. The Northwestern Construction Company's quarry on Newcastle Island is getting out large quantities of stone for Vancouver contracts.

## LE ROI NO. 2, LTD.

LE ROI NO. 2, LTD., is one of the few British Columbia mining enterprises that escape unfavourable comment in the London mining and financial press. While its property is not one of the largest of the Rossland mines, in point of size of ore bodies and quantity of ore produced annually, it possesses shoots of ore of higher grade than is general in the Rossland camp. Further, the mine has long had the advantage of fully capable management, which has persistently carried out a well-considered plan of development, with satisfactory results, as shown in the summary of the annual report to the shareholders printed elsewhere in this number of the *MINING RECORD*.

The following comment recently appeared in the *London Mining Journal*:

At the meeting of this company, the board had a satisfactory state of things to present to the shareholders. With the dividend now sanctioned, 6s. will have been paid in dividends for the past year, and the chairman was able to hold out the hope that a similar return would be continued. The costs, which were \$4.22 per ton last year and \$4.45 in the preceding, have been reduced to \$3.85. This is partly due to a fresh contract with the smelter at Trail, under which the smelter charges have been lowered to \$6.12 per ton, against \$8.07 last year. A good deal of ore has been located during the year in the No. 2 mines, and their position is said to be better now than ever before. Some questions of general interest came under discussion. In the first place, the company has been acquiring what are called "outside interests," having taken an option on the Vancouver group of silver-lead mines in the Sloean district, British Columbia, and also an interest in the Cloncurry Syndicate, which was the parent of the Queensland Exploration Company. \* \* \* \* \*

The directors seem to have made a very good start with the Cloncurry Syndicate and the Queensland Exploration property, and this success will probably ensure them offers of further profitable business.

The shares of Le Roi No. 2 are of £5, and a proposal to subdivide into £1 shares was put before the meeting, which rejected it on a show of hands. Splitting is a good deal out of fashion; it makes shares more marketable, and therefore tends to strengthen the price. But for that reason it has been frequently adopted in order to facilitate large sales by insiders, and the public now looks upon a proposal to split as a notice that the insiders want to clear out, and as a warning of a coming fall in the shares. Splitting would not have affected the capital account of the Le Roi No. 2, and if the directors are going into financial business the value of the assets in relation to the nominal capital will be matter for consideration if dividends are to be paid. Nor would splitting have prevented the shares from standing at a discount, and it is an inconvenience for a financial company to have its shares at a discount. For these reasons we should not be surprised if the directors of

Le Roi No. 2 reorganized the company. It would not, we think, be difficult to present a scheme which would adjust the capital account and raise the value of the shares.

### DOMINION COPPER COMPANY, LTD.

A Progressive Copper-Producing Enterprise.

**M**INING AND SMELTING copper ore in the Boundary district is shown to have been successfully carried on during rather more than a year over which period the operations of the Dominion Copper Company, Ltd., of New York, have extended. The *Boston Commercial* has published a review of the company's activity and results therefrom, as follows:

The condensed statement of the Dominion Copper Company, Ltd., for the first 13 months of operation under the Samuel Newhouse management and covering the period December 1, 1905, to December 31, 1906, shows net profits from operation of \$297,319. This showing was made with a total smelter capacity of about 600 to 650 tons per day, which capacity is now being increased to 1,500 tons per day by the installation of a new furnace, which is the largest copper-smelting furnace in British Columbia.

The furnace will be fed mechanically by side-dumping steel cars, drawn by electric locomotives. Before being fed to the furnaces, the ore is crushed in a mammoth crusher, of the same pattern as that in use at the Granby mines. After being crushed it is hoisted in a bucket elevator to the bu. floor, where it is dumped on a link steel belt conveyor. Under this arrangement the handling of ores from the ore car to the furnace is automatic, and will result in a large saving in labour. The entire smelter plant will be operated by electricity.

During the 13 months (December 1, 1905, to December 31, 1906) the Dominion Copper Company has operated, practically, during a period of construction. When Samuel Newhouse took hold of the management, a comprehensive plan of development and construction work at the mines and smelter (to a capacity of 1,500 tons of ore per day) was outlined, and the inauguration of this new furnace completes the plans then made.

The first report made to the present management by M. M. Johnson stated that with these improvements completed, and the output increased to 1,200 tons per day, the Dominion Copper Company could realize net profits of \$1.25 per ton of ore mined, with copper at the low price of 13 cents per lb.

It is expected that with the new furnace running, the company will produce 9,000,000 lb. of copper per annum, at a cost of about 8 cents per lb. With copper at 18 cents this output would show net earnings of \$850,000 to \$900,000, which would allow the company to provide for all fixed charges and sinking fund requirements, and leave 14 per cent. earned on the par value of its capital stock.

With copper at the present price, 25 cents per lb.,

and every indication that it will remain at that price, or sell higher, for the balance of the year, the net profits would be over \$1,500,000, which would show net earnings of 26 per cent. on the par value of the company's shares, after allowing for all fixed charges and sinking fund requirements.

It is believed that these figures as to amount of output are conservative, as during the past 13 months the company has produced 4,405,000 lb. of copper, with a total smelting capacity of only 650 tons of ore per day and working under the disadvantages of a remodelling of its smelter plant.

Development work at the mines also has been pushed, so that the ore reserves will be ample for the increased smelter capacity. During this time, a complete plan of development of the company's Rawhide and Idaho claims has been followed, and these two properties, which one year ago were hardly touched, are in shape to furnish 1,000 tons of ore per day.

Up to the present time a large proportion of the 600 tons of ore per day smelted has been taken from the Brooklyn and Sunset. Both these properties will continue to contribute their quota. The company is also doing development work on its Crown Silver and Athelstan properties. The ore reserves now in sight are sufficient to give the company a capacity of 1,500 tons per day for several years to come.

The capitalization of the company is \$1,000,000 bonds, and \$5,000,000 stock in shares of \$10 par value, making it strong financially. When all its improvements shall be completed and paid for, the company will still have over \$700,000 on hand in cash, so that it will be justified in at once going on a dividend-paying basis.

In a brief report covering the operations of the company during the 13 months mentioned above, M. M. Johnson, the company's consulting engineer, gives the following details:

Tons ore mined.....	226,560
Cost of mining and freight, per ton.....	\$1.70
Assay value of ore:	
Gold .....	\$1.23
Silver .....	0.22
Copper, per cent.....	1.16
Tons ore smelted.....	225,946
Smelting, cost per ton.....	\$1.71
Copper produced.....	Lb. 4,405,552
Average profit per month.....	\$22,871
December profit.....	\$24,603

The last of the material for the new furnace was received at the smelter January 25, and as soon as installation can be completed it will go into operation. Mr. Johnson says the completed smelting plant will be a most economical one, and that the company should be able to handle even 1 per cent. ore at a profit.

The outlook for the zinc industry is again encouraging, the United States market, for the greater part of last year practically closed against them, having been reopened to British Columbia zinc ores.

COMPANY MEETINGS AND REPORTS.

BRITISH COLUMBIA COPPER CO., LTD.

The New York *Commercial and Financial World* has published the following information relative to the British Columbia Copper Company, Ltd., which recently held its annual general meeting in New York:

"According to an official announcement just made, Colgate Hoyt has been elected president of the British Columbia Copper Company, Ltd., succeeding F. L. Underwood. At the same meeting Newman Erb was elected chairman of the board of directors, B. B. Lawrence, an expert mining engineer of wide reputation, and F. L. Sommer were elected vice-presidents, and R. H. Eggleston was elected secretary and treasurer. B. B. Lawrence, Edwin Hawley and C. A. Starbuck were elected members of the executive committee, together with the officers.

"The British Columbia Copper Company is one of the strongest and most important organizations operating in the British Columbia region. It was organized in 1898, under the laws of West Virginia, with a capital stock of \$2,000,000, in shares of the par value of \$5 each, which sum has recently been increased to \$3,000,000. The company owns copper mines at Greenwood, British Columbia, with adjacent properties, and is actively operating them. Important improvements have recently been completed in connection with its furnaces and operating plant. It originally had two furnaces and an operating plant and last year were added three modern furnaces, having a daily capacity of about 700 tons each, or about 2,000 tons in all. Various other improvements have been made, so as to bring the plant up to the highest degree of efficiency. It is expected that the company will now be able to produce refined copper at about 8½ cents per lb., and, with two furnaces and at the present price of copper, be able to earn approximately \$1,000,000 net per annum, to be increased when all three new furnaces shall be in operation.

"The company has also acquired considerable additional mining property of great promise.

"For the future the outlook is highly encouraging, and it is expected that the payment of dividends will have to be recorded in the near future.

"Large expectations are entertained of the new administration. Mr. Hoyt brings to bear great experience in connection with the handling of important railroad, financial and industrial interests. He is United States trustee of the Netherlands Fire Insurance Company, and director and trustee of other important corporations."

On February 14 the company issued the following circular:

"Under authority conferred by the stockholders and the board of directors of this company, stockholders of record upon the closing of the transfer books at 3 o'clock p. m., on Wednesday, February 20, 1906, will be entitled to subscribe for new shares on the basis of 30 per cent. of their holdings at that time and date, at the rate of \$5 a share, payable as follows: \$2.50 per share March 11, 1907; \$2.50 per share May 10, 1907.

"Colgate Hoyt & Company, of No. 36 Wall street, New York City, have been appointed fiscal agents of the company, for the purpose of receiving the subscriptions to the new stock, and all moneys payable to the company upon all such subscriptions shall be paid by the subscriber or his assigns, to said Colgate Hoyt & Co., at their office in the City of New York in conformity with the terms of the subscription.

"Upon the closing of the transfer books on February 20, 1907, Colgate Hoyt & Co. will issue appropriate warrants, specifying the number of full shares to which each stockholder is entitled to subscribe. Separate warrants will be issued fractional shares. The right to subscribe will expire on March 11, 1907, at 3 p. m. In case of default by the subscriber, or his assigns, in making any

payment provided to be made, or in the performance of any terms or conditions thereof, all rights of the subscriber or his assigns, shall cease.

B. C. STANDARD CO., LTD.

A meeting of shareholders in the B. C. Standard Mining Company, Ltd., (in liquidation), which owned and for some time operated the Hunter V. and Double Standard group of mines near Ymir, Nelson mining division, was held at Nelson on February 13, when the official liquidator, George R. Player, submitted his report for the period from December 21, 1905, to January 31, 1906.

The liquidator stated that the liabilities of the company on December 21, 1905, were \$15,443.06, and the accounts collectable \$204.36. An arrangement was made by some of the directors with William Fernie, of Victoria, B. C., whereby he was to lend the company \$5,000 to liquidate all the small accounts; \$4,000 of this has been received and the liabilities reduced by \$6,066.61, the sum owed now being \$9,504.30, exclusive of the Fernie loan. This, however, includes \$127.85 interest on notes which were in force at the time the company went into liquidation and which it was necessary to renew. The majority of the unpaid accounts bear interest which so far has not been computed. This will amount to \$1,250, approximately. The mine had been leased and since December 21, 5,099 tons of ore have been shipped from it, the total value having been \$16,845, on which royalties amounting to \$2,572.16 had been received. After paying the amount above-mentioned to the creditors and sundry items in connection with liquidation there is a balance on hand of \$313.30, as shown by the following cash statement:

<i>Dr.</i>	
To Royalties received .....	\$2,527.16
" Transfer fees .....	2.50
" Accounts collected .....	127.37
" Loan, William Fernie .....	4,000.00
	\$6,657.03
<i>Cr.</i>	
By Amounts paid to creditors.....	\$6,066.61
" Miner's licence to May 31, 1907 .....	100.00
" C. P. R. Telegraph Co., cables.....	33.67
" Lay and Fassett, experimenting <i>re</i> cyanide..	65.00
" Interest and exchange .....	14.50
" Stationery, postage, box rent, etc.....	42.60
" Advertising . . . . .	15.35
" Horse hire at Ymir .....	6.00
	\$6,343.73
" Balance in bank .....	313.30
	\$6,657.03

The shareholders are no doubt aware that the tramway was partially burned in August, but has been rebuilt and is now practically in better shape than when the company went into liquidation.

The report was accepted and the meeting adjourned.

LE ROI NO. 2, LTD.

At a general meeting of shareholders in the Le Roi No. 2, Ltd., held in London, England, on February 4, the engineers of the company reported that they have had charge of the property for four years, and that the year 1906 was the most profitable, as \$232,200 in profits was remitted to the London office. Beside this \$15,754 was spent in developing the Vancouver mine in the Slocan, or the net profits would have been larger by that sum.

The directors in their report for the year ending September 30, 1906, state that the audited accounts show a balance to the credit of profit and loss of £41,603 14s 3d on the operation of the company for the year, after writing off the sum of £13,125 17s 10d against mine explora-



tion and development, and £3,175 14s 5d as depreciation on machinery, mine, plant, etc. After paying the final dividend for the year ended September 30, 1905, there was brought forward the sum of £20,701 0s 2d, with which the present balance of £41,603 14s 3d gives a total of £62,304 14s 5d available for distribution. Out of this dividends totalling 5s per share, free of income tax, absorbing £31,500, have been paid, leaving £30,804 14s 5d to be carried forward. The directors recommend a final distribution for the year of 1s per share, free of income tax, leaving the sum of £24,504 14s 5d to be carried forward to next year. (The recommendation of the board of directors as to paying the dividend of one shilling a share was carried out, this making a total of 6s—approximately \$1.50—for the fiscal year.)

The better prices ruling during the year for copper and silver, together with the reduced smelting charges, the result of a contract entered into by the chairman on his visit to Rossland in the early part of last year, made it possible for the board to materially increase shipments and at the same time reduce mining costs, which latter show an expenditure of \$3.85 per dry ton of ore mined, as compared with \$4.22 and \$4.45 per ton for the two previous years.

An option has been acquired over the Vancouver group mine, a silver-lead property in the Slocan district, and the sum of \$15,754 has been expended upon it to date. The property had been previously worked upon a small scale for some time, and only a very high-grade silver-lead ore had been shipped when 708 tons yielded the considerable sum of \$65,826. Messrs. Hill and Stewart, the company's consulting engineers, anticipate being able to make sufficient profits from the shipment of ore and concentrates while developing the property, to cover all the expenses of the option.

The company has also acquired an interest in Queensland, Australia, where a large and, what seems to be, important copper field is being opened up. The company's interest consists in a considerable holding of shares in the Cloncurry syndicate, which in turn holds a large interest in the Queensland Exploration Company.

The directors again testify to the skilful management and services rendered to the company by their engineers, Messrs. Alex. Hill and Stewart, and to the excellent work done by the mine manager, P. S. Couldrey, and his staff at Rossland.

#### SKYLARK DEVELOPMENT COMPANY, LTD.

The adjourned annual meeting of shareholders in the Skylark Development Company, Ltd., which is working a small high-grade silver-gold mine situated in Greenwood mining division, Boundary district, was held about the middle of February at Phoenix. From the *Pioneer* it is learned that the reports of the secretary-treasurer and manager were read and adopted, the shareholders being well pleased with the results of operations for the year 1906. The following directors and officers were elected for the ensuing year: President, A. B. W. Hodges; vice-president, W. S. Macy; manager, O. B. Smith, Jr.; secretary-treasurer, A. B. Hood; C. D. Hunter, R. B. Boucher, F. C. Buckless, H. A. Wright and Page Doyles.

For the year ending December 31, 1906, the total receipts of the company were \$47,441.18, and the net profits on the operations at the Skylark mine, which has been continuously worked with a force of from 20 to 25 men, \$12,643. Of the latter amount, \$12,000 was paid on the bond, leaving a balance of \$3,000 due on the \$30,000 bond on April 1, which is already provided for by cars of ore now at the smelters for treatment. During the year the best car of ore gave returns of \$5,960.65. An average of all ore shipped, first, second and third class, was \$79 per ton, while the highest returns gave \$210 per ton net. During the year the company paid out for freight and

treatment, approximately, \$9,000; taxes were \$906.37, and \$750 was expended on new buildings. The old upright boiler was replaced by a locomotive boiler, and it is the intention, as soon as warranted, to install a 10-drill air compressor plant, so arranged that it can be driven by electricity, lines of both electric power companies passing close to the Skylark mine.

Manager Smith stated in his report that during the past 12 months 709 ft. of development work had been done in the Skylark mine, and 602 tons of ore shipped. The development consisted of 200 ft. of shaft work, 168 ft. of cross-cuts and 233 ft. of drifting and 108 ft. of raising. Beside this 620 ft. of diamond drilling was done, with results satisfactory to the management. Votes of thanks were passed by the shareholders to William Rowe, superintendent, and A. B. Hood, secretary-treasurer. The mine is located about two miles from Phoenix and the shares are almost all owned in Phoenix.

#### INTERNATIONAL COAL AND COKE CO.

The report of the directors, statement of liabilities and assets, and president's report, of the International Coal and Coke Company, Ltd., for the year 1906, have been published. From these the following particulars have been taken:

##### DIRECTORS' REPORT.

The directors present their third annual report, covering the year ending December 31, 1906, together with statement of assets and liabilities.

The net profits for the year, after paying all operating expenses and charges of every kind at the head office and mines, amount to \$198,192.15 (being over 7 per cent. on the outstanding capital), which sum has been derived from the various departments of the company's business, together with the sale of coal and coke, receipts on account of lots sold from the company's townsite, and returns from water and electric light supplied by the company to the people of Coleman.

As no dividend was paid on the capital stock of the company for the year, the above sum has been carried to credit of Profit and Loss, making a total at credit of that account of \$393,469.84.

In explanation of the "contingent liability" item, this amount is almost wholly made up of sight drafts long since paid. We do practically no discounting, sales being made on monthly account. As the plant is quite new, the policy has not been to add betterments and repairs to the cost of plant and write off depreciation, our idea being rather to keep the plant in the highest state of efficiency, consequently no depreciation should be written off.

With reference to the auditor's suggestion re townsite, this point is probably well taken, although the deferred payments on lots already sold will more than compensate for the cost of the land, as section 8, being townsite property, stands in our books at the original cost; the lots sold brought many times the price of an acre. It is the intention of the directors to adjust this account during the coming year.

The coal produced during the year was 334,230 tons, of which 49,635 tons were sent to the company's ovens and produced 31,066 tons of coke, which found a ready sale; the balance was marketed as coal.

In accordance with your instructions, the president arranged a bond issue of \$300,000 on the property, the same being pledged for \$200,000, and this amount—we are happy to report—is the only outstanding obligation of the company.

The total amount of the pay-roll for 1906 was \$360,874.72; average number of men employed, 365, and the number of days worked, 249.

During the year extensive additions were made to the plant (the expenditure having been \$85,112.04), which include an additional battery of coke ovens, additions to

the air haulage system, mine tracks and cars, powder, oil and lamp houses, scales, pumps, etc., etc.

BALANCE SHEET AS AT DECEMBER 31, 1906.

Liabilities—	
Share capital: 3,000,000 shares of \$1 each .....	\$3,000,000 00
Debenture bonds: authorized issue \$300,000 pledged to secure loan of .....	200,000 00
Contingent liability on bills and drafts discounted ..	\$ 80,421 55
Surplus:	
As at December 31, 1905 ..	\$201,527 69
Less amounts chargeable against operations of 1905 ..	6,250 00
	<hr/>
	195,277 69
Add profits of 1906.	198,192 15
	<hr/>
	393,469 84
	<hr/>
	\$3,593,469.84
Assets—	
Shares in treasury, 200,000 shares at par.....	\$ 200,000 00
Coal lands .....	2,855,185 00
Real estate, buildings and stable equipment.	16,510 85
Mine plant and machinery, including water-works and electric light equipment.....	413,197 82
Office furniture and fixtures.....	846 10
Coal, coke and stores on hand.....	34,379 80
Sundry debtors on open account.....	24,505 40
Interest and insurance paid in advance.....	6,940 30
Timber rights .....	155 00
Cash on hand and in bank.....	41,749 57
	<hr/>
	\$3,593,469 84

The auditors stated in their report: Expenditure on mine development has been charged against profits, which include proceeds of coal mined and the receipts from sales of the company's townsite lands, no credit being given to the property accounts in respect of these transactions and no provision being made for depreciation.

PRESIDENT'S REPORT.

Part of the president's report follows:

We were able to operate only 249 days in the year, the chief difficulty having been a shortage of shipping facilities. The Canadian Pacific Railway Company used every possible means to keep us supplied with cars, and move those cars when loaded, but unfortunately the general expansion of business has been so great that notwithstanding enormous additions to the rolling stock of that company, it has been quite impossible to keep abreast with the increased demands.

The increase in tonnage mined, over that of 1905, is 93 per cent., bringing about a reduction in the cost of mining per ton of 11 per cent., working only one shift of eight hours per day. The average daily tonnage during 1905 was 654 tons per day, while during 1906 the production was 1,337 tons. We have had most satisfactory results in mining of the pillars in the mine. The calculated saving of coal was about 60 per cent., but our experience has demonstrated 98 per cent. coal actually taken out of the pillars.

We have not added the development cost to the Capital Account, but have charged all such expenditures on the tons extracted. During the year the excess of development over shipments was approximately 400,000 tons. Our engineer gives an estimate of the coal developed, as at December 31, 1906, as being 1,600,283 tons. Were we to calculate even the small sum of five cents per ton, a very large addition would be made to Profit and Loss Account.

We began a prospecting slope on No. 2 seam; when

down some 860 ft. we began drifting north on the 200-ft. level to prove the coal, when we encountered a body of water, though every known precaution had been taken. This may prove a loss of some \$7,000. We are, however, more than compensated in the knowledge that the quality of the coal improves and our seams are regular and of great depth. Our production was in no way interfered with because of this accident.

In the operation of the mine we discovered that No. 2 seam was pitching at such a degree that if it were mined to some considerable depth, say 1,500 ft., it would be beyond our westerly line on section 5, and in order to insure continuity of operations at great depth, your directors deemed it wise and prudent to purchase the westerly half of this section, which was accordingly secured at a cost of \$10,000.

After the additions to the plant were provided for, and all obligations (other than the bonded indebtedness) had been taken care of your directors decided to declare a dividend of 1 per cent. out of the profits of the year just closed, payable February 1. Noting the total of quick assets, also of the surplus, you will, I think, agree that we shall be fully justified in the payment of similar dividends in May, August and November of this year, and with reasonable good fortune and no explosions or other unforeseen difficulties to contend with, the quarterly dividends can be materially increased, though the policy, as hitherto, will be to protect and gradually enhance the value of the property by the creation of a substantial surplus, having due regard to the shareholders' interests, by making reasonable returns on their investment.

All necessary steps have been taken to regularly list the International on the stock exchanges of Montreal and Toronto. When the new certificates to comply with the regulations shall be ready, the stock will be quoted daily.

The company's townsite, also the waterworks and electric light system at Coleman, are showing good profits, and as the works are enlarged will, I think, become an important source of a large and permanent revenue, even if kept at the present low figures.

COMPANY CABLES AND NOTES.

CABLES.

British Columbia.

*Le Roi*.—January. Shipments amount to 10,740 tons, containing 3,550 oz. gold, 5,100 oz. silver and 213,650 lb. copper. Estimated profit on this ore, after deducting cost of mining, smelting, realization and depreciation, \$28,000. (Office note—The Northport smelter has been closed down on account of want of fuel consequent upon the late strike at the coalfields. It is hoped shortly to reopen again. The mine is still working.)

*Le Roi No. 2*.—January: Shipped 1,200 tons. The net receipts are \$19,599, being payment for 1,099 tons shipped. Vancouver mine report for last month—Shipped 20 tons. The net receipts are \$1,332 (£275), being payment for 20 tons shipped. (Office note—No payments were received during the month for concentrates shipped from the Josie (Rosslund) or Vancouver (Slocan) mines.)

*Slough Creek*.—The erection of all the new machinery is being vigorously pushed.

*Tyce*.—January: Smelter ran 10 days and smelted—Tyce ore, 1,553 tons; custom ore, 635 tons; total, 2,188 tons. Matte produced from same, 131 tons; gross value of contents (copper, silver and gold), after deducting costs of refining and purchase of custom ore, \$23,756.

U. S. A.

*Alaska Consolidated*.—Intermediate level above No. 3 west drift is in about 107 ft.; all quartz, which looks good. Face assays, \$10.20. Intermediate level above No. 3 east drift—Length, 52 ft.; assays \$3.65.

*Alaska Mexican*.—January: 120-stamp mill ran 27 days; crushed 19,048 tons ore; estimated realizable value of

bullion, \$30,871. Saved 352 tons sulphurets; estimated realizable value, \$27,579. Working expenses, \$38,365. Returns cover month ending January 15. Short run caused by coal shortage.

*Alaska Treadwell.*—January: 240-stamp mill ran 24¼ days; crushed 24,426 tons ore; estimated realizable value of bullion, \$35,352. Saved 488 tons sulphurets; estimated realizable value, \$25,552. Working expenses, \$74,228. Returns cover month ending January 15. Short run caused by coal shortage.

*Alaska United.*—January: Ready Bullion claim: 120-stamp mill ran 26½ days; crushed 18,230 tons ore; estimated realizable value of bullion, \$18,861. Saved 310 tons sulphurets; estimated realizable value, \$10,174. Working expenses, \$26,415. Returns cover month ending January 15. Short run caused by coal shortage.

#### DIVIDENDS.

At a meeting of the Le Roi No. 2, Ltd., held in London on February 4, a final dividend for the fiscal year ended September 30, 1906, was declared. Amount of this dividend was one shilling (25 cents) per share, and it brought the total per share for the fiscal year up to six shillings (\$1.50) per share.

It is understood that the Granby Consolidated Mining, Smelting and Power Company, Ltd., intends shortly paying another dividend—its sixth.

#### NOTES.

The secretary of the Idaho Gold Mining and Smelting Company gives notice, in the *British Columbia Gazette*, that this company has ceased to do business in British Columbia and does not intend to resume.

A press despatch dated London, February 5, has been published, intimating that the proposition that the 120,000 £5 shares in the Le Roi No. 2, Ltd., should be divided into 600,000 shares of £1 each has been negated by a general meeting of shareholders.

The destruction by fire in February of the shaft house, hoisting plant, etc., at the Richard III mine, Mount Sicker, Vancouver Island, caused the owning company temporary inconvenience, but not much monetary loss, the property having been insured. Resumption of shipments of 40 to 50 tons of ore daily to the Tyee Copper Company's smelter at Ladysmith will follow immediately after a new hoist shall be installed.

In his annual report the manager of the Skylark company operating the Skylark mine, near Phoenix, Boundary district, stated that: "Last year we considered our ore body in the north of the 75-ft. level to be so broken up that it was hardly worth while doing more work there. However, the diamond drill showed us our mistake, and now we are running the north drift again on that level in good ore."

According to an announcement made publicly in Spokane, the headquarters of the Sullivan Group Company, its position is steadily improving. It was stated that: "About \$15,000 more net gain and 100 tons less bullion produced was the record of the Sullivan Group Mining Company for the month of January. The principal reason for the decline in the bullion output was that the water pipes at the smelter froze, it having been 32 deg. below zero there for a time during the recent cold snap. Bruce Clendenning has resigned the management of the mine and Ed. Dedolph, who has been metallurgist at the smelter for some time, is now general manager of all the company's property in East Kootenay. It is understood that the company is now in shape to begin buying in its bonds, issued some time ago. The foundations are all in for additional Heberlein roasting furnaces and the erection of this necessary adjunct to successful reduction of the ores will be decided by the trustees at their next meeting."

At a meeting of local shareholders in the Rosella Hydraulic Mining and Development Company, held at Nanaimo on February 22, a committee was appointed to

endeavour to sell more stock to shareholders and thereby raise funds for the ensuing season's operations. It was stated to the meeting that "rigid economy had been practised and the position of the company today had been accomplished by a total expenditure of but \$55,652.14 for which it has to show, as follows: Hydraulic leases, covering 4½ miles; two quartz claims on Haskins mountain; a modern hydraulic plant, together with a large quantity of pipe; a well-constructed flume, water ditch and reservoir; blacksmith shop, machine shop, tools, camps, etc.; and a large bank of gravel, through which the flume has to pass, cut to within 85 ft. of pay gravel, in the ancient channel of the stream.

#### CERTIFICATES OF INCORPORATION.

*The Investors, Ltd.*, with a capital of \$50,000, divided into 1,000 shares of \$50 each.

*Bertha Consolidated Gold Mining Company, Ltd.*, with a capital of \$375,000, divided into 1,500,000 shares of 25 cents each.

*Natural Resources Purchasing and Developing Company, Ltd.*, with a capital of \$100,000, divided into 1,000 shares of \$100 each.

*The North British Columbia Exploration Company, Ltd.*, with a capital of \$100,000, divided into 1,000 shares of \$100 each.

#### REGISTRATION OF EXTRA-PROVINCIAL COMPANY.

*Kootenay Copper Mining Company, Ltd.*—Head office at Spokane, Washington, U. S. A. Capital, \$50,000, divided into 1,000,000 shares of 5 cents each. Head office in British Columbia at Creston, West Kootenay. Attorney (not empowered to issue and transfer stock), O. J. Wiggins, farmer, Creston. Objects, mining in British Columbia, and in the States of Idaho and Washington, U. S. A.

#### COMPANIES REGISTERED IN ENGLAND.

*B. C. M. Syndicate, Ltd.*—Registered in London on February 7, with capital £6,200, in 6,000 ordinary shares of £1 each and 4,000 deferred shares of 1s. each, to search for, prospect, examine, and explore mines and ground supposed to contain minerals or precious stones, to acquire, hold, and deal with shares, stocks, debentures, debenture stock, bonds, obligations and securities issued or guaranteed by any company or undertaking carrying on business in the United Kingdom, British Columbia, Canada, or elsewhere. No initial public issue. The first directors are C. E. Daniel and F. E. Barnes. No qualification necessary. Registered office: 42 Old Broad Street, London, E.C.

*Vancouver Copper Company, Ltd.*—Registered in London on February 27, by Francis & Johnson, 19 Great Winchester Street, E. C. Capital £110,000, in £1 shares. Objects. To adopt an agreement with the Vancouver Railway Syndicate, Ltd., to acquire copper, iron, gold, coal, and other mines, rights, and claims, and to carry on the business of miners, smelters and refiners of and dealers in ores and minerals, etc., in British Columbia, the United States of America, Great Britain, or elsewhere. Minimum cash subscription, 30,000 shares. The first directors (to number not less than three nor more than seven) are to be appointed by the signatories. Remuneration, £200 each per annum (£100 extra for the chairman) and 5 per cent. of the profits available for distribution in excess of 15 per cent. on the shares, divisible.

Geo. C. Tunstall, Jun., for some time general representative of the Hamilton Powder Company in the Kootenay district of British Columbia, is now sales manager for the Standard Explosives, Ltd., Montreal, Quebec.

## COAL MINING NOTES.

The Nicola Valley Coal and Coke Company has commenced the shipment of coal from its property near Coutlee, in the Nicola district. An 18-ft. seam is being opened up and the coal taken out in the course of development shipped. The first carload shipped to the coast has been received in Vancouver, where its good quality became evident to those among whom it was distributed for sampling purposes.

Townsite agents are not usually modest in their statements. Those representing Hosmer, the new coal-mining town in the Crow's Nest Pass, assert, in an advertisement that: "Hosmer is the headquarters of the Canadian Pacific Railway Company's colliery operations in East Kootenay and the company is now spending millions in rapidly getting its mines on a producing basis. It requires thousands of tons daily to coal its own locomotives. The Crow's Nest Pass coal is the finest steam coal on the continent, and these mines are to be operated on a large scale. Coke ovens will be built this spring." All of which may be near enough to the truth to pass without being designated "hot air" only.

At Michel the Crow's Nest Pass coal Company is proceeding with dispatch to complete the new washhouse being built on the site of the one destroyed by fire last fall. The new building will be much larger and more commodious than the old one. By April 1 the building will probably be ready for use. The company will also erect 20 new cottages and a large up-to-date boarding house as soon as the necessary materials shall have been delivered.

The Diamond Vale Coal and Iron Mines, Ltd., expects to begin shipping coal from its property near Coutlee, Nicola district, about May next. The work of sinking a 10x10-ft. double compartment shaft to reach a 6-ft. seam of coal, is well in hand. Some 60 to 70 men are employed and the preliminary work of equipment and development is making good progress. Sinking is proceeding at the rate of between 75 and 100 ft. per month. Analyses of four representative samples from separate parts of the property show the coal to be of excellent quality.

A press despatch from San Francisco, California, dated February 10, gave the following information concerning the coal situation in that city: The steamer "Sheila" arrived at the Western Fuel Company's bunkers yesterday with 6,000 tons of Wellington Colliery Company's coal from Ladysmith. Unfortunately for San Francisco coal burners, about 40 per cent. of this cargo goes to fill government contracts, and will be distributed to the army posts in this vicinity and at Monterey. The remainder will be placed with city dealers, to the exclusion of orders from interior towns. No coal has been supplied to outside dealers for 30 days past, and many points are in great need. It is estimated that 1,000 cars will be necessary to supply these demands. \* \* \* The steamer "Condor," which arrived from Nanaimo on 5th inst., distributed about 1,200 tons here, and the remainder of 3,000 tons is being unloaded at Oakland. The total of about 4,500 tons, which arrived last week for San Francisco's exclusive use will be augmented by the 3,300-ton cargo of the "Tellus" due on 11th inst. The most important early shipment expected is that of 5,000 tons in the hold of the steamer "Foreric," from Newcastle, Australia, due within a week.

The *Hardware and Metal Journal*, of Toronto, Ontario, says: Discussing coal mining and that industry generally, Thos. R. Stockett, recently, expressed the opinion that the hardships in the Northwest would result in good to the people themselves and to the coal mining companies. Mr. Stockett, who is now manager of the Western Fuel Company's mines at Nanaimo, Vancouver Island,

was formerly in charge of the Crow's Nest Pass Coal Company's mines in southeast Kootenay, so he is in a position to know conditions as they are. He points out that even now the mines of which he is manager are slackening off in orders; and that in the summer season it is almost a case of shut down because the demand is so light. This is even more emphatically the case with the mines of the Crow's Nest. Then when winter comes on, with the extremely doubtful conditions of transportation, everyone rushes in orders. If consumers, especially in the prairie provinces, where the winter needs are accurately known always, would fill up their coal cellars and coal sheds in the summer and fall months when railway transportation is good, and before the grain rush begins and bad weather stops transportation, there would be no trouble. Speaking of conditions at Nanaimo, Mr. Stockett said that his company is now producing as much coal as the New Vancouver Coal Company, its predecessor in the Nanaimo mines, ever did in its palmiest days. Three years ago Nanaimo was considered at its lowest ebb, but now there is solid prosperity and quiet progress, exciting not the least comment, though, as he said, the amount of coal being raised equalled that of the best boom days of the island coal city.

## A CHEAP PROSPECTING DRILL.\*

This machine has been designed by Mr. Stanley B. Hunter to deal with a class of basaltic deep lead country, which lies intermediate between the shallow alluvial auriferous deposits, overlain by by Cainozoic strata of clays, gravels, and drift, and the extremely deep ground (reaching a depth of 600 ft. in places) where the superincumbent material is composed of about 80 per cent of basalt. In the former class of country, to a depth of about 100 ft., manual power is efficient, and probably cheaper than any other class of boring, costing from 1s. to 2s. (25 to 50 cents) per ft., but directly a stratum of hard basalt is met with, say only 20 per cent of the total depth, the cost will run up to 10s. or 12s. (\$2.50 to \$3) per ft.; while to send a diamond or calyx drill, the total equipment of which for such work will weigh from 21 to 25 tons, would, through transport and erection of plant, bring the cost per foot to an unduly high amount. A machine, therefore, between these two extremes becoming necessary, led to the designing of the one in question, the principal features of which are as follows:

Easy and cheap transport, either by road or rail.

Rapid starting of plant at bore site, the unloading, erection of derrick, and commencement of boring from time of arrival on ground, being about four hours.

The derrick forms, when lowered down on to road wheels, the carriage, upon which all tools, rods, casing, and camp equipment is carried.

Ample room for men to work round the borehole, a very necessary requirement when casing is being worked down through the drift.

Rigidity of derrick when a great lifting strain is exerted on rods or casing.

The substitution of an oil engine for steam power. At the machine now in use at Trentham, a "Simplex" oil engine of special design, colonial manufacture, is being used, and is giving complete satisfaction.

The lessening of one man per shift, the staff comprising four men, who work in two shifts when boring in basalt or clay, the four men working on the one shift only when in drift, handling casing or shifting from bore to bore.

The machine is capable of boring a hole to 8 in. in diameter, and, if necessary, calyx cutters and hollow rods can be used to produce a core. The total equipment, including engine for boring in 250 ft. ground, is about 7 tons.

\*From the "Annual Report of the Secretary for Mines and Water Supply for 1905," Victoria, Australia.

## BOOKS, ETC., RECEIVED.

- American Institute of Mining Engineers.*—Bi-monthly Bulletin, No. 12, November, 1906, and No. 13, January, 1907. Also "List of Members, etc.," January 1, 1907.
- California State Mining Bureau.*—Bulletin No. 44, "California Mines and Minerals." Compiled by Chas. G. Yale, statistician State Mining Bureau. With relief and county maps and other illustrations.
- Map of the Forest Reserves of California. Compiled by the State Mining Bureau.
- "Report of the Board of Trustees and State Mineralogist." Lewis F. Aubury, state mineralogist.
- Canadian Mining Institute.*—"Journal of the Canadian Mining Institute for 1906." Vol. IX, containing Proceedings, Papers, etc. Edited by the secretary, H. Mortimer Lamb. Also "List of Officers, Members and Student Members as at June 1, 1906."
- Columbia University, New York City, U. S. A.—School of Mines Quarterly.* Vol. XXVIII, No. 2, January, 1907.
- Department of Agriculture, Ottawa.*—"The Canada Year Book, 1905," second series. Containing events of the year, census and departmental statistics, etc. By A. Blue, chief officer Census and Statistics Office. Pages, 341.
- First Indian Industrial Conference.*—"Mining, Metallurgy, Mineral and Metal Works." A 44-page pamphlet by Rao Bahadur G. V. Joshi, B. A., head master Government High School, Satara, Bombay Presidency, India. (Per favour of Namabhai B. Darn, B. A., B. Sc., Geological Survey Office, Ottawa.)
- Illinois State Geological Survey.*—Bulletin No. 3, "Composition and Character of Illinois Coals." By Professor S. W. Parr, of the University of Illinois. With chapters on "Distribution of the Coal Beds of the State," by A. Bement, and "Tests of Illinois Coals Under Steam," by L. P. Breckenridge. Pages, 83. With maps.
- Imperial Institute, London, England.*—Bulletin of the Imperial Institute, Vol. IV, No. 4.
- Labour Department of Canada.* Report of the Department of Labour for the year ended June 30, 1906.
- Royal Colonial Institute, London, England.*—Journal of the Royal Colonial Institute, Vol. XXXVIII Part I, December, 1906; Part II, January, 1907; Part III, February, 1907.
- Sundry Geological Problems,* by G. Henriksen, inspector of mines, Christiania, Norway, being a statement of the author's conclusions from the geological observations he has been able to make in Norway.
- United States Geological Survey.*—
- "Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the Years 1901-5, inclusive." By Fred Boughton Weeks. Pages, 770.
- "Geology of the Bighorn Mountains, Wyoming." By N. H. Darton. Pages, 121. With maps and numerous half-tone illustrations.
- "Ore Deposits of the Silver Peak Quadrangle, Nevada." By Josiah Edward Spurr. Pages, 168. Illustrated by maps, sectional drawings, views of prominent features of country, representations of rocks and sections of specimens, etc.

## BOOKS REVIEWED.

*Rock Minerals, their Chemical and Physical Characters and their Determination in Thin Sections.* A study of rocks and their mineral components together with descriptions of the better known rock minerals. By Joseph P. Iddings, Chicago, Illinois, U. S. A. Octavo, xv, 548 pages, 438 figures and one coloured plate. Published at close of 1906 by John Wiley & Sons, scientific publishers, New York. Cloth, \$5, postpaid.

Part I of this book treats of general principles and methods of research, which are subdivided into three chapters—(I) chemical principles and characters, (II) physical principles and characters in part, and (III) optical properties. Part II of the work gives detailed descriptions, concluding with tables of the optical characteristics of the rock minerals.

Dr. R. W. Raymond, secretary of the American Institute of Mining Engineers, lately published the following comment on this book: Professor Iddings is a recognized authority in the modern science of petrology, which has so greatly enlarged, and at the same time focalized and defined, the work of geologists. Neither the nature nor the history of a rock can be decided nowadays without recourse to the refined methods and trained judgment of the petrologist, to whom the field-observer habitually sends his specimens for examination and classification. This book supplies the pressing and general need of a clear, comprehensive and trustworthy manual of the new science. It treats of the general principles and methods of research, including the chemical and physical characters and laws involved, and gives (in Part II) a descriptive catalogue of the rock-making minerals, followed by tables showing their optical characteristics, and a large "folder," presenting a coloured plate which exhibits their interference-colours and "birefringences." In short, the book is calculated to show the student how to observe thin sections of rocks, and how to interpret his observations—in both of which particulars there is danger of careless work and need of sane guidance.

*Notes on Metallurgical Mill Construction.* Edited by W. R. Ingalls, editor of the *Engineering and Mining Journal*, New York. Pages, 251. Octavo cloth. Price \$2, postpaid.

This book is a reprint of a series of articles, bearing upon some of the important details that enter into the construction of metallurgical plants, especially mills of various kinds. These articles have appeared in the *Engineering and Mining Journal*, chiefly in recent years. They relate to a variety of subjects of great importance in the design, construction, and operation of metallurgical mills, and are by eminent experts in the mining profession. The thorough and careful revision to which they have been subjected by the editor, Mr. Ingalls, has added to their general accuracy and reliability. The data they contain is now presented in a convenient and readily available form. The information given is comprehensive and includes much detail connected with the construction of concentration mills, cyanide plants, and smelting works. The volume is illustrated and the numerous diagrams add greatly to its practical value to mill and smelter men.

## THE NO. 5 WILFLEY CONCENTRATOR.

Mussens Limited advertise, on page XI of this issue, the No. 5 Wilfley Concentrator, for which they are sole Canadian agents. A circular they have had prepared gives full particulars of the special advantages possessed by this concentrating table, together with the great improvements effected in it, which, it is claimed, still keep it far ahead of all competing machines in the market the world over. Full and complete details of these tables will be found in Bulletins No. 21 and 22, which will be supplied free on application. The above-mentioned circular calls particular attention to a number of points well worthy of the consideration of all requiring concentrators, and says further that there is simply no comparison at all between the No. 5 Wilfley table this firm is offering and other tables made along imitative lines but the chief claim to merit of which latter is based on lightness of construction or a low selling price.—Advt.

W. H. Storms, for years prior to January 1, 1906, editor of the *Mining and Scientific Press* of San Francisco, California, has re-entered the field of mining journalism as managing editor of the *Mining Review* of Los Angeles in the same state.

## TRADE NOTES AND CATALOGUES.

Mussens Limited (formerly W. H. C. Mussen & Co.) of Montreal, Quebec, have sent out a circular letter again drawing attention to the fact that they are the sole Canadian agents for Fraser & Chalmers, Ltd., whose only works are at Erith, Kent, England, and who are stated to have the best equipped shops in the world for manufacturing the highest quality and latest designs of all classes of mining and metallurgical machinery. Enquiries are particularly solicited for crushing, milling, concentrating, and smelting equipment, as well as large winding engines, compressors, or any plant requiring special care in design or building.

The Jeffrey Manufacturing Company of Columbus, Ohio, U. S. A., has sent out Bulletins B and C illustrating the "Grab Bucket System" and "Coal and Ashes Handling Machinery for Power Houses." These show many ways in which grab buckets, conveyors, etc., handle coal, ashes, and other materials.

The Yukon Consolidated Goldfields Company, Ltd., has purchased a considerable quantity of electrical apparatus from the Canadian Westinghouse Company, which it will use in connection with gold-dredging work.

"Storage Batteries for Stationary Service" is the title of the Westinghouse Machine Company's "Catalogue S" which describes and illustrates "Type S" storage batteries of Westinghouse manufacture. In addition to descriptive notes there are a number of tables of technical details giving exhaustive information relative to the various apparatus illustrated.

The Chicago Pneumatic Tool Company has published a 116-page catalogue (No. 20) dealing fully with Franklin air compressors which it manufactures.

Power and Mining Machinery Company's catalogue No. 7, "Cement-Making Machinery," is a handsomely-printed and illustrated publication descriptive of machinery for the production of portland cement by either the wet or dry process.

"Hawthorne Works" is an illustrated booklet describing the Western Electric Company's new 110-acre plant at Hawthorne, Illinois, U. S. A.

Section No. 7 of the Canadian General Electric Company's Supply Catalogue has been received. It is devoted to wires and cables, and in addition to illustrations and descriptions of the materials, contains numerous useful tables.

The Wellman-Seaver-Morgan Company's pamphlet, "What We Do in Mining and Power Machinery," outlines in a general way the power and machinery department of its business, while accompanying illustrations show some of the more important pieces of equipment the company is prepared to supply.

The C. H. Shaw Pneumatic Tool Company's "Catalogue D" deals with rock drills and complementary articles it manufactures.

Particulars of its steel sheet piling are given in a booklet published by the United States Steel Piling Company, and reprints from trade journals supplement this information.

Mr. W. A. Duff, assistant manager of the Montreal office of the Canadian Westinghouse Company, has been promoted to the Western managership of that company, with headquarters at Winnipeg, Manitoba. Mr. Duff has been identified with the Westinghouse interests for some years, and his promotion is well deserved. He is a graduate in electrical engineering of McGill University, and well known in the electrical engineering field.

Arthur A. Cole, who prior to being appointed mining engineer to the Temiskaming and Northern Ontario railway commission was first chief assayer and afterwards mining engineer at the Centre Star and War Eagle mines, Rossland, is now located at Cobalt, looking after the interests of the commission in some valuable silver-cobalt mines in that district.

## MINING MEN AND AFFAIRS.

H. Mortimer Lamb, secretary of the Canadian Mining Institute expects to visit British Columbia in April.

M. S. Davys of Nelson recently spent a week or two in Victoria.

J. M. Turnbull of Trail, one of the Consolidated Mining and Smelting Company of Canada's mining engineers, has returned from a business visit to Mexico.

Edward Dedolph, manager of the Sullivan smelter at Marysville, East Kootenay, has returned from a business visit to Spokane, Washington, U. S. A.

W. Mitchell is now superintendent at the Second Relief gold mine at Erie, Nelson mining division, in succession to W. B. Hudson.

R. W. Brigstocke, who last year left Nelson for Cobalt, New Ontario, is now superintendent of the Drummond mine in that widely-known silver camp.

F. H. Oliver of Spokane who managed the Morrison mine, Boundary district, when it was being developed, is now at Toronto, Ontario.

W. E. Segsworth, for several years resident at Greenwood, Boundary district, recently went to Cobalt, New Ontario, to there look after some mining interests.

J. Cleveland Haas, E. M., of Spokane, Washington, has lately been examining silver properties at Cobalt, New Ontario, in the interests of United States clients.

W. N. Bissett, hydraulicking superintendent for the Cariboo Gold Mines, Ltd., has returned to Bullion, Quesnel Forks, after having spent the winter in California.

Paul Johnson spent a day in Victoria late in February, having come over from Seattle in company with D. B. Brown, president of the Alaska Smelting and Refining Company.

W. C. Dalglish, well known in the Slocan district in which he was a mine manager, is now located at Paterson, N. J., U. S. A., where he represents the Tiffany-Cobalt Mines, Ltd.

The Los Angeles *Mining Review* states that Herman Bellinger, metallurgist of the Greenwater & Death Valley Mining and Smelting Company, has arrived at Greenwater, California, from the East.

J. O. Gillice has resigned the position of representative of the Allis-Chalmers-Bullock Company for the Kootenay district, with headquarters at Nelson. He intends making California his next field of operations.

Robert R. Hedley of Nelson lately visited Fernie, south-east Kootenay, where he was the guest of G. G. S. Lindsey, general manager of the Crow's Nest Pass Coal Company, Ltd.

W. E. Zwicky of Kaslo recently visited the Sullivan lead-silver mine, East Kootenay. He was accompanied from Cranbrook by James Finlay, formerly superintendent of this mine.

Frederic Keffer of Greenwood, Boundary district, arranged to attend the ninth annual meeting of the Canadian Mining Institute, leaving S. C. Holman, late superintendent, in charge of the British Copper Company's several mines during his temporary absence.

Erland G. Hadow, some time ago in charge of the office of the Silver Cup Mines, Ltd., at Ferguson, Lardeau, is now at the Napoleon mine, Boyds, Washington, which mine is being operated by the British Columbia Copper Company.

R. H. Anderson has resigned as superintendent of the Sullivan Group Company's mine, situated on Mark Creek, near Kimberly, East Kootenay. He is stated to have obtained a better position with a mining company operating in the Coeur d'Alene country, Idaho, U. S. A.

W. Yolen Williams, of Spokane, Washington, formerly manager of the Granby Company's mines at Phoenix,



was a recent visitor to the field of his active operations during the years he was engaged in opening up the big mines of the company named.

Horace G. Nichols has arrived from England and taken charge at the Ymir mine. He is reported to have stated, when interviewed at Nelson, that ample funds are now available for the further development of the mine, at which operations were to be resumed early in March.

The *Nelson Canadian* has stated that E. M. Hand, late manager of the Ymir mine, was at that time undecided whether to remain in British Columbia or proceed to Mexico. In both countries mentioned positions had been offered to him.

The *Nelson Daily News* states that Al. Huston, who is in charge of development work at the Broadview mine, Ferguson camp, Lardeau, has 20 men engaged in opening up that property, and that it is intended to employ about double that number in the spring.

L. F. Warner, engineer in charge of the work of enlarging the water supply system of the Cariboo Mining Company in the Quesnel Forks country, is preparing for a resumption of operations with the opening of the ensuing season.

J. E. McAllister of Greenwood, manager for the British Columbia Copper Company, is expected to shortly return from Europe whence he went in the hope that the change of climate and scene, together with expert medical treatment, would result in his complete restoration to health.

R. Gilman Brown of San Francisco, California, has announced his intention to remove to London, England. Mr. Brown has been an occasional visitor to British Columbia in the capacity of consulting engineer to the Ymir Gold Mines, Ltd., operating at Ymir, Nelson mining division.

A. G. Low, director and deputy head of the Geological Survey of Canada, is dangerously ill at his home in Ottawa, Ontario. While his recovery is regarded as probable it is expected that should it happily ensue, it will be several months before he will be able to resume his official duties.

W. H. Aldridge of Trail, managing director of the Consolidated Mining and Smelting Company of Canada, late in February visited the Canadian Metal Company's Blue Bell mine on Kootenay Lake in company with J. E. Harrington, secretary, and S. S. Fowler, manager of the latter company.

W. J. Elmendorf, M. E., of Spokane, Washington, was in Nelson during February. Beside acting in the capacity of consulting engineer to the Reliance Gold Mining Company, Mr. Elmendorf's professional work in British Columbia has included that of examination of the mine workings over which the dispute arose that involved the long-continued litigation in the *Star vs. Byron N. White* case.

The *Hedley Gazette* states that A. Acherli, hydraulic engineer, and E. N. Breed, electrical engineer, have been looking into the additional power and equipment requirements of the Daly Reduction Company's stamp mill at Hedley. It is understood these gentlemen will advise what changes and additions are needed to give the mill the larger capacity requisite for the projected increase in its treatment capacity.

E. A. Holbrook, superintendent of the Daly Reduction Company's stamp mill and cyanide plant, has returned to Hedley, Similkameen, from his home at Fitchburg, Massachusetts, U. S. A., where he had been summoned on account of the serious illness of his wife which, unfortunately, resulted in the death of that lady on February 16.

The *Ashcroft Journal* states that D. P. Cameron, vice-president of the Western Engineering and Construction Company, has been up to Big Bar, on the Fraser River,

# P & B PAINT

A special study of preservative paints extending over a period of a quarter of a century has enabled us to produce the best paint for general use around smelters or chlorination works on the market to-day.

For painting cyanide tanks, acid vats, pipes, etc., P & B Paint gives entire satisfaction. Leaves a protective coating equal to three coats of metallic paint.

Send for P & B Paint folder which tells where and how to use P & B Paint.

## The Paraffine Paint Co.

Manufacturers of

**Malthoid Roofing; P & B Ready Roofing;  
Malthine Building Paper and  
other P & B Products.**

Seattle Office, 408 Occidental Ave.

Local Agents:

**R. ANGUS, VICTORIA.  
H. DARLING, VANCOUVER.**



in connection with the proposed installation of two dredges to work some gold-dredging leases there.

W. H. Brewer lately made a trip from Victoria to one of the Queen Charlotte group of islands, northern British Columbia. The production of copper ore in the locality visited has been commenced by a Japanese company which is opening up a claim that gives promise of developing into a valuable mine.

Robert B. Lamb, formerly general manager for the Daly Reduction Company at Hedley, Similkameen, B. C., has been appointed consulting engineer of the Barnes King Mining Company, operating at Kendall, Montana, U. S. A.

Byron N. White of Spokane, Washington, was in Victoria about the middle of February, remaining several days. He expressed himself as being pleased with the promise his Whitehorse copper properties are giving under development, and expects profitable returns from the ore—about 1,000 tons—he is shipping to the several coast smelters to ascertain values in bulk.

The professional card of Edward A. Haggen, mining engineer, of Revelstoke, appears on another page. Mr. Haggen is a member of the Canadian Mining Institute and the American Institute of Mining Engineers, respectively, and is well known in North Kootenay, particularly in the Golden and Revelstoke districts.

Thos. Kiddie, who succeeds Paul Johnson as manager of the Alaska Smelting and Refining Company's smelter at Hadley, Prince of Wales Island, southeast Alaska, goes north early in March to assume charge of the works and to ascertain what changes will be necessary in connection with the installation there of the Kiddie Hot Blast System, described in the *MINING RECORD* of October last (pp. 387-391). It is expected that a sufficient

supply of coke will have been delivered at Hadley by the end of March or early in April to admit of smelting operations being resumed.

#### NOTES FROM SALMO, NELSON DISTRICT.

Manager DeWitt, of the Ore Hill mine, Salmo, Nelson district, is enthusiastic as to the prospects before the mining division in which he is interested, says the *Nelson Daily News*. He declared it to be the "liveliest camp on the road." Every day, declared Mr. DeWitt, can be seen from eight to 12 cars being loaded at the siding at Salmo, some with ore, some with concentrates and some shingle bolts for Washington mills.

The Mother Lode mine is preparing for an immediate shipment and already has some 200 sacks of ore down at the siding. The Nugget sent down on January 10 a carload of ore stated to be one of the richest sent out of Salmo for years. The Kootenay Belle is working a force of ten or more men and is getting out good ore.

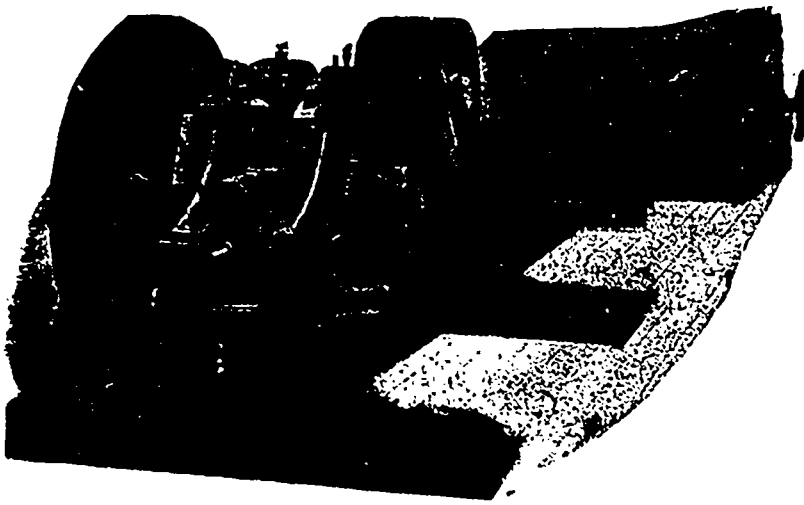
The Queen gold mine and stamp-mill are running regularly. The concentrates are proving to be better than any heretofore made by the mill and the management is pleased at the additional saving thus effected.

The Emerald is averaging three cars a week and could do more; probably it will ship in larger quantity later in the year. The ore is dry lead carbonate.

The company lately organized by Mrs. Collins to work some properties on Lost Creek has succeeded in getting out one car which has been shipped to the smelter.

The Summit which is contiguous to the Ore Hill, has got out some very rich ore lately and sent one car to the Hall Mines smelter.

The Ore Hill is not doing much at the present, but will, it is expected, be working a full force of men by the spring.



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HERBERT B. BROWN,  
Hedley, Similkameen, B. C.



**SYNOPSIS OF CANADIAN HOMESTEAD REGULATIONS.**

Any available Dominion Lands within the Railway Belt in British Columbia, may be homesteaded by any person who is the sole head of a family, or any male over 18 years of age, to the extent of one-quarter section of 160 acres, more or less.

Entry must be made personally at the local land office for the district in which the land is situate.

The homesteader is required to perform the conditions connected therewith under one of the following plans:

- (1) At least six months' residence upon and cultivation of the land in each year for three years.
- (2) If the father (or mother, if the father is deceased), of the homesteader resides upon a farm in the vicinity of the land entered for, the requirements as to residence may be satisfied by such person residing with the father or mother.
- (3) If the settler has his permanent residence upon farming land owned by him in the vicinity of his homestead, the requirements as to residence may be satisfied by residence upon the said land.

Six months' notice in writing should be given to the Commissioner of Dominion Lands at Ottawa of intention to apply for patent.

Coal lands may be purchased at \$10 per acre for soft coal and \$20 for anthracite. Not more than 320 acres can be acquired by one individual or company. Royalty at the rate of ten cents per ton of 2000 lbs shall be collected on the gross output.

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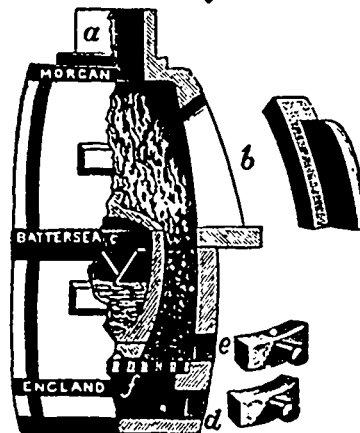
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