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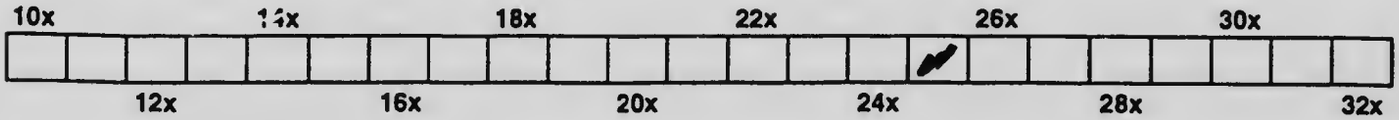

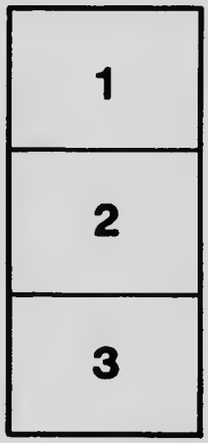

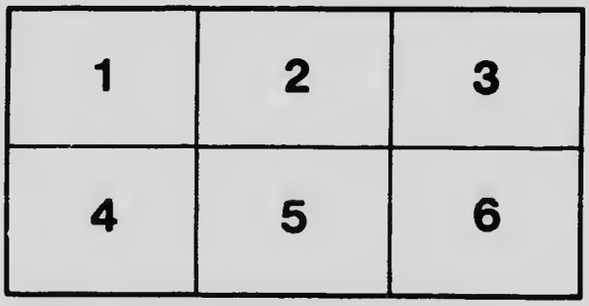

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BRITISH COLUMBIA BUREAU OF MINES

BULLETIN No. 1. 1914

PRELIMINARY REVIEW AND ESTIMATE

OF

MINERAL PRODUCTION, 1913

BY

WM. FLEET ROBERTSON, Provincial Mineralogist

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA.

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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To the Hon. Sir Richard McBride,
Minister of Mines, British Columbia.

Sir,—I beg to submit herewith a preliminary estimate of the mineral production of the Province for the year 1913, together with some notes on the progress of the mining and metallurgical industries during the year just closed; the information herein presented is, of course, subject to revision.

The object of this preliminary estimate and review is to give, as promptly as possible after the close of the year, an approximate statement of the condition of the mining interests, without waiting until the official statistical returns from the mines have been received, and without the delay that of necessity must take place in carefully preparing these and the detailed information given each year in the Annual Report of the Minister of Mines.

I have the honour to be,
Sir,
Your obedient servant,

William Fleet Robertson,
Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,
January 7th, 1914.

PRELIMINARY REVIEW AND ESTIMATE

OF

MINERAL PRODUCTION FOR THE YEAR 1913.

THIS bulletin has been prepared before the receipt of the official reports for the year 19[illegible] of the Gold Commissioners and Mining Recorders of the Province and the customary returns of mineral production annually made by managers mines and reduction-works; consequently, it must necessarily be regarded as being simply a preliminary review of the progress of the past year, together with an estimate of the quantities and value of the several mineral products of the Province, which it is believed will prove to be approximately correct.

The accompanying table shows an estimated mineral production during 1913 of a total value of $30,158,793.

This production, estimated for 1913, has only once been exceeded in the mineral history of the Province, i.e., by that of 1912, which was of some $2,282,007 greater value, and which is to be accounted for by the market prices of the metals in 1913 being uniformly lower than in 1912, and by the deterrent effect of labour troubles upon the production of the Vancouver Island collieries—which more than account for the difference found. As it is, the 1913 production stands second on the list, exceeding that of 1910—the next on the list—by $4,000,000.

CONDITIONS FAVOURABLE FOR PRODUCTION IN 1913.

Conditions during the year 1913 were, with the chief exception of those bearing upon coal-mining on Vancouver Island, generally favourable to a large mineral production, and the results of the year's mining operations should, on the whole, be regarded as satisfactory. It will be seen that copper output of the lode metals was smaller in considerable quantity than in 1912, and, since the average market price of that metal for 1913 was lower, there was a further corresponding decrease in the value. The decrease in placer gold is more than compensated for by the increase in lode gold, and is accounted for by hydraulic mining having been done in Quesnel Division of Cariboo District.

In view of the fact that there were long-continued and determined efforts made to prevent the operation of the coal-mines on Vancouver Island, except on terms the owners would not agree to, it is surprising that the decrease in total quantity of coal produced in the Vancouver Island District was not greater than the returns show it to have been—namely, somewhat less than 600,000 tons; but the increases of Nicola and Crowsnest Pass Districts, together amounting to 147,000 tons, reduced the loss in gross production of coal of the Province to approximately 450,000 tons. The net coal production—that is, after deducting the coal made into coke—shows a larger decrease, since a greater amount of coal was converted into coke, the production of which this year amounted to 285,123 tons—the largest coke production ever made in the Province.

PROVINCE'S PROPORTION OF PRODUCTION IN CANADA.

British Columbia's proportion of the mineral production of the whole of Canada continues to be comparatively large. The aggregate value of the production of this Province to the end of 1913 is, approximately, $460,000,000, but since the published

official records of that of the whole Dominion do not include production prior to 1886, the present comparison must be restricted to the period of twenty-eight years—1886-1913. Placing the aggregate for all Canada at $1,521,000,000 (which allows for 1913 a Dominion total of $150,000,000, an amount nearly $15,000,000 greater than that of 1912), and British Columbia's proportion for the same period at $395,000,000, it follows that this Province has to be credited with about 26 per cent. of the aggregate value of the mineral production of the whole of Canada in the twenty-eight-year period under notice.

It is a striking fact, as indicating the substantial increase in the value of the mineral production of the Province in recent years, as compared with that of less than twenty years ago, that nearly 35 per cent. of the $395,000,000 mentioned above as the aggregate of production for twenty-eight years is to be credited to the last five years, 1909-1913, while nearly 54 per cent. was produced during eight years, 1906-1913.

MINERAL PRODUCTION FOR TWO YEARS, 1912-1913.

The following table shows the quantities and value of the several minerals produced in the year 1912, and the estimated production in 1913. It may here be explained that the prices used in calculating the estimated value of silver, lead, copper, and zinc are the average prices for the year, as published in *The Engineering and Mining Journal*, New York, less a deduction of 5 per cent. off silver, 10 per cent. off lead, and 15 per cent. off zinc.

Minerals.	Production, 1912.		Estimated Production, 1913.			
	Quantity.	Value.	Quantity.	Value.	Increase.	Decrease.
Gold, placer ..... oz.	.....	$ 555,500	.....	$ 540,000	.....	$ 15,500
Gold, lode ..... oz.	257,496	5,322,442	266,547	5,509,526	$ 187,084	.....
Total gold	.....	$ 5,877 942	.....	$ 6,049,526	$ 171,584	.....
Silver ..... oz.	3,132,108	1,810,045	3,569,642	2,027,557	217,512	.....
Lead ..... lb.	44,871,454	1,805,627	54,205,594	2,130,280	324,653	.....
Copper ..... lb.	51,456,537	8,408,513	46,042,379	7,021,463	.....	1,387,050
Zinc ..... lb.	5,358,280	316,139	7,100,000	340,800	24,661	.....
Total metalliferous	.....	$18,218,266	.....	$17,569,626	.....	$ 648,640
Coal ..... ton., 2,240 lb.	2,628,804	9,200,814	2,136,694	7,478,429	.....	1,722,385
Coke ..... tons, 2,240 lb.	264,333	1,585,998	285,123	1,710,738	124,740	.....
Building materials, etc.	.....	3,435,722	.....	3,400,000	.....	35,722
Total value of production	.....	$32,440,800	.....	$30,158,793	.....	$ 2,282,007

PRODUCTION OF VARIOUS MINERALS BRIEFLY REVIEWED.

In order to indicate in a general way the sources of the various minerals mined in the Province and to give an idea of some of the conditions that affected their production, and, incidentally, brief information concerning the larger known mineral deposits occurring in British Columbia, the next following comments are submitted.

Gold.

No hesitation has been felt in estimating that the yield of gold, placer and lode combined, has been larger than in 1912. For placer gold, a decreased production is expected, taking the Province as a whole, of about $15,500—although the Atlin camp will show an increased production over last year; and for lode gold $5,509,526 (equivalent to an increase of $187,000) has been taken as fairly representing the production of this metal, so far as indicated by the advices received to date. Dealing with these classes of gold-mining separately, it may be observed:—

Placer Gold.—Practically all the placer gold recovered in the Province is obtained in the Cariboo and Cassiar Districts, less than one-twentieth of the total coming from the remaining districts. An approximate apportionment is: From Cariboo District, $190,000; Atlin Division of Cassiar District, $320,000; remaining parts of the Province, $30,000. It may be that for both these districts a larger yield will be shown, but this cannot be determined until after the final results of the season's operations shall be known.

In the Cariboo District the gravel-washing season was shorter than usual owing to a late spring, but the water-supply was very satisfactory during the first part of the season.

In the Barkerville Division the largest operators did a little better than usual, though several of the smaller properties were not so successful.

In the Quesnel Division the large plants were not operated and the output was comparatively small, chiefly from Keithley creek and a new hydraulic company at Moorhead.

The district will probably show a decrease of over $40,000.

In the Atlin District the season seems to have been favourable, the older producers doing better than usual, while a new company operating on Ruby creek began to make a very substantial output. The output of the camp is expected to be $30,000 better than last year.

As a result of serious prospecting, it seems probable that several new creeks may be profitably worked in the near future.

Renewed interest is being manifested in the Stikine-Liard District, where the Boulder Creek Hydraulic Company has had a fairly successful season, in a small way, with good prospects for the future.

The benches at Laketon are being tested by a drill, and if satisfactory results are obtained a dredging plant is to be installed; what success has attended this work is not as yet known.

In the Omineca section a couple of companies have had engineers making extensive tests of their ground, but the output from the district this year will be small.

Investigations are also being made as to the suitability of the Peace river as dredging-ground.

At present there is no gold-dredging being carried on in the Province; a dredge is, however, under construction on the Quesnel river.

In the early spring of 1913 reports were circulated that rich ground had been found on Silver creek, south of Tesiin lake, but these reports appear to have been unwarranted.

In the fall of the year an attempt was made to cause a "rush" to Sibolla creek, south of Francois lake; it cannot be learned that there was any justification for the reports circulated.

Though the Lillooet District has formerly always produced placer gold, it seems as if there would be little from there this year, possibly on account of the advent of the railway-construction providing more profitable employment.

Considerable work in connection with placer-mining had been done in the Similkameen District, although advices to hand do not indicate any important production this year.

Lode Gold.—Present information would indicate a production of lode gold of about 266,547 oz., worth $5,509,526, which would be an increase over last year of some 9,051 oz., worth $187,000. This increase comes from Rossland, Nelson, Lillooet, and the Coast Districts.

The estimated production has been credited approximately as follows: Rossland, 135,300 oz.; Boundary, including Osoyoos Mining Division, 103,300 oz., of which Camp Hedley is credited with 38,300 oz.; Nelson District, 23,500 oz.; Coast District, 3,000 oz.; Lillooet, 1,300 oz.

Taking the several districts of the Province in the order mentioned:—

The amount from Rossland came from the Consolidated Company's mines to the extent of approximately 120,000 oz., and about 15,000 oz. from the *Le Roi No. 2.*

In the Boundary District the largest producer was the *Nickel Plate* mine at Hedley, in Osoyoos Mining Division, included under the heading "Boundary," which recovered some 38,300 oz. of gold, worth $792,000 in the stamp-mill, from concentrates and cyanide treatment.

The *Jewel* produced about 4,000 oz. from stamp-milling.

Most of the remainder was obtained from the smelting of copper-bearing ores; the Granby Company recovering some 40,500 oz., the British Columbia Copper Company nearly 19,300 oz., and the *No. 7* almost 800 oz.

In the Nelson District the production from the *Queen* has been less than last year owing to labour troubles, the decrease, however, being more than compensated for by the substantial increase made by the *Mother Lode*, also in Sheep Creek camp. The next most important producers were the *Yankee Girl* and the *Arlington*.

In the Coast District the chief producer of lode gold was the *Marble Bay* mine on Texada Island, in which it is found associated with copper-ores.

In the other large copper-mine on the Coast, the *Britannia*, no gold is recovered.

It is likely that there was some lode gold produced in the Atlin District, but no official information is as yet available, while unofficial reports are at least contradictory. The *Coronation* mine in the Lillooet Division worked part of the year and produced over 1,300 oz. of gold.

It cannot be learned that the Portland Canal District made any important production.

In the estimate no allowance has been made for gold from the west coast of Vancouver Island, although it is possible that a little may have been produced.

The expectation of an output this year from the Surf Inlet mines on Princess Royal Island was not realized, but considerable development-work was done during the year.

Silver.

It would seem as though the amount of silver produced this past year would be about 3,570,000 oz., which is the greatest production of this metal made since 1902, and, as compared with 1912, is an increase of over 437,000 oz.

This was produced approximately as follows: Slocan, 1,860,000 oz.; Ainsworth, 487,000 oz.; East Kootenay, 413,000 oz.; Boundary, 380,000 oz.; and Nelson, 160,000 oz. The three former districts show material increases and the latter two show decreases.

The Slocan thus produced over half the total silver output, and of this about two-thirds was from the *Standard* mine, followed in importance by the *Rambler-Cariboo* and *Van-Roi*.

Other mines in this district shipped silver-bearing ores, amongst which were the mines of the Consolidated Mining and Smelting Company, and also the *Slocan Star*, *Eastmont*, *Surprise*, and *Reco*.

In the Ainsworth District the largest production was made by the Consolidated Mining and Smelting Company's mines, followed in importance by the *Utica*, *Bluebell*, and *Silver Hoard*.

In East Kootenay, of a total production of about 413,000 oz., the Consolidated Mining and Smelting Company's mine, the *Sullivan*, assisted by the company's *St. Eugene* mine, produced about 407,000 oz.

In the Nelson District the Consolidated Company's mines, the *Molly Gibson* and *Silver King*, together produced 120,000 oz. out of the total of 160,000 oz., while in Rossland camp the same company's mines produced nearly 78,000 oz. out of a total output of about 105,000 oz., the *Le Roi No. 2* producing about 27,000 oz.

In the Boundary District, of the total estimated production of 379,000 oz., the Granby Company produced about 250,000 oz., the British Columbia Copper Company about 84,000 oz., and the *No. 7* about 25,000 oz.; while the *Union*, *Bounty Fraction*, *Sally*, and others contributed in lesser amount.

The Vancouver Island and Coast District is credited with 94,500 oz., of which the *Britannia* produced about 72,000 oz. and the *Marble Bay* 20,000 oz.

The Hazelton District for the first time enters the field as an important producer, providing nearly 46,000 oz. of silver, of which 41,000 oz. is credited to the *Silver Standard* mine.

Lead.

Figures have been received from most of the larger shippers of lead-ore, giving their approximate productions for the year, the last month having to be estimated as a probable amount; the smaller shipments have been estimated on a known tonnage received at the smelter, at the assay value of former years.

It is possible that in some instances the figures sent in are assay contents of the ore shipped and not lead actually recovered, so the estimate of production given may prove somewhat high, although it is considered that the 10 per-cent. deduction from the market price, taken in calculating the value of the product, will cover any excess of output claimed.

The total estimated production is put down at 54,206,000 lb., of which the Slocan and Ainsworth Divisions together are credited with 31,000,000 lb., East Kootenay with 20,300,000 lb., and Nelson with 2,000,000 lb.

The largest shippers in the various districts were as follows: In the Slocan, the *Standard*, 16,600,000 lb.; the *Rambler-Cariboo*, 2,200,000 lb.; and the *Van-Rol*, 780,000 lb.

In the Ainsworth Division, the *Bluebell*, 7,800,000 lb., and the Consolidated Company's mines, 1,300,000 lb.

In East Kootenay, the Consolidated Company's mines, 19,000,000 lb., and the *Monarch* at Field, 1,000,000 lb.

In the Nelson District, the *H.B.* mine produced over 900,000 lb., and the *Emerald*, 800,000 lb.

The London price of lead having been for seven or eight months of the year above that at which the Dominion Government bounty on lead ceases to be payable, it follows that the total amount of bounty paid or payable on account of the 1913 lead production will be found to be comparatively small, so that probably there will be from $500,000 to $600,000 of the original appropriation of $2,500,000 still remaining unearned by the lead-producers.

Copper.

Although complete authoritative figures are not yet at hand, still enough have been received to show quite clearly that the amount of copper recovered from the smelting of the ores of the Province during 1913 will fall very much short of the production of 1912; the best advices available indicate that the copper recovered this past year will amount to about 46,042,379 lb., which represents, as compared with 1912, a decrease in amount of 5,414,158 lb.

The decrease in total value of this year's product is even greater than the decrease in amount of the product would indicate, for this year's market price is slightly more than 1 cent lower than in 1912, and this alone would on this year's product account for a lessened value of $460,000.

The total decrease in value this year as compared with 1912 will amount to about $1,387,000.

Copper is the only metal that does not show an increase over the year 1912. While such is a fact, it is nevertheless true that the 1913 output is greater in amount than any other year, with the exceptions of 1908 and 1912, in the history of mining in British Columbia.

It might be further pointed out that 1912 was phenomenal as regards its copper production, inasmuch as in 1911 the Boundary smelters were hampered by the shortage of coke, due to strikes at the collieries, and at the mines development was pushed ahead; as a result, the year 1912 found the mines in an unusually good shape to make a large output, while the mining companies were stimulated to do so by the high market price for copper.

It would therefore seem that this year's copper output is in reality considerably above the average and denotes a steadily increasing production.

The tonnage of copper-bearing ore mined in 1913 was nearly the same, being 2,302,000 tons; from which it is deduced that the average "copper-content" of a ton of ore was 21.75 lb. in the year 1912, and was only 20 lb. in 1913, which indicates that, owing to improved methods and consequently lower costs of mining and smelting, ore of a still lower grade than in former years was treated at a profit.

This gives hope that improved methods and means may eventually be found to profitably treat the large bodies of ore known to exist which are of too low a grade to allow of a profit being made by present methods.

The production of copper has been credited to the various districts about as follows: To the Boundary, nearly 29,000,000 lb.; Coast District, 14,000,000 lb.; Rossland camp, 2,200,000 lb.

As to the future, it would appear that the Boundary, which now provides about 60 per cent. of our output of copper, is likely not only to hold up its present output, but to steadily increase it; while the Coast District within a year or so will be making at least three times its present output, due to improved processes at the *Britannia* mine and the operation of the Granby Company's plant at Observatory inlet, where a 2,000-ton-a-day smelter is now nearing completion, with enough ore behind it, actually proved, to keep it running for some years.

Zinc.

The informal advices so far received from the producers of zinc seem to indicate a production of zinc this past year that is much higher than even the most sanguine had hoped for, and until final statistical figures are available it can only be hoped that the outputs claimed by the various shippers have not been exaggerated.

It is a fact, however, and this may be the explanation, that large quantities of zinc-concentrates and ore which would find a market in the United States have been stored and held in anticipation of a change in the United States tariff, which would permit of zinc-ores entering that country at a much lower Customs rate.

This change arrived this pa[illegible] fall, and it is said that it makes a difference of several dollars a ton in favour of the shippers; since then the stored-up zinc-ores have been rushed over the Line.

Subject to future correction and to the remarks just made, it is estimated that the output of zinc in 1913 will be approximately 71,000,000 lb., all of which, with the exception of 130,000 lb. credited to the *Monarch* mine near Field, is expected to have been produced in the Slocan. Above figures should read 7,100,000 lb.

The *Standard* mine, of Silverton, is credited with more than half the total output, while the *Lucky Jim*, *Van-Roi*, *Rambler-Cariboo*, *Surprise*, and *Noble Five* contributed in a lesser degree.

The laboratory experiments in electric smelting of lead-zinc ores that have been made during the last two years under the direction of the Mines Branch of the Dominion Department of Mines having reached a sufficiently advanced stage, arrangements have been made to experiment on a larger scale, and for this purpose an electric furnace has been constructed at Nelson, and G. C. Mackenzie, of the Mines Branch staff, assigned to the duty of endeavouring to smelt Slocan ores in sufficient quantity to demonstrate the commercial value of the reduction process to be used. It is, as yet, too early to make any statement as to the success or otherwise of the work that is being undertaken there.

Iron.

Little, if any, progress seems to have been made toward the utilization of the iron-ores known to occur in different parts of the Province. So far as information made public goes, there was no advancement in 1913 other than that more development-work was done on some of the deposits of iron-ore.

Coal and Coke.

Preliminary returns received show a gross production in 1913 of about 2,577,000 long tons of coal, as compared with nearly 3,026,000 tons in 1912. The quantity made

into coke was 440,000 tons, leaving 2,137,000 tons as the net production of coal. The quantity of coke made was rather more than 285,000 long tons, which constitutes a record in production of coke in the Province, the highest previous year's output having been that of 1905, of 271,785 tons. For purposes of comparison the following table is shown:—

	1913.	1912.	1911.	1910.	1909.
Coal, gross .....tons, 2,240 lb.	2,576,886	3,025,709	2,297,718	3,139,235	2,400,600
Less made into coke ..... "	440,192	396,905	104,656	339,189	394,124
Coal, net ..... "	2,136,694	2,623,804	2,193,062	2,800,046	2,006,476
Coke made ..... "	285,123	264,333	66,005	218,029	258,703

When the year opened the Canadian Collieries (Dunsmuir), Limited, had succeeded in considerably increasing the output from the mines of its Comox Colliery, notwithstanding that the United Mine Workers of America had for several months required its members to abstain from working in those mines owing to the persistence of the company in its determination not to recognize that organization. Having got its production almost up to normal quantity at its Comox mines, the company next gave its attention to its Extension mines, at which a strike had also been declared by the union. Other measures having failed to prevent progress being made at Extension Colliery as well as at Cumberland (Comox Colliery), the United Mine Workers of America declared a strike at all coal-mines on Vancouver Island, with the result that the miners of the Western Fuel Company, Nanaimo, had to violate their unexpired agreement with that company and cease work. The strike also affected the mines of the Pacific Coast Coal Mines, Limited, operating at South Wellington, Morden, and Suquash, and of the Vancouver-Nanaimo Coal Mining Company working the Jingle Pot mine near Nanaimo. With the exception of the last-mentioned company, the operators continue to decline to accede to the demands of the United Mine Workers of America, and the position at the close of the year was that the Canadian Collieries Company was working its Cumberland mines to full ordinary production capacity, and its Extension mines to about the extent it was doing when the general strike was called at the end of April; the Western Fuel and the Pacific Coast Coal Mines Companies were working with comparatively small forces of non-union men, yet were producing some coal; and the Vancouver-Nanaimo Company had all the union men it could find work for.

While the labour troubles at Vancouver Island mines had caused a decrease in production of coal to the estimated extent of approximately 596,000 tons, there were increases in Nicola and Crowsnest Districts of about 57,000 and 90,000 tons, respectively, which reduced the decrease in the coal production of the Province as a whole to a net total of about 449,000 tons. The gross production of the several districts was as follows:—

	Tons of 2,240 lb.
From Vancouver Island mines	962,620
From Nicola and Similkameen mines	262,768
From Crowsnest mines	1,351,498
Total quantity of coal produced	2,576,886
Less made into coke	440,192
Net quantity of coal produced	2,136,694

Leaving out of account the present interruption to production at some of the Vancouver Island coal-mines, the statement appears to be warranted that on the whole the coal-mining industry of the Province is in a progressive condition. That

this is so is demonstrated particularly by the considerable developments of mines and large additions to plant and machinery made by three of the four companies operating on Vancouver Island. Some particulars of important development-work and new equipment now referred to were given in the Annual Report of Minister of Mines for 1912.

In the Nicola field, the Inland Coal and Coke Company made the largest output of coal of any in the district—about 116,000 tons, compared with 31,000 tons in 1912. No considerable addition to plant was made. The chief new development-work done was driving a new slope—No. 5. High railway freight rates prevented the Nicola Valley Coal and Coke Company from extending its market, so its output of coal was comparatively small—about 110,000 tons, as against nearly 143,000 tons in 1912. In addition to continuing operation of mines previously worked, the company opened Nos. 7 and 8 mines. In No. 7, situated near the top of Coal Gully hill, the main slope has been sunk 500 feet and is being extended; from this a number of working-places have been opened off, giving the mine a present output-capacity of nearly 200 tons of coal a day from a 16-foot seam of excellent coal. In No. 8 there is a 6-foot 6-inch seam which is promising, but sufficient development has not yet been done to determine its value as a producer. The company could mine and ship 750 tons a day if called upon, but there is not a present demand for so much. Even the Canadian Pacific Railway Company's requirements of coal are smaller now than in the past, as many oil-burning locomotives have been substituted for coal-burners. The Diamond Vale Collieries Company increased its small output from 3,300 tons in 1912 to 6,300 tons in 1913, and the Pacific Coast Colliery Company made a beginning with a production of 462 tons of coal.

There was little change in the Similkameen field. The output of 28,800 tons made by the Princeton Coal and Land Company was only a few hundred tons larger than in 1912. The United Empire Company made little progress, its output having been quite unimportant. The Columbia Coal and Coke Company's property changed ownership, and its new owners commenced to develop a different part of the property to that in which the first management of the Columbia Company had done much work without profitable result.

Both the Crow's Nest Pass Coal Company and the Hosmer Mines, Limited, made a larger production of coal in 1913 than in 1912. The output of the first-mentioned company was approximately 1,041,000 long tons of coal, gross, or, after deduction of 333,000 tons made into coke, 708,000 tons net. Its coke output was 225,480 long tons, as against nearly 219,000 tons in 1912. During the year the company developed what is known as "B" seam, which lies 320 feet above No. 1 seam of the Coal Creek measures, and thus provided for a present addition of about 500 tons a day to the producing-capacity of its Coal Creek Colliery. At its Michel Colliery, the company developed two new mines above the old workings of No. 8 on the north side of the valley, and in this connection a skip incline was constructed to convey the coal down the mountain to the tipple level, the incline grade starting at 30 per cent. and increasing to 60 per cent. toward the lower end. The skips or cages carry 8 tons of coal and are easily controlled by rotary multiple brakes over a distance of 1,280 feet in eighty seconds. A profitable production is expected from these new openings in the ensuing year. Much prospecting-work was done on the south side of the valley, where a new seam was found about 150 feet above No. 3 seam. A working section of about 10 feet of coal of generally good quality was opened here. As indicating favourable working conditions throughout the last year, it may be mentioned that the output of the company's Coal Creek Colliery exceeded that of 1910 (1911 was not a full year as regards operation of mines) by about 230,000 tons, while the quantity of coke made at the ovens at Fernie was about 9,600 tons greater than that of the previous record year, and nearly 44,000 tons higher than the coke production of 1910. There is promise of considerable improvement at both Coal Creek and Michel Collieries in 1914, especially at the mines of the latter, and it is hoped that the economic development-work now in progress at the Coal Creek mines will materially enhance the general results.

Only a brief summary of the year's operations at the colliery of the Hosmer Mines, Limited, has been obtained. The output of coal was about 237,500 long tons, gross. Approximately 107,000 tons was used in making coke, leaving a net output of coal of 130,500 tons. The amount of coke made was about 59,000 long tons. The increase for 1913 as compared with 1912 was, therefore, in gross production of coal, about 49,000 tons (or 14,000 tons net), and in coke 14,200 tons. There was not any new mining development during the year. Improvements and additions to the plant included double-tracking "B" incline and adding another drum to the engine operating the same; installing an 8-foot diameter Sheldon-Keith wheel-fan for ventilating "No. 2 B" south mine; and providing a steam-locomotive for the rock bank and boiler-coal.

At the Corbin Colliery, a fire, due to spontaneous combustion, necessitated the closing of No. 1 mine in April, and it was kept closed throughout the remainder of the year. No. 4 mine was opened after No. 1 was closed; it is on a seam which is really a branch off the No. 1 seam, and has a present production of about 250 tons a day. No. 3 mine, known as the "Big Showing," was provided with transportation facilities, the railway to it from Corbin, eight miles in length, having been completed in the first half of the year. This mine is situated nearly 1,000 feet higher than No. 1, which is near the level of the valley. In No. 1 mine the coal-seam is nearly vertical and varies greatly in size. W. W. Leach, of the Geological Survey of Canada, described it as varying from a minimum thickness of 10 feet to a maximum of nearly 250 feet. This great difference, he said, may be due to compressed monoclinal folding. At the upper mine the coal has been stripped of the overburden near the top of the hill, and it is shown in a synclinal basin about 370 feet in width, the thickness of the coal near the centre having been proved by drilling to be more than 100 feet. During the summer and autumn, coal in No. 3 mine was worked in open-cuts by a steam-shovel, and sent down the switchback standard-gauge railway for shipment. The snowfall being heavy, open-cut working is not practicable in winter, but about 150 tons of coal a day is being mined underground here. A Marcus screen has been purchased for this colliery, but it will not be put in until next spring.

Of the new coal fields in various parts of the Province there is little to report so far as concerns the probable early production of coal. In the Upper Elk River District, so far as known, there was not any advancement made toward the utilization of the large quantity of coal occurring in that part of the Province, which has been estimated by D. B. Dowling, of the Geological Survey of Canada, as covering an area of 140 square miles, and containing approximately 14,000,000,000 tons of coal that can be mined. Until railway transportation shall be provided, this important district will remain undeveloped. Neither in the northern part of Cariboo District nor in the North Thompson River country, in both of which coal is known to occur, is there present prospect of production. Prospecting-work done on coal-measures on Graham Island of the Queen Charlotte group has not yet resulted in any production of coal worth mentioning. More development-work has been done on coal properties in parts of the Skeena District tributary to the Grand Trunk Pacific Railway, the construction of which is now nearing completion, and some attention has also been given to properties in Groundhog basin, in the northern part of Skeena District, but the latter is without transportation facilities, and not much progress has been made.

Miscellaneous.

No production of platinum in 1913 has been reported, neither from Tulameen District nor from the vicinity of Nelson. Nor has anything more been heard concerning diamonds from rocks in the Tulameen country, the earlier discovery by the Geological Survey still remaining purely of scientific interest.

Some drilling for oil in South-east Kootenay was done, but as yet without results of commercial importance.

The demand for structural materials—stone, cement, clay products, etc.—has not been so great latterly as in 1910 and 1911, so the value of the output of this class of non-metallic minerals was probably lower in 1913, and in the absence of

data on which to base calculations no definite statement can be made. The marble-quarry in the Ainsworth Mining Division was worked and marble was shipped from it. Near Victoria, on Saanich arm, a second cement-manufactory was started, and near Princeton a beginning to produce cement was also made, but in neither case was a large output made. The Vancouver-Portland Cement works at Tod Inlet continued to make an important production. The destruction by fire of the large pottery-works at Victoria has added to the decrease in production of structural materials, but this loss in output is only temporary, the erection and equipment of new works having been provided for.

MINING DISTRICTS OF BRITISH COLUMBIA.

In order to give a general idea of the mineral deposits, mines, and reduction-works of British Columbia, a summary of these, together with an outline of the chief features of the operations during 1913 in connection with the mining and metallurgical industries of the Province, will now be presented. As the mining districts are numerous and cover a large area of territory, the information that follows is, necessarily, incomplete, for it is not practicable in a general review to give particulars of all that should have notice were space available. The various districts and their respective subdivisions will here be briefly dealt with and in the order in which they usually appear in the Annual Reports of this Department.

CARIBOO DISTRICT.

Three mining divisions are usually included under the general head of Cariboo District—namely, the Cariboo, Quesnel, and Omineca Divisions. In this district mining operations are restricted almost entirely to placer-mining, there being little, if any, other productive mining. Doubtless this extensive area possesses great potentialities in its undeveloped lode-mineral resources, and in much smaller degree, perhaps, in coal, but the fact that heretofore it has been entirely without railway transportation facilities has been an effective bar to the utilization of those resources. However, railway-construction has already been sufficiently advanced through the extreme northern portion of the district to have already in small measure benefited it, and as the construction of a railway from the south is in progress which will eventually give rail connection with tide-water in one direction and the Grand Trunk Pacific transcontinental railway in the other, there is good reason to look for a removal, possibly within a year, or at most two years, of this chief disability under which the district has so long laboured.

Passing mention has already been made of the 1913 season in Cariboo—that it was a short one for placer-mining. The spring opened late and the gravel-washing season closed early, so that the time suitable for actual mining operations was shortened both at the beginning and the end of the season. However, while it was practicable to operate, there was plenty of water, and in Cariboo Division, though not in the Quesnel Division to any considerable extent, full advantage was taken of the advantageous conditions prevailing throughout the working period.

Cariboo Mining Division.

As in other years, there has not been received by the close of the year under notice much information relative to what properties were worked and with what results. An exception is in connection with the operations of John Hopp, who worked three of the four hydraulic placer mines he holds, situated on Williams creek and some of its tributaries. These three were the *Lowhee*, *Mosquito Creek*, and *Stouts Gulch*; the *Forest Rose* was not operated in 1913. With the exception that, unexpectedly, it became necessary to do a lot of dead-work in the *Lowhee* pit, the season was a satisfactory one, results, notwithstanding the comparatively short run, having been well up to those of most ordinary seasons.

The West Canadian Deep Leads, Limited, which had previously done much work in sinking a three-compartment shaft, with the object of reaching bed-rock and then driving in search of beds of rich gravel, was working this year on a drain-tunnel, but so far as known has not yet recovered much gold. Other companies that have operated in recent years and some of which were at work in the 1913 season are as follows: The Lightning Creek Gold Gravels and Drainage Company, Limited, on

Lightning creek; Lightning Creek (British Columbia) Hydraulic Mining Company, working the *South Wales* ground; Ogden Gold Mining Company, on Lightning creek; Venture Mining Company, on Peters creek; Wormwold Creek Mining Company, on Wormwold creek; Four-Leaf Clover Hydraulic Mining Company, on Perkins gulch; Summit Creek Hydraulic Mining Company, on Summit creek; Cooper Creek Mining Company, on Sugar creek; and others on Mustang creek, China creek, Nugget gulch, Waverley, and several more. Boring was done to test the Pleasant Valley ground and determine its suitability or otherwise for dredging. Little more than the assessment-work necessary to keep them in good standing was done on the mineral claims in the Division held by various owners.

To give an idea of the general position in the Division, the following is quoted from the last published report of the local Gold Commissioner: "The actual mining receipts show an increase over those of last year by nearly $3,000, and the records of placer claims and placer leases issued also show an increase. In this district there are now 390 placer leases in good standing and thirty-two record placer claims, of which there have been taken up this year fifty-four leases and twelve record claims."

Quesnel Mining Division.

As compared with former years, comparatively little work was going on in this Division this past season and the output of placer gold was small.

In past years the most important operations were those carried on at *Bullion*, the property formerly operated by the late J. B. Hobson and later acquired by the Guggenheim interests, under whose ownership it has remained unworked for the last few years; the extensive plant and water system having been left to the care of a watchman.

In the latter years of the working of this pit the sluice-grade had risen and was finally some 80 feet above bed-rock, leaving that depth of the best gravels untouched.

To reach this gravel with a sluice-grade, about the last work Mr. Hobson started there, was a tunnel from the Quesnel river, through the solid rim-rock, at such a level as to come below this gravel and so regain bed-rock operations.

Late this fall a lease and option on the property was obtained from the present holders by R. T. Ward, formerly of Horsefly, and associates, who intended, this winter, to rehabilitate the plant and to work next year.

In the meantime, however, in the belief that the Guggenheims had legally abandoned the property, it was restaked as open ground by several others, and it seems probable that the ownership of the ground may have to be decided by the Courts, leaving little probability of its being operated next season.

The Quesnelle Hydraulic Gold Mining Company, whose extensive installation at Twenty-mile creek and splendid water system, probably the best in British Columbia, have been described in the Reports of this Department, did not do any work this season, the plant being in charge of a watchman.

The results of the company's operations in 1912 did not come up to expectations as regards the amount of gold recovered per cubic yard of gravel moved, not being anywhere near what the previous extensive sampling had indicated. The question has been seriously considered by the company as to whether the manner in which the hydraulic operations were conducted in 1912 were such as to recover any important proportion of the gold present, and it is probable a second attempt at hydraulicking will be made in 1914 under different management.

The efficiency of the water system was proved to be all that could be desired, and the company officials claim the cost of moving the gravels, etc., was reduced to 1.3 cents per cubic yard.

The hydraulic property on Spanish creek, held by the late J. B. Hobson and since his death acquired by John Hopp and associates, was, for some reason, not operated this past season.

On Keithley creek about the usual amount of work was carried out by small operators, and some gold was recovered.

On the South fork, as usual, a number of Chinese were at work on benches and bars, saving some gold.

On Moorhead creek, the Moorhead Mining Company has been operating a small hydraulic plant on the left bank some two miles up from the mouth. The gold-tenure of the deposit seems to have been satisfactory, and a substantial amount of gold recovered, although information as to the quantity is still lacking.

The operations of the company have been limited by a small water-supply under a very slight head, which has been taken out of Moorhead lake; this water belonged to the water rights of the old Bullion Company. Until the ownership of this water-supply shall have been decided or some other source of water obtained, the company cannot do any effective work.

John McReay, formerly of Quesnel Forks, and associates have been working for the past couple of seasons on the Clearwater river, over the divide from the East arm of Quesnel lake. A small force of men will be kept on the ground all winter; it is reported that the results so far obtained offer considerable encouragement as to the future.

The Water Tight Dipper Dredge and Mining Company, Limited, a Calgary company, has been engaged all season in building a dredge, of a pattern peculiarly its own, on the bank of the Quesnel river, near the mouth of Moorhead creek. By the end of the season the scow was about completed, and the machinery, most of which was on the ground, is expected to be installed before next spring, when an attempt to launch the completed structure will be made.

The dredge is being built for the purpose of dredging the bars and bed of the Quesnel river, on which the company holds two placer-dredging leases from Quesnel Forks down-stream.

Omineca Mining Division.

The Omineca Mining Division, with recording office at Hazelton, is probably the largest in the Province, and its various sections differ materially in every way.

Omineca River Section.—The section embracing practically all the watershed which eventually drains into the Peace river is sometimes spoken of as the Omineca River section. This is exclusively a placer-gold district and was the scene of the Omineca gold excitement in the 70's, since when small placer-mining operations have been continued. But, as the individual workings became exhausted and recourse had to be had to machinery and plants, the remoteness of the section from transportation was almost prohibitory to success.

Within the past few years active interest has been again manifested in the section, as was indicated by the Gold Commissioner in his report for 1912: "In the Omineca River section there has been a marked activity, thirty-eight new leases having been taken up and many transfers being made, the tendency being for the consolidation of the leases in financially strong hands, owing to the necessity of installing heavy machinery."

This past season it is understood that the Omineca Gold Mines, Limited, has been actively engaged in prospecting and developing placer ground on Slate creek, where what is thought to be an old channel has been discovered, and it is reported this will be operated next season.

The Kildare Company, an Ottawa organization, is stated to have been employing a number of men on the company's leases on Slate creek, under the management of G. W. Otterson.

Considerable work is reported to have been done, repairing old ditches, etc., while a large amount of heavy machinery is said to be in Hazelton awaiting transportation over the snow this winter. The management claims that the development has proved very satisfactory and fully justifies the installation of the plant.

H. B. Perks reports that he has been employed all summer by the Royal Standard Company, testing its leases by sinking some fifty pits on Germanson creek, and, while bed-rock was not reached in any instance, that the gravel tested high enough to warrant operations being continued.

While, as will be seen, a very considerable amount of work has been going on, it has chiefly been preparatory rather than productive, and it is not expected that any considerable output of placer gold has been made this season.

In the southern portion of the Division, in what might be called the "Hazelton section," and along the line traversed by the Grand Trunk Pacific Railway, there has been considerable activity in the development of lode mines, and the Division this year began to make appreciable shipments of ore.

The *Silver Standard* shipped nearly 300 tons of high-grade gold-silver-lead ore, and the *American Boy* and the *Omineca* are each reported to have shipped a car-load of argentiferous galena; while the *White Heather*, on Toboggan creek, made a trial shipment of some 3 tons, running over 100 oz. of silver to the ton and over 40 per cent. lead.

Prospecting continues to be carried on on the mountains north of Hazelton with a fair measure of success, while reports from the Rocher Déboulé camp indicate a considerable amount of ore in sight, of a grade to permit of profitable mining and shipping.

The claims on Hudson Bay mountain have been developed with, it is reported, satisfactory results.

Altogether, it seems probable that in the near future the Hazelton section will have become a substantial contributor to the lode-mining industry.

While nothing new of an encouraging nature has been heard from the Groundhog coalfield, it is known that prospecting has been continued, and the results will be looked forward to with interest.

The coalfields on the headwaters of the Zymoetz and Morice rivers, to both of which access would be had from Telkwa, on the Grand Trunk Pacific Railway, have both had development-work done on them, and have been examined by coal-mine engineers, whose reports give encouragement that workable fields will be developed.

A certain amount of placer-gold mining was attempted on Gold creek near Kitsalas, and a small amount of gold recovered. The operators, A. St. Marie and associates, obtained from their workings heavy particles of a light-coloured metallic substance which local and California experts told them was platinum, but which was found in the Government Laboratory to be *arquerite*, a native amalgam of silver, without a trace of platinum.

CASSIAR DISTRICT.

The extensive area known as the Cassiar District includes the following mining divisions: Atlin, Stikine, Skeena, Queen Charlotte, and Portland Canal.

Atlin Mining Division.

Atlin has become the most important placer-gold district in the Province, and is estimated to have produced this past season about $320,000 worth of gold, which represents about 60 per cent. of the Provincial output. This is an increase of 10 per cent. over last year, and is the greatest output the camp has made since 1908.

It is encouraging to note this increase in a placer camp, for, while it was assisted by a favourable season as to weather and water-supply, it was chiefly obtained by increments on old properties and the development of new producers.

Pine Creek.—The Ruffner properties on Pine creek still continue to be the most important in the camp. The Guggenheim properties on Tar flats, held under lease by the Ruffner companies, are reported to have done better than usual, the output, in default as yet of official figures, being estimated at about $75,000. The North Columbia Hydraulic is likewise estimated to have produced about $45,000, probably a little less than last year. There are few individual miners on Pine creek, and they are not expected to have made any important output.

Boulder Creek.—The Black claims are the most important on this creek, which, together with the individual miners, are expected to have produced about $10,000 worth of gold. *Gold Run* did not make any material production this year.

On Birch Creek, H. P. Pearse was the most important producer, being estimated to have obtained about $10,000 while individuals obtained from $2,000 to $3,000.

On Otter creek, J. E. Moran is estimated to have obtained some $4,000.

The miners on Wright creek are said to have obtained from $4,000 to $5,000.

On Ruby creek, T. M. Daulton's company, the Placer Gold Mines, is reported to have done exceptionally well, having, after some years' preliminary development, struck very rich ground. Of this fact there seems little doubt, but as to the amount of gold recovered there is a wide margin between the various unofficial estimates obtained; but it seems safe in this preliminary estimate to credit the company with $35,000.

The company is said to have had delivered in Atlin some $12,000 worth of high-carbon steel plates for lining its sluiceways, so it would appear as though the company not only had money in hand, but also high expectations from its property. The development of this property is one of the new features of the camp this past season.

On Spruce creek, it is reported that the Spruce Creek Power Company did not operate. On the *Gladstone* lease, James McCloskey, though said not to have taken out quite as much as in 1912, is still credited with some $45,000.

Individuals working on Spruce—of whom there are quite a number—are reported to have realized in the neighbourhood of $44,000; included in this are material outputs by McPherson, Matthews, and others.

Only a small output is expected from Wilson creek, probably not over from $1,000 to $2,000.

On McKee creek, the individual holdings have been pretty well absorbed by the one large company operating on the creek, the Pittsburg-British Gold Company, which is reported to have had a successful season and to have recovered about $35,000, from which it is unofficially reported dividends were paid to the extent of $10,000.

O'Donnell river seems to have proved attractive to J. M. Ruffner, who has been developing property there, since he had not "come out" by the end of the year, and consequently definite information is as yet lacking. He is said to have been meeting with fair success, although his output this year is not expected to be much over $3,000.

The area of the Atlin placer-gold field seems to be gradually extending and promises well for a continuance of its production.

Mineral Claims.

The only lode mine producing in this Division is the property of the Northern Partnership—formerly the *Engineer* group—on the east side of Taku arm. The property is and has been equipped for some years with a 2-stamp mill, which has been in operation for a considerable part of this past season, producing a certain amount of gold—how much is not known, although it is claimed that the quartz treated was quite rich.

O. H. Partr[illegible] and Hon. M. Edgerton were developing the *Ben M'Chree* at the southern end of Taku arm, but appear to have at least temporarily abandoned that work, and have been engaged in development-work on the *White Moose*, on the west side of the arm—not on the old location on the beach, but some distance up the hill to the westward—with what they claim to be very satisfactory results.

The claims in Rainy Hollow, on the headwaters of the Klehini river, do not appear to have had much attention this past season, further than the assessment-work necessary to keep them alive.

Good roads have been built into the district, but no serious work has resulted on the claims, nor any output recorded.

Stikine and Liard Mining Divisions.

In the Stikine Division proper there is no mining going on, and as far as is known very little prospecting; all that has been heard of is a little on the Iskut river by the Iskut Mining Company. There is no placer-mining in this Division.

The south-eastern portion of the Division includes a large part of the Groundhog coalfield, which was described in last year's Report, and in which during this past season work has been confined to prospecting, with no serious development, and nothing further has been learned that would indicate the future of the camp.

In the Liard Division the only work going on is a certain amount of placer-mining in the vicinity of Dease lake.

The only important workings there are those of the Boulder Creek Mining Company, operating a hydraulic plant on Thibert creek, fully described in last year's Report.

This company has been at work all season, working in the new pit, which is reported as proving very satisfactory and producing a fair amount of gold, the exact amount not yet being known.

The flats at the mouth of Dease creek, described in the Report mentioned, have this year been the scene of extensive drilling operations by two companies, for the purpose of testing the gold-content of the gravels, which, if these preliminary operations prove satisfactory, will lead to the establishment of a dredging plant, to which mode of working the ground is eminently suited.

Queen Charlotte Division.

As yet, no report of actual production this year has been received from the Queen Charlotte Division. On Graham island, prospecting for coal has been carried on by several parties in the interior of the island, but the results so far obtained have not as yet proved coal of commercial importance.

Boring for oil has been going on at the north of the island, without having met with success.

The British Pacific Coal Mines, which partly equipped a colliery on Skidegate inlet last year, has apparently not continued work to any great extent, nor become a producer.

The very interesting discovery was made that a part of the seam opened up at this place consisted of a peculiar form of carbon, which has been classed by a Russian geologist as *schungite*, and is described as an intermediate state between anthracite and graphite.

The practical peculiarity of the mineral is that, while it has all the appearances of being good coal, it will not burn and cannot be ignited in a blast-gas flame.

On Moresby island, on the east coast, the usual amount of development and assessment work has been done on the claims near Lockeport and at Ikeda bay, while work has also been done on Huston inlet claims and on Copper island, Kunghit island, and Collisou bay.

On the west coast of the island, on Tasu harbour, important work has been carried on all year by R. R. Hedley and associates in developing a copper property containing magnetite impregnated with copper-pyrites.

A crossent adit tunnel has been driven in for 300 feet, which, according to Mr. Hedley's sampling and assays, cuts several bands or zones of mineralization. One band 40 feet thick assayed 2.5 per cent. copper; another, 13 feet thick, 2.85 per cent. copper; and the balance about 1.5 per cent. copper, with a little gold and silver.

On account of the excess of iron in the ore, it proved so attractive to the smelter that Mr. Hedley has been offered smelting rates practically free of charge. Mr. Hedley hoped to be able to ship several hundred tons before the close of the year, but it is not known whether he succeeded in doing so.

Skeena Mining Division.

The most important development in this Division and on the Coast has been the progress made at Granby bay, on Alice arm of Observatory inlet, by the Granby Consolidated Company in equipping its *Hidden Creek* mines with a mining and smelting plant capable of treating 2,000 tons of ore a day.

A review of this sort will not permit of a detailed description of the plant; it is sufficient to say that it will be up to "Granby standard," and will include a

most up-to-date mine equipment, while the smelting plant will include blast-furnaces, converters, etc. A great part of the plant has already been erected, and it is a most certain that the summer of 1914 should see it in operation.

The mine has been already described in the Reports of this Department, but it might be said that the company estimates it has blocked out above the working-adit 8,000,000 tons of 2.2-per-cent. copper-ore, which estimate is practically endorsed by the mining engineer sent by this Bureau to examine the property.

An average of about 1,000 men has been employed during the summer of 1913.

On Alice arm, in addition to the Granby Company's holdings, this Bureau has official reports showing that some twenty miles up the Kitsaulte river, which flows into Alice arm, there are deposits of copper-ore of a workable grade which the present development would give good reason to believe are of very considerable extent, rendering it probable that this section may also develop into an important copper camp.

Near the Granby Company's property—but not included in it—seemingly extensive bodies of copper-ore have been found on the *Bonanza* and *Groundhog* claims.

It certainly would appear as though the mineral wealth of this section was just beginning to be discovered.

At Kwanitza, forty-five miles up the Grand Trunk Pacific Railway from Prince Rupert, salt has been discovered, and a small quantity extracted in an experimental way.

A large basin occurs at this point on the creek, and on the edges of the basin brine was found to be seeping out. Some four boreholes have been put down in the basin, and each yielded a heavy brine, carrying about ¾ lb. salt to gallon of brine. One of the holes had at the bottom crystalline salt mixed with clay.

While much yet remains to be proved, it seems probable that the basin contains a large deposit of salt. The quality of the salt evaporated in a crude evaporating-pan on the claim is very pure and quite up to commercial standard.

The properties on Princess Royal island, owned by the Surf Inlet Gold Mines, Limited, described in last year's Report, and which were expected to produce this season, have not yet been equipped and made no output.

Portland Canal Mining Division.

As far as can be learned, there has been no ore shipped from this Division this year.

In the Glacier Creek section of the Bear River district, the properties are all awaiting the development of the 2,500-foot tunnel being driven by the Portland Canal Tunnel Company. This tunnel had at the end of the year just struck the crush zone in which the ore was found 2,000 feet higher, but as yet no development has been done at the tunnel level.

No further development has taken place regarding the *Red Cliff* and no ore has been produced.

D. G. Forbes reported on the Salmon River claims for this Bureau, and considers that the present development gives substantial expectation of the development of large ore-bodies of workable grade.

EAST KOOTENAY DISTRICT.

South-east Kootenay.

Some particulars of the coal-mining operations in the Crowsnest section of East Kootenay have already been given, those showing that two of the three operating collieries made a greater production of coal and coke than in 1912, while the third one opened a large deposit of coal from which it is expected a considerable output will be made next summer and autumn.

Of the metal-mining properties, there were only two in South-east Kootenay that produced ore in larger quantity than a car load. These were the *Sullivan* group, near Marysville, and the *St. Eugene*, at Moyie. The *Society Girl* was worked during part of the year, but only shipped a single car-load of ore.

Sullivan Group.—The following brief reference was made to this property in the recently issued annual report of the Consolidated Mining and Smelting Company of Canada, Limited: "Development of the *Sullivan* group has been satisfactory in opening up new ore, and the mine should continue to produce for a good many years to come." That report covered a period of fifteen months, to the end of September, 1913, during which period the *Sullivan* produced 41,284 tons of ore containing 448,379 oz. of silver and 23,411,667 lb. of lead, giving an average of 10.86 oz. of silver a ton and 28.35 per cent. lead.

During the calendar year the mine was worked steadily with a force of about 100 men, and there was much development-work done, besides the shipment of about 34,000 tons of ore to Trail. The development-work included driving two lower levels north, and, in addition, a lot of diamond-drilling was done. Additions to plant included auxiliary steam-boilers at Mark creek, so that the 30-drill compressor there may be driven altogether by steam, or by part steam and part water, when water-power is not available or insufficient. Building improvements made were: New machine, blacksmith, and carpenter shops; dry-house, storehouse, etc., and, in connection with accommodation for the employees, a large dining-room and kitchen. A steam-heating system was put in at all the men's buildings.

Reverting to the mine—the development-work done resulted very satisfactorily, the reserves of lead-ore having been considerably increased, and much of the ore opened having proved to be of a higher grade. The zinc-lead ore sorted out before shipment of ore to the smelter is stored for later treatment whenever a suitable plant shall be provided.

St. Eugene.—From twenty to twenty-five men were employed at this mine, doing hand-work, the mill not having been operated, and consequently no power was available for machine-work. Some development was done, with encouraging results.

North-east Kootenay.

The *Monarch* mine and concentrating-mill, situated near Field, in Golden Mining Division, were operated by the Mount Stephen Mining Syndicate, of Vancouver, which, during part of the year, shipped its lead product to Kingston, Ontario, and at other times to Trail. Zinc-concentrate is also made at the mill, and this has to find a market in the United States.

The construction of the Kootenay Central Railway was in progress all the year and steel was laid over a considerable distance, both south from Golden and north from the Crowsnest Railway. A length of this railway from the Crowsnest line north to Fort Steele was opened for traffic, while freight was brought south from the Canadian Pacific Railway main line to places along the Columbia river. It is hoped that, when this railway shall be completed, there will be some metal-mining done in Windermere Mining Division.

WEST KOOTENAY DISTRICT.

West Kootenay District has long been one of the most important in the Province as a metalliferous-mining region, though in some years Boundary District has produced metals of a larger total value as well as a much greater quantity of ore. The metals produced in West Kootenay are gold, silver, lead, copper, and zinc, which comprise all the lode metals of commercial value obtained in the Province. Rossland, in Trail Creek Mining Division, has long been its most productive mining camp. Next in importance come Slocan, Ainsworth, and Nelson Divisions, with Trout Lake Division one of the small producers. There are other divisions, but no mining of importance has been done in them in recent years.

Ainsworth Mining Division.

There was more mining done in 1913 in Ainsworth Division and a larger production of mineral made than for several previous years. From the incomplete returns so far received, it appears that twice as much lead was produced in 1913 as in 1912, while the increase in silver seems to have been about 50 per cent.

The *Bluebell* mine, owned by the New Canadian Metal Company, and situated on the east shore of Kootenay lake, mined about 78,000 tons of lead-silver ore; from that quantity approximately 8,000 tons of lead-concentrate was produced and shipped to Trail. No marked progress was made toward realization of the zinc resources of this mine, but the storage of some of the middling zinc-bearing material has been commenced. Development-work was continued at depth, and the third level below Kootenay lake is being approached. There was not any important construction-work done at mine or mill during the year, nor was there any noteworthy change in the plant.

The Consolidated Company did much work on its *Highland* and *No. 1* properties. The *Highland* group was bought during the year, and the development done on it resulted satisfactorily. The ore is a clean galena ore, with medium value in silver. Besides doing a lot of crosscutting and drifting, a new adit tunnel was commenced at about 200 feet lower down the hill. The aerial tramway, 4,000 feet in length, from the mine to the mill was repaired and the mill plant overhauled. A compressor driven by water-power was put in at the mill, and a 6-inch air-line to the mine constructed. At the close of the year an hydraulic plant was being installed at the mill, including Pelton wheels and generator, with water being brought from Cedar creek, 1,000 feet above the mill-level. It is intended to generate here sufficient power for all the company's properties in the camp. The aerial tramway from *No. 1* group to the lake-front is 9,000 feet long; it was constructed in 1912, and since then the lower terminal has been so arranged as to allow of delivery of ore directly into barges. The main working-tunnel of the mine was straightened, and from it a shaft was sunk 100 feet and drifting commenced from the bottom. A motor-driven compressor was installed at the mine, the current for operating it coming from the *Highland* mill. The company bonded several other properties in the camp and did work on them, and in connection with these it acquired the Taylor hydraulic air-compressor on Coffee creek. About 160 men in all were employed in the camp by this company. The *Silver Hoard* mine was worked by a Spokane (Washington) company, which continued the development of the property and shipped some 1,250 tons of ore. The Florence Mining Company, also of Spokane, was engaged in driving two tunnels on its group on Princess creek, north of Ainsworth camp, using two 3-drill compressors to supply air for the machines. In the western part of the Division, the *Utica* shipped 650 tons of ore, notwithstanding transportation difficulties occasioned by the reconstruction of the line of the Kaslo & Slocan Railway. The Eagle Lode Mining Company, of Spokane further developed the *Eureka*, and J. L. Retallack & Co. worked the group of mines near Whitewater, doing much development-work and shipping more than 500 tons of ore. Work was also done on the *Panama*, which shipped silver-ore, while a little zinc-ore was sent out from the *U.S.*, in Jackson basin. The marble-quarry north of Kootenay lake was worked, but no particulars of shipments of marble have yet been received.

Slocan and Slocan City Divisions.

Slocan Division had, on the whole, its best year in mining for a comparatively long while. With a few exceptions, notably the suspension of work and production at the *Lucky Jim* mine, good progress was made. The *Rambler-Cariboo* had its first full year of mining and concentrating operations since the early 90's. Development-work was done on the 1,200-, 1,300-, and 1,400-foot levels of the mine, and ore was mined in these and in the 900-foot level. The quantity of ore shipped crude to Trail was about 750 tons, and of silver-lead concentrate more than 2,000 tons, besides which approximately 1,000 tons of zinc-concentrate was shipped to Bartlesville, Oklahoma, U.S.A. At the mine forty-eight men were employed and fifteen at the mill.

The low-level crosscut adit being driven on the *Payne* property was in nearly 2,700 feet by the end of the year, with 500 feet more to be driven to get to where it is expected the vein will be cut.

Near Sandon, the *Richmond-Eureka*, *Ruth-Hope*, and *Slocan Star* were all worked throughout the year. The *Richmond-Eureka* shipped about 1,000 tons of ore and

kept a small number of men steadily employed, but no developments of importance resulted. The output of the *Ruth* was about 500 tons; no information was obtained concerning work on the property. The *Slocan Star* mine was developed considerably, and ore was found at greater depth than in previous years. The most striking development was in No. 8 level, where, early last October, a shoot of high-grade silver-lead ore was encountered. The mine superintendent reported this ore-body to contain 2 feet of clean ore and 4 feet of concentrating ore. Drifts had been run east and west, and when the last report was received there was similar ore in both faces, while in the eastern drift the face showed the ore to be twice as wide. Between 400 and 500 tons of first-class ore shipped to Trail averaged about 88 oz. of silver to the ton, 55 per cent. lead, and 7 per cent. zinc. At the annual meeting of shareholders in the company, held in December, it was stated that results obtained had fully justified the deep-level development undertaken about two years ago, and the outlook for the mine was believed to be promising. The *Surprise*, above Cody, and the *Noble Five* group near by, were both worked the greater part of the year. The large quantity of ore found at considerable depth in the *Surprise* convinced the owners of the wisdom of having persisted in their policy of deep development. Results in the *Noble Five* group, too, have been satisfactory, and the work of driving an adit at greater depth has been commenced. Neither of these mines made heavy shipments in 1913, the *Surprise* having sent out but 300 tons and the *Noble Five* less than 100 tons of silver-lead ore and some zinc-ore; both mines are expected to have better transportation arrangements in 1914 and to ship more ore.

The most satisfactory results in the Slocan Division were those achieved by the Standard Silver-Lead Mining Company, which mined about 56,000 tons of ore, of which rather more than 4,000 tons was shipped crude and nearly 52,000 tons put through the concentrator. The mill products were 9,860 tons of silver-lead concentrate and 5,440 tons of silver-zinc concentrate; much of the latter product was shipped to Oklahoma late in the year. The metal contents of the ore and concentrates were: Silver, 1,206,000 oz.; lead, 16,634,000 lb.; and zinc, 4,680,000 lb. New shoots of ore were found on several levels of the mine, and the amount of ore in sight appeared to be larger at the close of the year than at the beginning. No. 7 adit was in well on toward 3,000 feet by the end of the year; it passed through one large shoot of ore, but the development of that ore-body is being deferred until after the adit shall have been driven far enough to get under the ore-shoots being worked from No. 6 adit. A second compressor was put in below the mine and more concentrating plant added at the mill. Last summer the working force at the *Van-Roi* mine was reduced, and the concentrating-mill was idle for two months while development-work was being done at the lowest level opened in the mine. More ore having been found, the mill was again operated, and since then both mine and mill have been kept going. The year's output was reported as having been 25,600 tons of ore, from which was made 688 tons of silver-lead and 840 tons of silver-zinc concentrate. As the ore found on No. 9 level is of as high an average grade as any previously taken out of the mine, this is regarded as auguring well for the mineralization of the veins at depth. The management of the Silverton Mines, Limited, owning the *Hewitt-Lorna Doone* group, was disappointed when its newly erected concentrating plant was found to be unsuitable to the requirements of the available ore; however, the mill is being reconstructed by the Minerals Separation American Syndicate with the object of treating the *Hewitt* zinc-lead-silver ores by flotation. The results that shall be obtained by this process will be taken as a criterion of what it will be practicable to do on similar Slocan ores containing sphalerite, galena, ruby-silver, siderite, etc. It may be mentioned, in this connection, that zinc-lead ores containing much siderite as gangue offer a far different and more difficult concentration problem to that of zinc-lead ores with a siliceous gangue, the siderite making it necessary to do the primary flotation without the use of acid, which is a much narrower application of the flotation process than where acid can be used if desirable.

Before passing to notice of other parts, it should be mentioned that a number of Slocan properties besides those above mentioned had work done on them in 1913.

These include the *Alamo-Idaho* group (which shipped about 300 tons of ore), *Apex, Cinderella, Ivanhoe, Mountain Con, Reco, Colonial, Wonderful Lucky Thought, Hartney, L.H.*, and others.

In Slocan City Division, the purchase of the *Ottawa* property by the Consolidated Company was one of the most important mining events of the year, for this company will doubtless do much work to thoroughly explore the mine. The *Eastmont*, on Ten-mile creek, shipped 337 tons of ore, the *Neepawa* three cars, and the *Black Prince, Lily B., Meteor*, and several others smaller lots of ore.

Nelson Mining Division.

In this Division, the operations of the Consolidated Company on the *Silver King* and the *Molly Gibson* groups, and those of the British Columbia Copper Company on the *Eureka* and *Queen Victoria*, were of much importance to this part of the Division, the steady working of those several properties having given good results, not obtained by intermittent working in previous years. Most of the work done on the *Silver King* group was in putting in order the long aerial tramway from the mine down to Nelson, and in driving the *Dandy* tunnel so as to make connection with the *Silver King* shaft at about the 800-foot level. This tunnel is probably more than 2,000 feet long. Much work was done in timbering old levels and stopes. Between 2,000 and 3,000 tons of ore was shipped to Trail, this having been taken out in the course of development. The mine was unwatered to the bottom (1,000-foot) level. Besides doing development-work, diamond-drills were used freely in exploring the ground. More buildings were erected, compressors and other machinery put in working-order, an electrically driven pump installed on the bottom level, and things generally got in good order for permanent working. From seventy to seventy-five men were employed.

At the *Molly Gibson*, results of development-work in the lowest level were satisfactory. The shoot of silver-lead-zinc ore opened, while not very wide, was fairly continuous and of good grade. Snowslides last winter having taken out two miles and a half of the aerial tramway, this had to be reconstructed; higher towers, some of them up to 80 feet, were built, and longer spans were arranged so as to clear places where slides come down. Buildings at the mine were so erected as to be protected from snowslides. Between making substantial surface improvements and developing the mine at a lower level, the *Molly Gibson* was put in better shape than it had been previously.

The British Columbia Copper Company installed a boiler and compressor plant at the *Eureka* mine, and did development-work that opened fair-looking bodies of ore. Ore shipment from the *Queen Victoria* mine was kept up, and about 28,000 tons was shipped to the smelter at Greenwood. Some thirty men were worked here and twenty-seven on the *Eureka*.

The *La France*, on La France creek, in the eastern part of the Division, was worked by Chicago men, and ore was cut on the No. 6 level at about 1,000 feet from the portal of the crossent adit.

In the Ymir camp, development-work at depth was continued in the *Dundee*, the *Wilcox*, and the *Yankee Girl*. The last mentioned shipped about 3,850 tons of ore. In Erie camp, ore was mined and milled by the *Second Relief* during the greater part of the year. The *H.B.* and the *Emerald*, both in the vicinity of Salmo, shipped lead-ore to Trail. In Sheep Creek camp, the *Mother Lode* mined and milled about 25,000 tons of gold-ore, and the *Queen* a smaller quantity; the operations of the latter were hampered by the Ymir Miners' Union declaring a strike against the mine.

Trail Creek Mining Division.

The information at present available in regard to this district indicates a production for the past year of about 270,000 tons, from which were recovered 135,300 oz. gold, 105,000 oz. silver, and 2,200,000 lb. of copper. This shows a fair increase over the production of 1912, which was only 243,870 tons, and is also greater than in either 1911 or 1910. The producing mines are all located in the immediate vicinity

of Rossland, and the ores are smelted at the Trail smelter. The Consolidated Mining and Smelting Company of Canada, owning the *Centre Star* group and the smelter and refinery at Trail, is by far the largest operator in the Division, the tonnage from its properties being about 227,000 tons. The Le Roi No. 2 Company, owning the *Josie* mine, is next with shipments totalling nearly 40,000 tons, while the balance is made up of shipments from small properties.

The year's developments in the larger mines in Rossland camp were more than ordinarily successful. In the Consolidated Mining and Smelting Company's *Centre Star-War Eagle* group and its *Le Roi* mine results were decidedly satisfactory. At the former, the chief developments were on the Nos. 13 and 14 levels of the *War Eagle* mine, there being at the close of the year considerably more ore in sight than at the beginning. At that depth the ore is more basic but has a better average value, running higher in gold though lower in copper. The ore-shoots are very large, so the outlook for long-continued production is good. In the *Le Roi* much ore has also been developed, this being in several different parts of the mine; the ore reserves were fully twice as large at the end of 1913 as at the corresponding period of 1912, with the average value well maintained. One of the compressors in the *Black Bear* power-house—a 40-drill machine—was electrically equipped during the year and a rope-drive added, the change having been made from steam. This machine is operated in connection with both the *Le Roi* and *Centre Star* group mines. The total footage of development-work done in 1913 was rather more than 15,000 feet, of which nearly 10,600 feet was in the *Centre Star* group and more than 4,400 in the *Le Roi*. Near the *Black Bear* power-house the company has established a concentrating plant, chiefly for testing ores from the various properties it is interested in; the equipment includes appliances for different flotation methods and for cyaniding.

The Le Roi No. 2, Limited, also had an encouraging year in respect of developments underground, having found good ore at a depth of 1,500 feet—ore of a character indicating that the veins may be expected to prove to be more freely mineralized in both gold and copper than has hitherto been the case. This applies to ore-shoots developed on other levels as well, so that the general outlook for the company's mines is regarded as assuring. There is also good reason to look for favourable developments in the northern part of the company's ground, where not much exploration has yet been done, results of prospecting indicating the probable occurrence of shoots of good ore there. Development-work done in the company's *Josie* group totalled 5,010 feet, and diamond-drilling 15,075 feet. From nearly 40,500 tons of mixed ore mined there was sorted out about 5,000 tons of waste, leaving approximately 19,000 tons of ore that was shipped crude to the smelter and 16,500 tons of mill ore. In addition, 1,700 tons of ore came from the deep-level development. The mill ore yielded nearly 1,600 tons of concentrate. Shipments to Trail totalled 22,300 tons, this quantity including the concentrate mentioned. The crude ore shipped averaged 0.643 oz. gold and 1.199 oz. silver to the ton, and 1.94 per cent. copper; the concentrate contained 0.818 oz. gold and 18.1 lb. copper to the ton. Ore was mined on all levels from the 200- to the 900-foot, both inclusive; also from the 1,100- and 1,500-foot levels. The last mentioned corresponds in depth with the 1,650-foot level of the adjoining *Le Roi* mine, and the 1,100-foot with the No. 9 level of the *War Eagle*.

The smaller mines in Rossland camp did not ship much ore. The *Giant-California* sent 102 tons to the smelter, the *Nickel Plate* 96 tons, and the *Phœnix* 23 tons. There was little progress made in the South Belt other than that of the Richmond Consolidated Company, which erected mine buildings, constructed a head-frame over the *Lily May* shaft, installed a 16-drill compressor and a steam-hoist, and, late in the year, reported having found a good-sized body of ore on the *Lily May* 200-foot level. The *Inland Empire*, in the western part of Trail Creek Division, was operated, both mine and stamp-mill, but no particulars of what was done have yet been obtained.

Trail Smelting-works.—The Consolidated Mining and Smelting Company made many improvements to its lead- and copper-smelting works at Trail, thereby increasing both its ore-treatment capacity and efficiency. Important changes were made in

the copper-smelting department. The old No. 2 copper blast-furnace was taken out and a larger one constructed in its place. The new furnace has been built with an arched top and flat flue instead of having the old-style goose-neck flue over the furnace. Four of the five old furnaces are to give place to three new ones of the style of the one now in operation, the dimensions of which are 42 inches by 35 feet at the tuyere level. There are twenty-eight standard tuyeres on each side of the new furnace. A second large furnace is being built in place of No. 4, which has been taken out. The object of doing away with the goose-necks is to leave clear space for an overhead travelling electric crane for handling purposes on both furnace floors. The two old lead stacks are being removed and three blast-furnaces are being built for lead-smelting; the dimensions of the latter are 45 by 216 inches at the tuyeres, and each furnace will have wrought-iron jackets with fourteen tuyeres, also cast-iron jackets with single tuyeres, as have been in use on the old furnaces. Height from tuyere centre to feed-floor level is 17 feet 6 inches. Conveyors and larger electric locomotives have been provided to facilitate handling ores, fluxes, coke, etc., from bins to furnaces, and other changes have been made to reduce cost of handling materials. Another Root No. 11 blower has been added to the blowing plant; this one to give 401 cubic feet a revolution and to be driven by two 300-horse-power induction motors. In the lead-sampling mill two more sets of Traylor heavy-duty rolls have taken the place of lighter rolls, to ensure finer crushing. The Huntington-Heberlein roasting and sintering plant has been rearranged; besides the seven H.H. roasters, there are thirty-six converter-pots, and these have been conveniently placed in four parallel rows of nine each. Two Wedge roasters have recently been added to the plant. A concrete bin has been built in a convenient place between the roasters and the converter-pots, and a steel conveyor now takes the roasted ore from the roasters to the bin. A Niles 20-ton crane, operated electrically, lifts the pots and places them under the discharge-gate of the bin, and, when filled, replaces them on their stands. Then, after the charge has been sintered, it takes the pots and dumps the sinter on a floor, from which the broken material is lifted by a large-size Hayward clam-shell bucket to grizzly and revolving trommel, whence it is taken by a conveyor to storage-bins. A gas-producer supplies fuel to the roasters and gas has been substituted for gasolene as fuel for the Dwight-Lloyd sintering-machines. Many other improvements have been made and still others are being prepared for.

As indicating the extent and success of the company's operations in the Province, the following extract is made from the report of the president at the last general meeting, speaking of the period of fifteen months ending September 13th, 1913: "The net profit, after deducting $146,019.30 for development and $193,256.06 for depreciation, amounts to $998,367.14, out of which three dividends (a total of 8 per cent.) amounting to $464,352 have been paid, leaving a balance of $534,015.14, which, added to the credit of profit and loss account, as shown last year, makes a total of $1,717,650.49 at the credit of that account."

Other West Kootenay Divisions.

There was little mining done in other divisions of West Kootenay, except that the *Silver Cup* and *Ajax* mines, of the Ferguson Mines, Limited, in the Trout Lake Division, shipped about 520 tons of silver-lead ore to Trail—the former 95 tons and the latter 425 tons. The *Silver Cup* was worked on lease latterly. It is hoped the *Ajax* will develop into a profit-earning mine, but this will remain for the future to prove. The *Fidelity*, near the foot of Trout Lake, sent a few tons of ore to Trail.

No information was received relative to the Big Bend of the Columbia, in Revelstoke Division, in which lode and placer properties have been prospected in past years; nor has progress been reported in connection with the development of mica-deposits occurring in that part of the Province.

BOUNDARY DISTRICT.

The Boundary District, the mines of which together produce more copper than those of any other part of Canada, led in 1913 in British Columbia in respect of both

the quantity of ore mined and the total value of metals produced. The ore-output of the mines in the Greenwood and Grand Forks Divisions was nearly 1,800,000 tons, as compared with 1,900,000 tons in 1912 and 1,187,000 tons in 1911. The slight decrease in tonnage in 1913, as compared with 1912, was not due to any serious cause, but simply represents a slight variation in the yearly capacities of the smelters, both of which were operated as nearly continuously as possible throughout both years. It is customary to include the production of Osoyoos Division with that of the others above mentioned, but leaving that out for the present, a rough approximation of the output of metals from Greenwood and Grand Forks Divisions in 1913 is as follows: Gold, 65,000 oz.; silver, 370,000 oz.; and copper, 29,000,000 lb. For statistical purposes there will be added about 38,300 oz. of gold from the Hedley Gold Mining Company's mines in Osoyoos Division. The total value of the output (including $785,000 from Hedley) was approximately $6,700,000, which constitutes a record for the year as compared with that of metalliferous minerals from other districts in the Province. This amount is only exceeded for total value of all mineral production by the Coast District, where, in addition to about $3,000,000 for metallic minerals, the sum of $6,500,000 is recorded as the value of coal and structural materials.

Granby Consolidated.—The Granby Consolidated Mining, Smelting, and Power Company, Limited, in 1913 mined and smelted about 1,225,000 tons of ore from its own mines in Phœnix camp. This compares with 1,240,000 tons in 1912 and 606,000 tons in 1911. (It will be remembered that the strike in the Crowsnest collieries adversely affected production in 1911.) The company has not been able to maintain such a large tonnage without somewhat depleting its ore reserves, which are now estimated at between 5,000,000 and 6,000,000 tons of minable ore. Development-work for the year was carried on as usual, the total for the year amounting to 12,800 feet of drifts, crosscuts, and raises. Diamond-drilling runs to about 1,300 feet a month when in full operation, and the cost of this is put down as adding to development costs about 14 cents, bringing mining costs up to about 75.4 cents a ton of ore mined. This compares with 78 cents a ton for 1912. As in past years, the diamond-drilling has been continued in territory outside the present sphere of mining operations, with the object of finding new bodies. The area to be drilled was systematically mapped in 1911, and the position of the drill-holes determined on, and in this way the whole property of the company will be thoroughly prospected. Many deep holes (1,200 to 1,500 feet) have been put down, but to date these have not disclosed any ore-bodies. The entire holdings of the Snowshoe Gold and Copper Mines, consisting of the *Snowshoe*, *Pheasant*, *Fair Play Fraction*, and *Alma Fraction*, 117 acres in all, have been purchased by the Granby Company. It is planned to run a drift from the *Curlew* tunnel through the *Snowshoe* ground, and from this mine all the available ore and handle it through the *Curlew* terminals, which at present handle ore from the *Curlew*, *Gold Drop*, etc. An option was also secured on the *Big Copper* property, six miles from Greenwood, and diamond-drilling carried on from October until December, when work ceased for the winter. The showing on this claim is a body of more or less silicified limestone carrying iron-oxides and native copper.

At the company's big smelting-works at Grand Forks—the largest in the British Empire—everything has proceeded very smoothly, without any important change being made. The method of handling the slag by granulating and elevating it on belt-conveyors to a height of 100 feet, which has been in operation for two years, is working satisfactorily, and, it is claimed by the management, is cheaper than the old hot-dumping system. The average cost of handling the slag from each ton of ore treated is about 5½ cents. The eight furnaces, together with the converter department, were run practically continuously throughout the year, with only occasional stoppages of one of the furnaces for minor repairs.

In his report for the company's fiscal year ending June 30th, 1913, the superintendent of the smelter included the following information: "Average smelting cost for the year was $1.214, as against $1.256 for 1912. . . . Converting Department: Costs are lower this year per ton of ore. This department handled 34,500 tons of 32.9-per-cent. matte. Taking the year as a whole, from the operating

end it shows very well. We have handled a larger tonnage than previous years, and we have handled higher silica slags with less copper loss. Our costs are less than any previous year since we began operations. There was no difficulty with labour." The treasurer's report for the same period (fiscal year ended June 30th, 1913) shows that a net profit of $1,214,599.30 was made, from which is deducted dividends amounting to $449,055.46, interest, discount, etc., leaving a surplus of $683,149.17, which carried forward gives the company a "Total surplus at credit, June 30th, 1913, . . . $3,119,270.73."

B.C. Copper Company.—The *Mother Lode* and *Rawhide* mines and the smelter of the British Columbia Copper Company were operated steadily throughout the year, but it is to be noted that the tonnage handled at the smelter was nearly 100,000 tons less than in 1912. For some time only two out of the three furnaces at the smelter were in blast, the principal reason being that ore shipments from some of the mines were curtailed in order to mine only the higher-grade ore. Exact figures as to the total ore treated at the smelter are not available, but a close estimate is about 600,000 tons, which is divided as follows: *Mother Lode*, 300,000 tons; *Rawhide*, 240,000 tons; *Queen Victoria* (Nelson), 30,000 tons; and the balance custom ore. Shipments from the *Wellington Camp* group, *Emma*, and the *Lone Star* and *Napoleon* (these last two being situated just south of the International Boundary-line in the adjoining State of Washington) for this year were either nothing or very small. The approximate recoveries of metals from the Company's mines in the Province were: Gold, 20,000 oz.; silver, 85,000 oz.; copper, 8,208,000 lb.

Work was commenced during this year on a 100-ton-a-day concentrator at Boundary Falls, which is designed to treat ore from the *Lone Star* mine, and also to experiment on ores from the *Copper Mountain* properties, which the company has now under bond. This plant will use a preliminary water-concentration followed by an oil-flotation treatment of the tailings. The exact type of mill process has not yet been decided on, but it is expected that the mill will be in operation in the spring of 1914. The company has been carrying on extensive development-work on several properties held by bond during the past year. Of these, the *L. & H.* near Silverton, the *Eureka* near Nelson, and the *Copper Mountain* properties in the Similkameen District are all shaping up well, and it is likely that the near future will see the British Columbia Copper Company operating on a larger scale than ever before.

At the *Mother Lode* mine the same system of mining as has been adopted for the past two years was adhered to—namely, drilling a large number of holes in advance, in pillars and benches, and then firing them all at once with electric-fired charges. In this connection it is interesting to note that in August a blast, which is claimed to be the largest in the history of mining, was set off. The scene of this blast was a number of pillars and floors with a total height of 300 feet; 4,834 holes of an average depth of 14 to 15 feet were charged with 49,550 lb. of 40-per-cent. anti-freezing powder. It required 87,048 feet of electric wiring, the holes being connected in series of forty to a group. To prevent any possibility of an accident, everybody was taken off the hill and three safety-switches were placed in the circuit, all of which had to be connected before the electric spark could pass. The blast was a complete success, between 400,000 and 450,000 tons being broken down. This system results in a material decrease in the cost of mining, but at the expense of the grade of the ore, since, as a consequence, large quantities of waste are broken down with the ore. Officials of the company state that mining costs are now in the neighbourhood of 50 cents a ton, which is indeed a notable achievement. In an attempt to bring up the grade of the ore, which in past years has dropped very low, a picking-belt has been installed on which waste is picked out by two or three men. The results of the last three months show that this innovation is a decided success.

The *Rawhide* mine is really owned by the New Dominion Copper Company, but as the British Columbia Copper Company controls the stock of the former company, it is customary to refer to it as one of their mines. Shipments from this mine were about 30,000 tons less than in 1912, but work was continuous throughout the year. Development-work consisting of raises and drifts was kept well in advance of the stoping operations.

Other Mines.—About 4,500 tons was shipped from the *No. 7*, owned by the Consolidated Company, of Trail, but it has been closed down now for several months.

The *Jewel* mine, ten miles north of Greenwood, completed a reorganization in its 15-stamp mill and cyanide plant in July and has since been maintaining a steady production. Estimates place its output for the year at about 8,500 tons, returning 4,110 oz. of gold, which really represents the operation for six months.

A small shipment of ore was made from the *Elkhorn*, and driving on the *Argo* tunnel was intermittently continued. A little development-work was carried out on the coal-measures at Midway. A slight revival of interest is taking place in the West Fork district; the *Sally*, on Wallace mountain, near Beaverdell, having been bonded and three cars of ore shipped, while development-work is being carried on with a crew of eight men, and the *Carmi* has been secured under option by Victoria people. The advent of the Kettle Valley Railway in the district should stimulate activity in mining.

SIMILKAMEEN DISTRICT.

Hedley Gold Mining Company.—The only important producing mine in this district is the *Nickel Plate* group, situated a few miles from the town of Hedley, which, together with a 40-stamp mill and cyanide plant, is owned and operated by the Hedley Gold Mining Company. Estimates show that this company mined and milled about 70,700 tons, yielding 38,232 oz. of gold during the past year. These figures show a slight increase over corresponding ones for 1912, and an important fact to be noted is that the grade of the ore milled is also slightly higher, being about $12 a ton, as against $11.19 for last year. The main working-shaft at the mine is now the Dixon incline, started in 1912, and now down 500 feet, which will eventually be continued to at least 1,100 feet, and possibly farther. The *Sunnyside* mine is not being worked now to any extent. Diamond-drilling was not carried on during the last nine months of the year, for the reason that the two drills owned by the company were being used by the Exploration Syndicate No. 2 on adjoining property. Development-work was kept well ahead of stoping operations, and at the present time the mine has larger ore reserves than at any time in its history. About 65 to 70 per cent. of the values recovered at the mill are obtained as concentrates, the balance being saved from the cyanide treatment. With the payment of the final 3-per-cent. dividend in December, the total dividends for the year amounted to 30 per cent. on the capitalization of $1,200,000. Also this brings the total dividends for the four years the present company has owned the mine up to 100 per cent. In other words, the shareholders have received the whole of their capital back and still have their stock, which is now quoted at about three times the par value. For some time past the 800-horse-power water- and steam-power plant of the company has hardly been able to supply the demands on it, and also frequent stoppages occur in winter due to freezing-up of the flume, etc. In order to obviate these difficulties and also to get sufficient power for all purposes, the company is proceeding with a power-development on the Similkameen river. A flume two miles and a half long, with a penstock and necessary machinery, is projected which would give 1,500 to 1,700 horse-power at extreme low water.

A number of the prominent shareholders of the Hedley Gold Mining Company have formed the Exploration Syndicate No. 2 to acquire and develop claims adjoining and in the vicinity of the *Nickel Plate*. In the spring of 1913 they secured bonds on about fourteen claims on the Twenty-mile Creek slope of Nickel Plate mountain. Two diamond-drills were kept at work until October, when cold weather necessitated a stop. No information as to the results attained have been given out as yet.

Voight's Camp and Copper Mountain.—No work has been done during the past year at Voight's camp by the British Columbia Copper Company, who carried out a lot of development-work in 1911 and 1912. It is understood that the company and Mr. Voight are unable to agree as to terms, and although the company has a small interest, it is not prepared to go ahead until it secures complete control. In the meantime the company has been actively developing a group of eleven claims on

Copper mountain (adjoining Voight's camp), including the old *Sunset* property. One hundred men and five diamond-drills have been kept continuously at work, the prospecting consisting of borings, trenches, open-cuts, hand shafts and tunnels. Several payments on the different bonds have already been made, and it is practically assured that nearly all the claims will be taken up.

Plans are now being prepared for opening up and mining the ore, which will probably be done by means of a crosscut tunnel from the Similkameen River side. These plans include a 1,000-ton-a-day concentrator and a hydro-electric power plant on Whipsaw creek. The site of the concentrator will be somewhere down by the river, the ore being brought down by tramway from the mouth of the tunnel. Experiments have shown that a high extraction of the values in the ore can be made by means of an oil-flotation process. No exact figures as to the tonnage or grade of the ore are available, but it is believed that to date several million tons of 1.5 to 2 per cent. copper-ore have been shown up.

The ore consists of primary chalcopyrite and bornite, together with some secondary copper minerals, chalcocite, cuprite, and native copper, in a variable gangue rock which is generally a monzonite. Speaking generally, the whole mountain is slightly mineralized, but it is only along certain favourable lines, which seem to be in some way influenced by a series of dykes, that sufficient concentration has taken place to give rise to commercially valuable ore-bodies. The ore-bodies are extremely irregular and indefinite, to some extent belonging to the contact metamorphic type, and being developed in inclusions of highly altered sediments in the monzonite magma, and in other cases being developed along fracture zones in the monzonite itself. A heavy hæmatite showing occurs in one place, but as a rule the ore is highly siliceous. Values in gold and silver are very low.

Princeton Coal Company.—The coal-mine at Princeton owned and operated by the Princeton Coal and Land Company has been producing steadily all year. The main incline is now down 1,100 feet, and the coal is to some extent improving in quality with depth. The company is shipping some coal to Vancouver, where it hopes to build up a market, and, a year or two, when the direct railways to the Coast—the V. V. & E. and the Kettle Valley—are finished, ship a large tonnage. These direct railways to the Coast will reduce the railroad haul from about 600 miles to 100, thereby enabling the coal company to make a fair profit, which is impossible just now. The mine has plenty of available coal, as at present only the top 8 feet of a seam 24 feet thick is being mined.

The East Princeton Coal Company mined a small quantity of coal, which was sold to the cement plant for use in their boilers.

Cement Plant.—The new cement plant of the British Columbia Portland Cement Company commenced operations in the early summer, but was shortly after closed again to make some necessary alterations to the boiler equipment. It was reopened in October and has since been running steadily. The works are situated on One-mile creek, two miles and a half from Princeton, and connected by a spur track to the V. V. & E. Railway. The whole plant is modern and up-to-date, and is designed for a capacity of 500 barrels a day. Raw materials, limestone and shale, are obtained in the immediate vicinity. A market for the cement is expected throughout the interior of the Province, and also the removal of the duty on cement entering the United States will allow the company to extend its trade into the adjoining State of Washington. Chemical and physical tests show the cement to be of good quality.

Coalmont.—The coal-mine at Coalmont formerly owned by the Columbia Coal and Coke Company has been purchased by a syndicate headed by A. McEvoy, of Vancouver. The old company did not meet with much success in its work on the Tulameen River side of the coal-basin, as, although one good seam of coal 12 feet wide was crosscut in its long tunnel, it was found to be so completely crushed and powdery as to be of no commercial value. The new company commenced work in a small way in October to develop the coal on the North Fork side, where several seams of good coal had already been partially developed. Working the coal in this place will necessitate a railway four to five miles long, and surveys are now being made for this purpose.

Placer-mining.—Options on a number of the placer leases on the Tulameen river, extending from Princeton upwards of twenty miles, have been secured by a strong Eastern company. A Keystone drill was brought in and work commenced in October to test the gravel in various places by boreholes. This prospecting-work will last until next summer, and if the results are satisfactory a dredge will be installed.

On Granite creek, Messrs. Lambert and Stewart are still working on their hydraulic-placer proposition, but as yet have not made a clean-up.

Tulameen District.—Very little mining development or prospecting has been done in the camps along the upper part of the Tulameen river, with the exception of Summit camp, at the head of the river in the Hope range. At this camp the Treasure Mountain Company has been developing steadily all year with five or six men. A crosscut tunnel 600 feet long was being driven to crosscut the vein at a depth of 450 feet, which by this time should be far enough in, but no information has been received as to the results. The *Indiana* property was also worked for a time, and a number of prospectors were in the district all summer.

NICOLA VALLEY.

The metalliferous-mineral deposits of the Nicola Valley District remain undeveloped, except that assessment-work is done on numbers of mineral claims for the purpose of retaining the right to them. One copper property in this district was examined by the British Columbia Copper Company, but the results of this examination are not known. The gypsum-deposit near Merritt has not been worked during the year. The branch of the Kettle Valley Railway has been practically completed to the Canyon House, but will not be operated until the balance of the line is completed to Hope via the Coquihalla pass. The coal-mines at Merritt have, on the whole, had a successful year, the tonnage shipped for this year, 232,000 tons, being greater than that of last year by about 55,000 tons.

Particular details of the coal-mines are given at another place in this bulletin, but here it may be stated that, while the Nicola Valley Coal and Coke Company reduced its output, the Inland Coal and Coke Company nearly quadrupled its tonnage of last year. The Nicola Valley Company is in a position to mine a much larger tonnage than it is doing, but cannot secure a market for it. The completion of the Coast railways should improve conditions somewhat. The Diamond Vale Company did not do much again this year, and the Pacific Coast Colliery was developing, but did not ship much coal.

KAMLOOPS AND YALE.

The Mining Divisions of Kamloops, Ashcroft, and Yale did not show any great activity during the past year.

In the Kamloops Division, the *Iron Mask* shipped about 570 tons of gold-copper ore, but no other shipments have been recorded. Annual assessment-work and a small amount of prospecting was carried out, while various attempts at placer-mining were made. No more work was done on the coal-measures occurring in the valleys of the North Thompson river.

In Yale Division, the *Aufcas* property, near Hope, is reported to be looking well and is being steadily developed. A little placer-mining is still done on some of the streams, but the returns are small.

LILLOOET DISTRICT.

The Bridge River section was the only part of this district in which much mining was carried on last year. The most important development was that of the Coronation Gold Mines, a Victoria company that acquired the old *Ben d'Or* property on Cadwallader creek three years ago. After developing for two years, the old 10-stamp mill on the property was repaired last spring and operated nearly continuously until December; 840 tons of ore was milled, from which 1,368 oz. of gold and 295 oz. of silver were recovered; 20 tons of concentrates was saved but not shipped. A small force of men is at work this winter, sinking from a point in the No. 4 (the lowest) tunnel.

The *Blackbird*, which is also held by a Victoria syndicate, was prospected during the summer by ground-sluicing to expose the leads, and a crosscut tunnel 100 feet long driven, together with 100 feet of drifting on the vein.

The *Pioneer* was sampled and examined for the owners, and it is understood that some development-work is being carried out this winter.

Annual assessment-work was carried out on a number of other claims in different parts of the district.

Placer-mining in the district declined to practically nothing, and a very small output is recorded. The Golden Dream Company, which holds placer leases on Cadwallader creek, did some prospecting on its ground during the summer and fall, and is keeping a few men at work all winter.

The Cadwallader Creek section has been greatly helped by the completion of a good wagon-road from Seton lake to the *Pioneer* mine, while the whole district will be considerably benefited by the completion of the Pacific Great Eastern Railway from Newport to Fort George, on which construction-work is being rapidly pushed ahead.

VANCOUVER ISLAND AND ADJACENT COAST.

In this district coal-mining constitutes the most important class of mining, and this has already been dealt with in some detail under the heading of "Coal-mining," so only a brief summary will be given here.

In 1912 the gross coal output of Vancouver Island was 1,558,240 long tons, while in 1913 the output promises to be only about 962,620 long tons, valued at $3,369,170, a decrease of 595,620 long tons. This loss of about 600,000 tons of coal, of a money equivalent of nearly a quarter of a million dollars, is one of the losses directly chargeable to the labour troubles which have harassed the coal-mining industry of the Island during the past year, for the companies were all in a position, at the beginning of the year, to have made an output greater than that of 1912.

In this, the southern portion of the Coast District the metal-mining operations at *Britannia* on a large scale, and on Texada island on a smaller scale, are of considerable moment, and are the only lode-mining operations of importance in this large district.

Britannia Mines.—The Britannia Mining and Smelting Company has been operating and further extending the equipment of its mine and of its concentrating plant at Britannia Beach, on Howe sound, to an extent that is realized by few persons, even in the adjacent Coast cities.

The company's policy seems to be to avoid publicity; its stock is held by a numerically small group and is not quoted on the exchanges, so that the attention of the public is seldom drawn to the fact that the company is employing steadily between 600 and 700 men, and is making the second largest copper output of any individual mining company in the Province, it being excelled only by that of the Granby Company.

The company mined in the past year some 212,000 tons of ore, and recovered therefrom over 72,000 oz. of silver and over 13,000,000 lb. of copper.

The property has been described in the Reports of this Department, so that brief mention here is sufficient. The original mine-workings are at an elevation of from 3,275 to 3,775 feet above and are about three miles and a quarter from the Beach, where the concentrating plant is located, connection between the two being made by an aerial tramway, the maintenance of which and its uncertainty under such a heavy tonnage has been a source of annoyance to the company.

To remedy this and to develop the mines at a greater depth, the company has just completed an adit tunnel, about a mile long, driven in at about 2,000 feet lower elevation than the old workings, the portal of which will be connected with the Beach by a surface, narrow-gauge tramway operated by electricity, over which supplies will be transported to the mine, and the ore brought down to the large ore-bins now being built above the concentrator building.

The concentrating scheme, briefly outlined, is as follows: The ore from the mine is coarsely crushed and wet-screened, passes on to a travelling picking-belt, from which waste and clean ore are picked off, going respectively to the waste dump and shipping-bins, while the remainder is delivered by the belt to coarse crushing-rolls and sizing apparatus, and eventually passes to a series of jigs, which produce headings, which go to shipping-bins; while the tailings, in the coarser sizes after recrushing and rejigging, all find their way to a fine-crushing plant and to a series of Hardinge mills, in which they are finely crushed and mixed with the oil, which is the first step in the oil-flotation process of the Minerals Separation Company. As will be seen, the only materials thrown away, after leaving the picking-belt, are the tailings from the flotation process. An experimental unit, of some 50 tons a day, of this flotation method has been in operation for a year with such satisfactory results that the company has now practically rebuilt its mill to conform to the requirements of a flotation plant capable of handling the entire product of the mine, which now is almost completed. Until the experimental stage of adjusting the new plant to the particular requirements of the ore has been passed, the company does not appear desirous of giving information for publication.

On Texada Island, the *Marble Bay* mine has continued its operations during the past year and has made regular shipments. Details of the work done or of the output made this year have not been received as yet; it is thought, however, that the product this year will be less than in 1912. The output in 1912 amounted to about 18,000 tons of ore, containing some 2,000 oz. gold, 20,000 oz. silver, and 1,000,000 lb. copper.

The *Cornell*, formerly leased to Dr. Tauzer, of Seattle, has now been leased to other parties, who are reported to have found a body of high-grade ore within a few feet of the old Tauzer workings; this is now being developed. No material output is expected from the mine this year.

The *Copper Queen*, it is reported, has been bonded by the Granby Company, and will be thoroughly investigated.

It cannot be learned that any important work was done on the *Little Billy*, nor that any shipments were made.

Nothing new has been heard as to the *Iron* mines, on the west side of Texada island, and no work has been done there.

The lime-quarries on the north end of the island have been in operation, but it is estimated made a decreased product.

On Vancouver Island there has been some work going on on the west coast, where the *Kallapa* is reported to have shipped between 100 and 200 tons of ore carrying gold. Other development-work is going on in the vicinity of Clayoquot sound, but no shipments have been made.

It is reported that the Ptarmigan Mines, an English company holding a number of claims in the Big Interior basin, has been engaged in building a road and tramway from Clayoquot sound in towards the claims; no news has been received as to work actually done on the claims.

The old *Tyee* tramway has been purchased by the company and transported to the west coast in anticipation of its being erected there.

The assays of samples brought down by the company's engineers show very high assays in copper, much higher than was ever obtained from samplings of the *Big Interior*. It is not probable that shipments will be made until after 1914.

PROFITS OF THE MINING COMPANIES.

The following is a list of dividends paid by metalliferous-mining companies during the calendar years 1912 and 1913:—

Name of Company.	1912.	1913.
British Columbia Copper Company, Greenwood	$177,513	$ 88,756
Consolidated Mining and Smelting Company, Trail	212,176	348,264
Granby Consolidated Mining, Smelting, and Power Company, Grand Forks	.....	899,911
Hedley Gold Mining Company, Hedley	360,000	360,000
Le Roi No. 2, Rossland	29,400	43,200
Standard Silver-Lead Company, Silverton	425,000	650,000
	$1,224,089	$2,390,131

The Granby Company has thus declared dividends of $900,000 in these two years; in 1912 the company set aside $1,500,000 to equip its Hidden Creek mines, while for the fiscal year ending June 30th, 1913, "the profits from operations amounted to $1,214,599."

The report of the Consolidated Mining and Smelting Company of Canada, Limited, for the period of fifteen months ending September 13th, 1913, has been issued.

The report of the president, D. W. Matthews, says: "The net profit, after deducting $146,019.30 for development and $193,256.06 for depreciation, amounts to $998,367.14, out of which three dividends (a total of 8 per cent.), amounting to $464,352, have been paid, leaving a balance of $534,015.14, which, added to the balance at the credit of the Profit and Loss account as shown last year, makes a total of $1,717,650.49 at the credit of that account."

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