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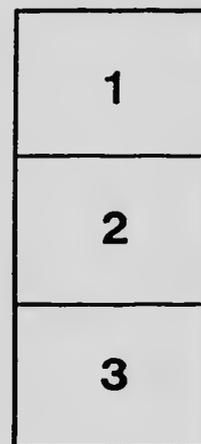
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BRITISH COLUMBIA BUREAU



BULLETIN No. 1, 1916

PRELIMINARY REVIEW AND ESTIMATE

OF

MINERAL PRODUCTION, 1915

BY

WM. FLEET ROBERTSON, Provincial Mineralogist

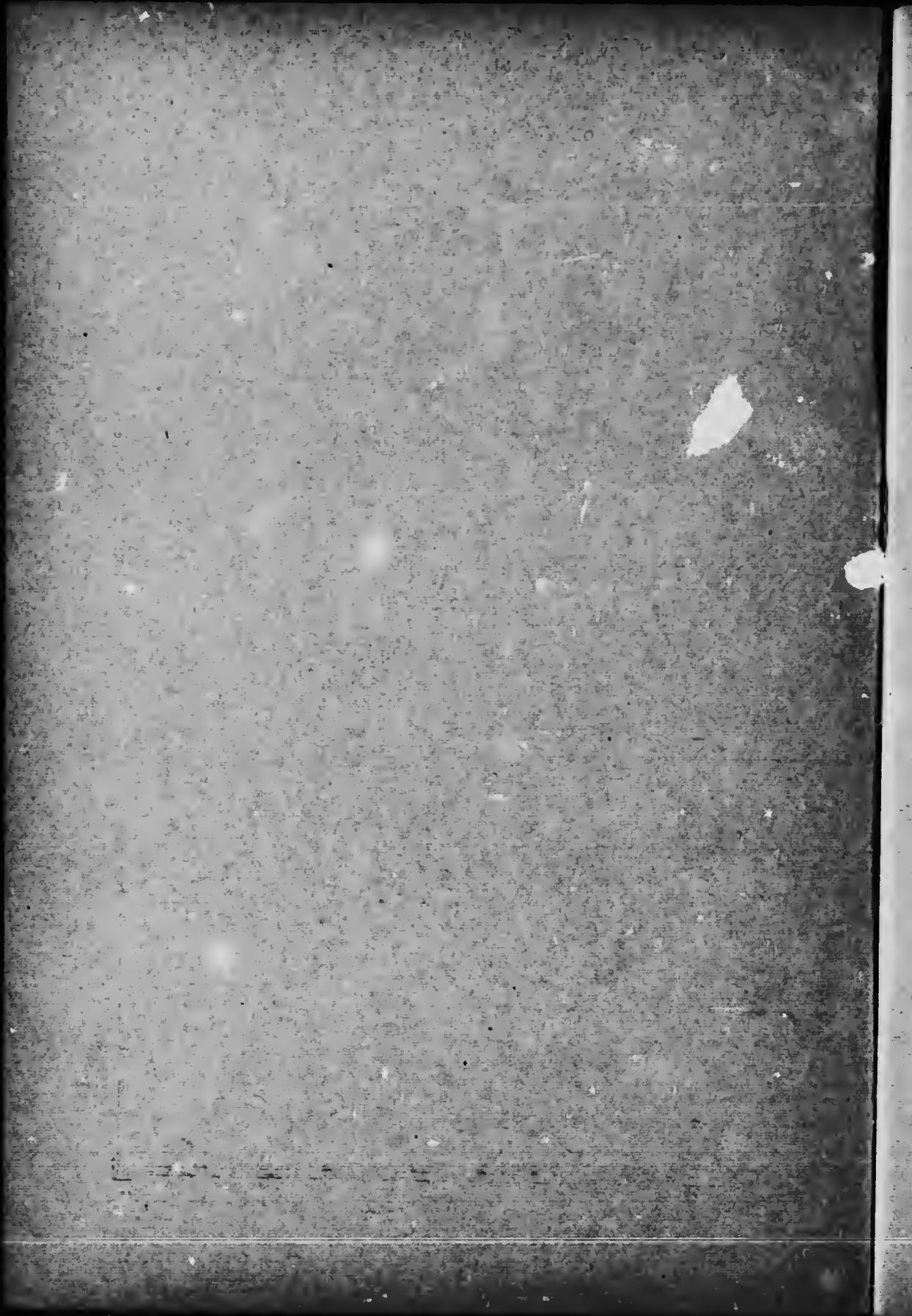


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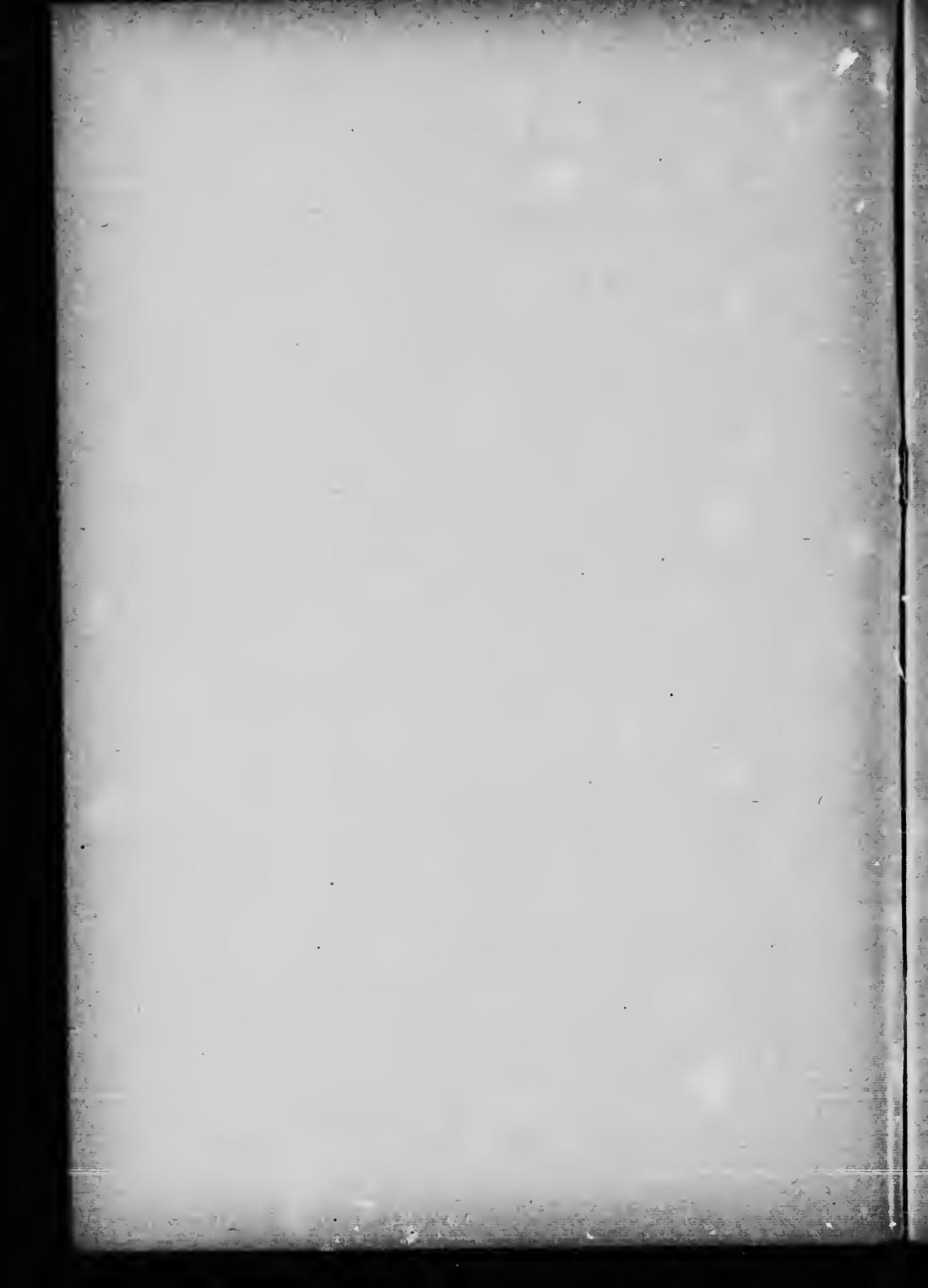


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TO THE HON. L. A. CAMPBELL,
Minister of Mines, British Columbia.

SIR,—I beg to submit herewith a preliminary estimate of the mineral production of the Province for the year 1915, 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 returns from the mines have been received, and without the delay that of necessity must take place in carefully preparing the detailed information given each year in the Annual Report of the Minister of Mines.

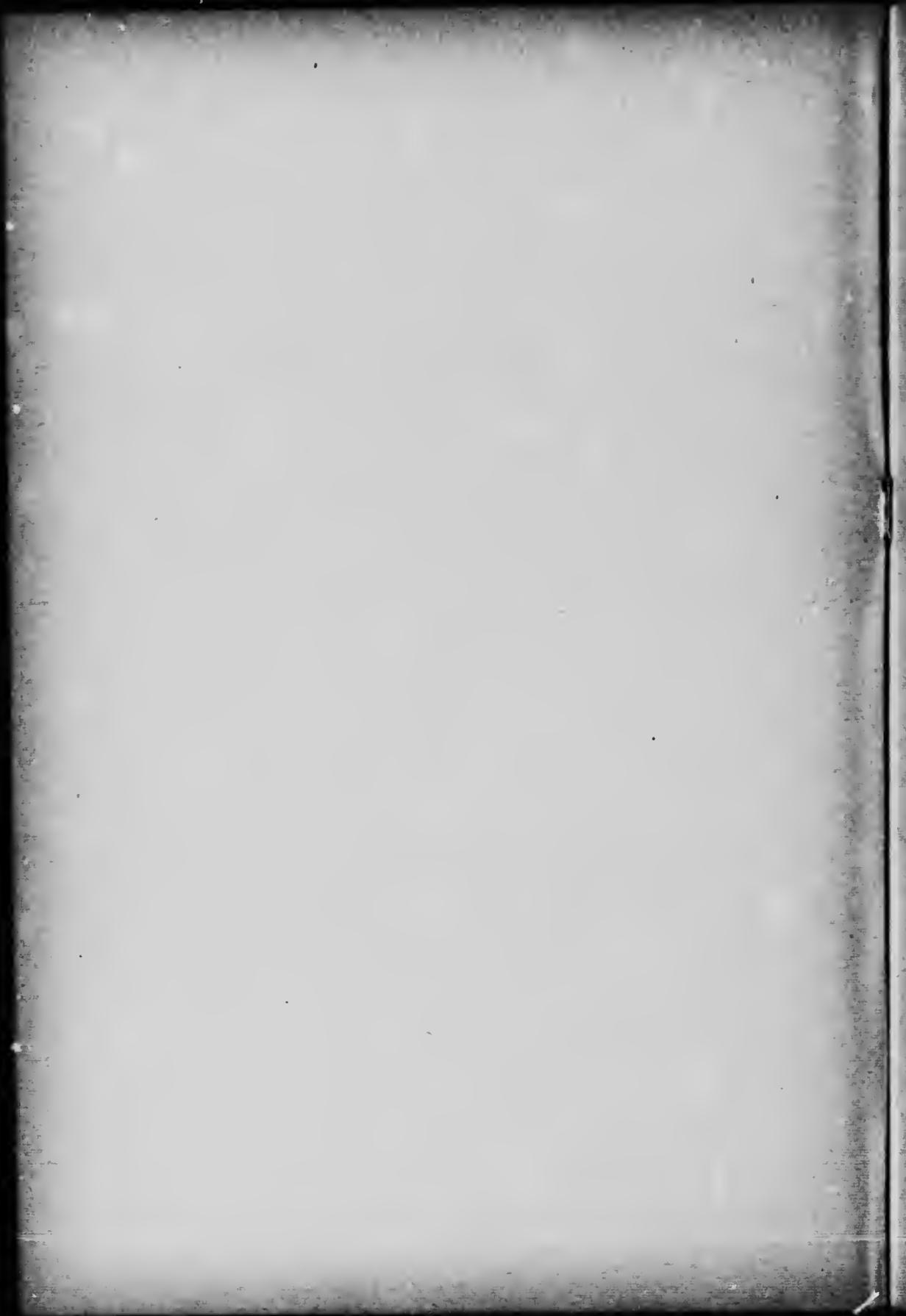
I have the honour to be,

Sir,

Your obedient servant,

WILLIAM FLEET ROBERTSON,
Provincial Mineralogist.

*Bureau of Mines, Victoria, B.C.,
January 22nd, 1916.*



PRELIMINARY REVIEW AND ESTIMATE

—07—

MINERAL PRODUCTION FOR THE YEAR 1915.



This bulletin has been prepared before the receipt of the official reports for the year 1915 of the Gold Commissioners and Mining Recorders of the Province, and the customary returns of mineral production annually made by managers of 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 1915 of a total value of \$29,200,584. It will be seen that the total value of the production of 1915 as estimated is some \$2,010,739 greater than that of 1914, which, considering the times, must be regarded as a very encouraging showing.

The year 1915 opened under very inauspicious conditions as far as mining was concerned; the war had only gotten fairly started, and at that time the final issue was in doubt, while the duration of the conflict was then quite unknown.

Under these circumstances it is not to be wondered at that the metal market was so uncertain that producers felt timid as to the future, particularly as the opening months of the year saw the prices of all the metals, except zinc, much below normal.

Apparently no one foresaw or appreciated the trend of modern warfare, with its unprecedented use of artillery, nor realized the tremendous amounts of metal that would be consumed thereby.

How great this consumption of the metals has been can scarcely be appreciated when expressed in figures, but some conception of the enormous expenditure of metals can be obtained from a calculation published by the *Mining and Scientific Press*, and based upon French official statements, that 4,500,000 shells were used by the section of the French Army in Champagne during a four days' bombardment along a twenty-mile front.

The editor, T. A. Rickard, calculates that these shells contained about 18,000,000 lb. of copper, 30,000,000 lb. of lead, and 8,000,000 lb. of zinc. To apply these quantities to the total output of British Columbia made during the year 1914, it will be seen that the year's output of copper would have lasted that small section of the French Army about ten days, the lead-output for seven days, and the zinc-output for slightly less than the four days.

The close of the year 1914 found many of the mines closed down and most of the large producers restricting their output under a common agreement to do so.

Then came the enormous demand for shells of all sorts, from all the Allies, necessitating the use of an amount of copper, lead, zinc, and other metals which soon depleted the stocks, so that by May and June the prices of the metals began to soar, and all the mines that were in a position promptly to supply the demand were pushed to make as great an output as possible.

These higher prices for metals continuing throughout the remainder of the year, stimulated the mineral production very greatly and rendered the margin of profit on production much higher.

It seems to have been generally considered that these higher prices were only war prices, and that, at the close of hostilities, the value of metals would drop at least to normal, if not below. Consequently, as the duration of the war was not expected to be very long, those mines not prepared to make a production in the near future could not expect to profit by higher prices, and, as capital was in demand for other purposes, the amount available for development was very slight.

The result has been that actual producers increased their outputs, but few new ones began a production, so that the amount of new development done throughout the year has been less than normal.

In British Columbia the recruiting sergeant has found such ready response from the prospectors and miners that prospecting is practically at a standstill and is left to those too old to be accepted for military service or otherwise disqualified.

Of all the metals produced in British Columbia, silver was the only one the price of which was not raised by the war, for the reason that it is not used in war materials, despite the old saying that "wars are won with silver bullets." On the contrary, the price of silver fell off very considerably; in 1913 the price of silver in New York varied between 63 and 57.8 cents, averaging for the year 59.8 cents; in 1914 the average price for the year was 54.8 cents, while for 1915 the average price for the year was only 49.7 cents.

This low price of silver acted as a deterrent to production in many of the silver-lead mines of the Slocan, Alnsworth, and Nelson Divisions, the ores of which contain, on the average, about twice the value in silver that they do in lead.

To show the effect of this drop in silver values in these Divisions, using the lead produced as an indicator, as the proportions of lead and silver are fairly constant in our galena ores, Alnsworth produced in 1915 only about one-third as much lead as in 1914, Slocan produced about 90 per cent. (but here the ores of the larger properties carry so much zinc that there was a profit in that metal), while in the Nelson Division the lead output in 1915 was only about half that of the previous year.

The output of silver in 1915 is estimated as being \$255,703 less than in the preceding year.

The various metals and their production are reviewed in detail later in this report, but it might be noted here that the following table shows the gross value of the metallic minerals recovered as being \$20,895,696, which represents an increase over last year of over \$5,000,000, a percentage increase of about 33 per cent., which is certainly a matter of congratulation.

It might further be pointed out that the metalliferous output for 1915 would appear to be the greatest in the history of mining in the Province, being more than 10 per cent. greater than in the former record year of 1912.

With the exception of silver, which has already been commented upon, all the other metals show a material increase. Coal, however, shows a very heavy falling-off—about \$925,000; while building materials, etc., appear to indicate a decrease of \$1,352,917, or nearly 50 per cent. of the previous year's output.

These two latter items are not an index of mining, properly speaking, but are influenced by the general industrial and financial state of the Province, as they are to all intents and purposes for home consumption and not for export.

The features of the year are the very great increases in the copper and zinc productions, and, as the prices of both these metals seem to show no indication of serious decrease, while the present developments of the properties give reason to expect further large increases in 1916, there is every cause to believe that the coming year will be a record one as far as the metalliferous mines are concerned.

It is to be noted that this past year the value of the copper-output is practically 50 per cent. of that of the gross metalliferous production of the Province.

It is a matter of congratulation also that zinc is now being refined in the Province—as described later—and there is every prospect that within a short time copper will also be refined here, thus enabling us to ship these products in a marketable form.

MINERAL PRODUCTION FOR TWO YEARS, 1914-1915.

The following table shows the quantities and value of the several minerals produced in the year 1914, and the estimated production in 1915. It may here be explained that the prices used in calculating the estimated value for 1915 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.

	PRODUCTION, 1914.		ESTIMATED PRODUCTION, 1915.			
	Quantity.	Value.	Quantity.	Value.	Increase.	Decrease.
Gold, placer.....		\$ 505,000		\$ 745,000	\$ 180,000	
.. lode.....oz.	247,170	5,109,004	244,378	5,051,293		\$ 57,711
Total gold.....		\$ 5,674,004		\$ 5,796,293	\$ 122,289	
Silver.....oz.	3,602,180	1,876,736	3,434,393	1,621,033		\$ 255,703
Lead.....lb.	50,925,048	1,771,877	45,990,372	1,917,799	145,922	
Copper.....	45,000,609	6,121,319	57,905,488	10,006,068	3,884,749	
Zinc....."	7,806,467	346,125	13,817,808	1,554,503	1,208,378	
Total value of metalliferous.....		\$15,790,061		\$20,895,696	\$5,105,635	
Coal..... tons, 2,240 lb.	1,810,967	6,338,385	1,546,664	5,413,324		\$ 925,061
Coke..... "	234,577	1,407,462	248,424	1,490,544	83,082	
Building materials, etc.....		2,857,917		1,500,000		1,357,917
Total value of production.....		\$26,388,825		\$29,299,564	\$2,910,739	

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.

Placer Gold.—The estimated recovery of placer gold for 1915 is \$745,000, of which practically all is obtained in the Cariboo and Cassiar Districts, only about one-tenth of the total coming from the other districts. An approximate apportionment is as follows: From Cariboo District, \$312,000; Atlin Division of Cassiar District, \$355,000; Stikine and Llard, \$30,000; remaining parts of the Province, \$48,000. It may be that a larger yield will be shown, but this cannot be definitely stated until after the final returns of the season's operations shall have been received.

The output of placer gold is larger this year than it has been since 1907, and will probably be about \$180,000 greater than that of last year. This comes as an agreeable surprise, for the snowfall of the winter of 1914-15 was unusually light, and, as this is the principal source of the water-supply, it was anticipated that the quantity of water available for hydraulicking would fall short of the usual quota.

In hydraulic mining it has been pretty well demonstrated that the gold output is in direct proportion to the number of days in which water was available for piping, hence there seemed little hope for even a normal production of placer gold during the season of 1915.

The Weather Bureau, however, as though in compunction for the niggardly amount of snow provided, so arranged the spring weather that the snow melted very gradually—not much faster than the water could be used—while the absence

of spring freshets prevented the great waste of water usual at such times. Subsequent summer rains in the Cariboo District also very much assisted in keeping up the water-supply.

The shortage of work general throughout the Province during the early summer caused a greatly increased number of men, both whites and Chinese, to undertake small placer operations; this was particularly noticeable in the districts adjacent to Quesnel and Quesnel Forks.

During the summer months the unusually low water exposed bars on the Fraser and Thompson rivers which are seldom accessible, and these were worked in numerous places by Indians and Chinese, with good results.

In the Barkerville section of the Cariboo District the larger hydraulic companies made a greater output than usual, while an increased number of individuals appear to have been working in a small way; this is also true of the Quesnel and Quesnel Forks sections, which report much larger amounts of gold recovered than has been the rule for some years past.

This is accounted for by the general shortage of other work throughout the northern part of the Province, which caused many men to once more take up placer-mining, even if it only produced wages.

No authentic news has as yet been received from the Omineca District, where considerable work has been going on, most of which, however, is of a preparatory nature, and it is not expected that any great output has been made this year, probably not more than about \$12,000 all told.

In the Atlin District the shortage of water was very noticeable, some of the companies being so short as to be only able to work effectively for half the season. On the other hand, some of the companies were evidently working in richer ground; it is not known whether this was by good luck or by intentionally attacklug only the richer parts, in an attempt to compensate for the water shortage.

Very little summer rain fell and its absence was much felt during the latter part of the season. Notwithstanding these drawbacks, it would appear that a somewhat increased production was made in this district.

In the Liard-Stikine District the Boulder Creek Hydraulic Mining Company had a successful season, taking out about \$20,000 from its ground on Thibert creek. Bull and Flinn and Mitchell Bros., working in the same vicinity, made small outputs.

Four different partnerships were at work on Dease creek, with success enough to at least pay wages.

This year some gold was taken out of the Tahltan river by Indians and others working in the river-bed.

It is to be noted this year that two or three parties were working down the Liard river, at McDame creek, and on Rosella creek, a section that has been practically abandoned of late years.

The Stikine and Tulameen rivers produced more gold this year than for some years back and give promise of again being a factor in the placer-gold industry.

Vernon District also yielded some gold from hydraulic operations in Slawash creek.

Yale Mining Division made an unusually good output, owing to the very low water in the rivers exposing the bars.

The Fort Steele Mining Division made a better output than for some years past.

Lode Gold.—The quantity of lode gold produced seems to have been less than in any of the last three years. The output is estimated at \$5,051,203, as compared with \$5,100,004 in 1914, a decrease of \$57,711. The chief reason for this decrease is a very heavy decline in the output of the Nelson Division and a lessening of the outputs in the Boundary and Coast Districts. To offset this there were increases in Omineca, Skeena, and Trail Creek Divisions.

The amount of the total decrease is so small that, when the full returns are received, the balance may be changed to the other side, and so, speaking approximately, it may be said that lode-gold productions in 1914 and 1915 were the same.

The gold production of the various districts is estimated to have been approximately as follows:—

	Oz.
Rossland	141,970
Boundary	82,190
Nelson	9,338
Skeenn	5,080
Coast	2,860
Omineca	1,539
All others	1,374

The production in the Rossland District shows an increase of 3,411 oz. as compared with 1914, which is accounted for by an increase in the tonnage shipped.

The Boundary District shows a decrease of 2,700 oz. as compared with 1914. The Granby Company's mines made an increase of about 8,000 oz., but the British Columbia Copper Company, the *Jewel*, and the *Union* show decreases respectively of about 5,000, 4,300, and 800 oz.

The *Nickel Plate* production is expected to have been about the same as the previous year—viz., 38,000 oz. The other properties in this district only contribute small amounts, and of these the *Carmi* and *Dividend-Lakeview* produced less than last year.

A reduction of about 7,000 oz. is estimated for the Nelson District, or nearly 46 per cent. This decrease is mainly due to a falling-off in the production of the *Mother Lode* mine on Sheep creek, where the cyanide-mill was only operated a short time owing to the exhaustion of the developed ore reserves at the mine. The mine is at present closed and the future plans of the company are not known.

The *Queen* mine, on Sheep creek, made about the same output as the previous year, and it is said that development-work on the lower levels is proving satisfactory in showing the continuation of the ore-shoots.

The *Second Relief*, near Erie, milled more ore than in 1914, and the *Granite-Poorman*, near Nelson, again entered the list of producers, being operated by leasers.

The *Yankee Girl* mine, at Ymir, did not ship any ore, but a low-level tunnel was driven into the vein and drifting was commenced on it. This work is now progressing and good ore is being found. It is probable that a mill will be erected on the property in the near future.

The production of gold from the Skeena District is practically all from the *Hidden Creek* mine, at Anyox. The increased tonnage mined at this property accounts for the increased gold production in this Division of 72 per cent.

The Coast production shows a slight decrease due to the smaller output from the *Marble Bay* mine.

The Omineca production comes almost entirely from the *Rocher Déboisé* mine, near Hazelton, which is a new property that only commenced shipping this year. The ore is a high-grade copper ore, carrying low gold and silver values.

About 21 per cent. of the gold production of the Province comes from the milling of auriferous quartz ores and 79 per cent. from the smelting of copper ores carrying gold and silver.

Silver.

The quantity of silver produced seems to have been about 3,434,393 oz., worth \$1,621,093, a decline from the production of 1914 of 167,787 oz. and \$255,703.

Unlike the other metals, silver declined in price owing to the effect of the war on the market. Unfortunately for the producers, this metal is not used for munitions or war material of any kind. The decline in the price of silver is best seen by comparing the average yearly prices for the least three years, which were:—

1913	59.8 cents an oz.
1914	54.8 cents an oz.
1915	49.7 cents an oz.

It is encouraging, however, to see that the market price is now improving, as

having started at 48.8 cents in January and dropping to 47.2 cents in August, it increased to 54.97 cents in December.

The chief demand for silver comes from the Far East, and, as there were some disturbances in China, the demand was less than usual. Silver for use in the arts was less in demand in Europe than in former years, as a result of the war. On the other hand, there was a greater demand for silver for coinage purposes.

The approximate production of the various districts is estimated to have been as follows:--

	Oz.
Slocan and Slocan City	1,799,002
Fort Steele	481,258
Alnsworth	331,408
Boundary	300,714
Skeena	169,382
Trall Creek	159,102
Omineca	80,165
Coast	69,240
All others	38,052
Total	3,434,303

Of these, Slocan, Fort Steele, Boundary, Skeena, and Trall Creek all show small increases, while all the others show slightly decreased productions. The heaviest falling-off is in the Nelson Division, which only produced about 14,227 oz. in 1915, as compared with 150,401 oz. in 1914. The silver production of this district in 1914 was mainly from the *Silver King* and *Molly Gibson* mines of the Consolidated Company, both of which were closed during the year 1915.

The Slocan District again leads all other districts, by a large margin, in silver production, having produced this year slightly over 70 per cent. of the Provincial output. The *Standard*, at Silverton, made the largest individual output, with nearly 850,000 oz., followed by the *Surprise* with nearly 300,000 oz., the Silverton Mines with 180,000 oz., the *Rambler-Cariboo* with 175,000 oz., and the *Mountain Con* with 90,000 oz. Many other smaller properties shipped, the total number of shipping mines in the district being about thirty.

The smaller production from the Alnsworth Division is due to the closing-down of the *Highland* mine and a lessened output from the *Bluebell*, which latter was only operated during the last half of the year. The largest producer in this section was the No. 1 mine, owned by the Consolidated Company, followed by the *Spokane-Trinket*, *Cork-Province*, and the *Bluebell*.

In East Kootenay the only important producer is the *Sullivan* mine of the Consolidated Company, from which 474,000 oz. was obtained. Small amounts come from the *St. Eugene*, owned by the same company; the *Monarch*, at Field; and the *Silver King*, in Wludermere.

Over 66 per cent. of the Boundary production comes from the Granby Company's mines at Phoenix. Other mines contributing to a small degree were the *Union*, in Franklin camp; the *Sally*, at Beaverdell; the *Mother Lode*, in Deadwood camp; and the *Jewel-Denaro*, in Long Lake camp.

The silver production from Trall Creek comes from the smelting of the gold-copper ores of Rosland camp, which carry about $\frac{1}{2}$ oz. of silver to the ton.

The Skeena production comes almost entirely from the Granby Company's *Hidden Creek* mine, at Auyox.

The Omineca production shows a decline of about 40 per cent. as compared with the previous year, but a very considerable increase in the number of small shippers is an encouraging sign for the future.

Figures regarding the Coast production are as yet only approximate, but it is believed that a considerable decrease will have been made. The silver from this district is all obtained from the smelting of copper ores carrying low values in the precious metals, and is not, therefore, very important.

About 78 per cent. of the total Provincial output of silver comes from the treatment of silver-lead-zinc ores and 21.5 per cent. from the smelting of gold-copper ores carrying silver.

Lead.

The total amount of lead produced in 1915 is estimated to be about 45,900,372 lb., valued at \$1,917,770. This represents, as compared with the previous year, a decrease in the quantity of the metal produced of 4,034,670 lb., but, owing to the higher market price prevailing in 1915, the value of this year's product is some \$145,922 greater than that of the previous year.

The diminished quantity of output occurs chiefly in the Ainsworth Division, which produced over 5,000,000 lb. less than last year, due to the fact that the *Highland* did not work at all and the *Bluebell* only worked during the latter part of the year.

The Nelson Division this year only produced half as much lead as last year.

East Kootenay, on the other hand, produced 2,000,000 lb. more in 1915 than in the previous year, its gross lead production being 26,708,377 lb.; of this amount the *Sullivan* mine is credited with 26,320,000 lb., which represents over 57 per cent. of the Provincial output.

Ainsworth Division produced this year only 2,873,306 lb., of which the *Bluebell* is credited with 1,603,000 lb. and the *Cork-Provance* with 715,000 lb., the remainder of the production being contributed by some dozen smaller properties.

The Slocan District produced about 14,791,795 lb. of lead, which is 442,115 lb. less than last year. The principal contributors to this 1915 production were the *Standard* with 8,480,945 lb., the *Surprise* with 2,323,377 lb., the *Rambler-Cariboo* with 1,543,351 lb., and the *Slocan Star*, which is expected to have put out 1,163,000 lb., while the *Ruth-Hope*, *Silverton Mines*, and others added their share.

Nelson Division is expected to have put out about 1,017,498 lb. of lead, of which the *Emerald* is supposed to have contributed over 900,000 lb. and the *Leadville* over 71,000 lb.

The only other Mining Division making any important lead-output was Omineca, which produced about 320,000 lb., of which the *Swartse* is responsible for 60,000 lb. and the *Silver Standard* for 55,000 lb.

Trout Lake Division produced less than 140,000 lb. of lead.

Copper.

The amount of copper estimated to have been produced during the year 1915 is the largest in the history of copper-mining in the Province, amounting as it does to 57,905,488 lb., worth \$10,000,068; the highest previous production, made in 1912, was 51,456,537 lb., valued at \$8,408,513.

The production as estimated for 1915, compared with that of the previous year, shows an increase in quantity of 12,895,789 lb. and in value of \$3,884,749.

Owing to the heavy demand for war purposes, principally for brass to be used in shells, the market price of copper increased steadily during the year. The year opened with copper at about 12.7 cents a pound in the New York market, and at the end of December it was 22.25 cents; the average price for the year was 17.275 cents, as compared with an average price of 13.6 cents in 1914. This higher market value of the metal assisted materially in raising the value of the copper produced, thereby greatly stimulating production.

The large increase in quantity of copper produced this year is due to a greatly increased production from the Granby Company's *Hidden Creek* mine, at Anyox, on Observatory Islet, and to a return to a nearly normal output from the Boundary District. A slight decrease is anticipated from the *Britannia* mine, due to a shut-down for some time owing to a snowslide; but this decrease is more than made up by the output from the *Rocher Deboulé* mine, in the Omineca Division. Nelson Division shows a considerable decrease, which is however, more than compensated by an increase from the Trail Creek Mining Division.

The copper production from the several districts is expected to have been approximately as follows:—

	Lb.
Skeena Division	21,801,340
Boundary District	17,520,334
Southern Coast District	10,736,086
Trail Creek Division	4,616,776
Omineca Division	2,822,000
All other districts	348,052

The big mine and smelter of the Granby Company at Anyox were operated continuously throughout the year, and the tonnage treated was gradually increased, until, at the end of the year, 2,000 tons a day was being smelted. The ore reserves of this mine are very considerable and are given in the annual report of the company for the fiscal year ended June 30th, 1915, as amounting to 9,620,612 tons, with an average copper content of 2.19 per cent. The Granby Company this year produced from its mines in Skeena and Boundary 65.4 per cent. of the Province's copper production.

Another important producer of copper in the northern portion of the Province is the *Rocher Déboulé* mine, near Hazelton. After developing for a couple of years this property commenced shipping in June, and by the end of the year had shipped 17,000 tons, carrying 2,788,000 lb. of copper, besides gold and silver values.

In the Boundary District the Granby Company's mines at Phoenix and smelter at Grand Forks were operated to nearly full capacity since the end of January. The recovered copper content of the ore, however, was less than in any previous year, and this fact, together with a slightly lessened tonnage, accounts for a smaller copper-output than in the years 1912 and 1913; in 1914 the smelter was closed for about one-third of the year, and so the output was less than in any of the years previously mentioned.

The explanation of the lowering of the grading of the Granby Company's ore is that an electrically driven shovel was used to clean up the pillars which had been blasted down in the large "glory-hole," and that thereby a larger proportion of waste rock was included in the ore, which was justified by the shovel reducing the operating costs in this part of the mine.

The British Columbia Copper Company, which operates the *Mother Lode* mine at Deadwood and smelter at Greenwood, was, in former years, another large producer of copper in the Boundary District. During the last two years, however, this company's production has declined very materially. At the smelter one furnace was operated during the last half of 1915 and a production of about 1,500,000 lb. of copper was made. The ore-bodies at the *Mother Lode* are, apparently, nearly exhausted, but the company has developed a large tonnage of low-grade copper ore at Copper Mountain, in the Similkameen Division, the treatment of which, it is anticipated, will be begun in the near future.

Exact figures regarding the output of copper ore from the *Britannia* mine are not yet available, but it is believed that a production of about 10,000,000 lb. of copper will have been made, which is about 2,000,000 lb. less than in the previous year. This decrease is mainly due to the disastrous snow- and rock-slide which, last spring, cleaned out the upper workings and killed a number of men, necessitating a close-down for some months, during which time ore shipments were suspended. The company has during the past year doubled its milling capacity, and, as its ore reserves are said to be very large, it should in the future make a larger yearly output than ever before.

Some crude ore is shipped from this mine, but the major portion goes through the mill, which is a water-concentration plant, followed by an oil-flotation treatment of the tailings from the former, and has a capacity of 2,000 tons a day. The concentrates and crude ore are smelted at the Tacoma smelter.

The copper-mines on Texada Island made a smaller output than in 1914, the *Marble Bay* production being expected to be about two-thirds that of the previous year; the smaller mines did very little.

For the first time in some years, copper ore was shipped from Vancouver Island; this was from the *Willow Grove*, at Sooke, near Victoria, which made an output of 86,000 lb. of copper.

The Trall Creek copper production comes from the mines of the Consolidated Company, and the *Josie* group of the Le Roi No. 2 Company, the ores from which are smelted at Trall. These ores are, in reality, gold ores carrying $\frac{1}{2}$ to 1 per cent. of recoverable copper and are more valuable for their gold contents. The output this year shows an increase of 836,940 lb., which is accounted for by the increased tonnage treated.

Development-work is always kept well ahead in these mines and a long future life for them is now well established.

The copper production of the Nelson Mining Division has been, in former years, chiefly from the *Silver King* and *Queen Victoria* mines. The former mine was closed during the year, while the latter was only operated for a short time by leasers. About 35,000 lb. of copper was produced, which is also the total for the Division.

Copper-mining is now the most important form of mining in the Province, and this year it practically equalled in value the entire total value of the other lode minerals produced, and exceeded, considerably, the value of the coal and coke production. It forms 40.7 per cent. of the total value of metalliferous mines and 34 per cent. of the total mineral production. In the working of the large, low-grade copper-deposits and the subsequent smelting of the ores produced, a great number of men are employed and a large proportion of the money value is retained in the country in the payment of wages and purchase of supplies.

All the copper ores carry small amounts of the precious metals, and therefore any increase in the copper production also increases the output of gold and silver. The high price of copper during the past year has stimulated prospecting and the development of copper claims, and there is no doubt that the Provincial output will steadily grow in future years.

At the copper-smelters in the Province the only important development was the installation of copper-converters at the Consolidated Company's smelting-works at Trall, which will soon be in operation. Until now the copper matte from Trall has been converted to blister-copper at Tacoma. The question of refining the blister-copper produced in the Province has been considered during the past year by some of the larger companies and also by the Government, and it is possible that a copper-refinery may be established in the near future.

Zinc.

The quantity of zinc shown to have been produced in 1915 amounted to 13,817,808 lb., having a value of \$1,554,503. These figures are so very much higher than have ever before occurred in the zinc production of the Province that comparisons are almost out of the question.

The former highest recorded productions were in 1909, when 8,500,000 lb. of zinc was produced, worth \$400,000, and in 1914, when the production was 7,866,467 lb., valued at \$346,125. It will be seen, therefore, that this year's output has been, in value, about four times as great as that of former record years.

This is one of the instances where the war has been a help, the zinc-mining interests having reaped a harvest that was not expected.

The price of spelter in the New York market averaged, for the year 1913, 5.65 cents a pound; for the year 1914 it averaged 5.21 cents; but for the year 1915 it averaged 13.23 cents; while the average for the month of June, 1915, was 21.2 cents, and for the month of December, 1915, the average price was 15.39 cents.

It can readily be seen that such a very great increase in the market value of the metal would not only serve as a stimulus to the zinc-miner to get to market

every ton of ore he possibly could, but would also permit the mining of many ore-bodies which, at the normal price of zinc, could not have been handled at a profit.

One trouble was that there was not enough smelter capacity on this continent to supply the demand for the metal, and these smelters were soon so overstocked with ores that they ceased to accept ore except on outstanding contracts.

The supply of ore brought out by these conditions was so great that such smelters as were equipped to handle it only bought at a very large margin of profit, so that the zinc-miner did not make as great profits as the increased market price of the metal would seem to indicate.

Of the total output of 13,817,808 lb., about 8,822,880 lb. came from the Slocan District, 3,127,200 lb. from Nelson Division, 1,370,000 lb. from Alnsworth Division, and 491,719 lb. from East Kootenay.

The largest producer in the Province was the *Standard*, in Slocan Division, which is credited with 3,778,857 lb., followed by the *H.B.*, in Nelson Division, with 2,387,514 lb., and the Silverton Mines, Slocan, with 1,385,850 lb.; while the *Zincton* mine, in Nelson District, produced 730,005 lb.; the *Silver Hoard*, in Alnsworth, 600,000 lb.; the *Lucky Jim*, in Slocan, 640,000 lb.; and the *Rambler-Cariboo*, 540,000 lb.

A description of the electrolytic zinc plant, which is now under construction at Trall, will be found in the notes on the Trall Creek Mining Division.

Other Minerals.

No iron ore has been used or shipped from the Province during the past year, and, as far as can be learned, but little prospecting or development work has been done on iron claims.

A small quantity of crude placer platinum has been recovered on the Tulameen river, in the Similkameen District, estimated at about \$2,000 in value. This was obtained from placer-gold workings being carried on, and the results are considered encouraging.

Prospecting for petroleum by means of boreholes has been in progress in South-East Kootenay, on the Queen Charlotte Islands, and elsewhere, but oil in commercial quantities has not yet been encountered.

Considerable interest has been evinced during the past year in molybdenite deposits, owing to the high price of this mineral, caused by demands for war purposes. This mineral, which is a sulphide of molybdenum, is used in the manufacture of special high-grade steel for guns. The actual output of molybdenite during the year was confined to a shipment from the *Molly* group, on Lost creek, in the Nelson Mining Division, which was sent to the Henry E. Woods Ore Concentrating Company, Denver, Colorado; this shipment amounted to 24 tons and contained by assay 12.26 per cent. of molybdenite. Some development-work was done on the property and it is now under lease and bond to a Vancouver syndicate, which intends to erect in the spring a small concentrator. The market requirements are such that a molybdenite ore must be concentrated up to 85 or 90 per cent. molybdenite (MoS_2) before it is marketable. The Lost Creek property has several thousand tons of from 2 to 4 per cent. ore, so that, with a suitable mill, a small production could be maintained.

Another property, on Alice arm, in the Skeena Mining Division, controlled by J. D. Ross, of Seattle, is reported to have a large showing of molybdenite, and it is said that a mill is being erected on it which will soon be producing a ton a day of high-grade concentrates. Other prospects in the Nelson, Kamloops, and Lillooet Mining Divisions showing some molybdenite have been investigated, but as yet none of them have assumed any great importance.

Molybdenite ore, concentrated so as to contain 85 to 90 per cent. of that mineral, is now worth from \$2,500 to \$3,000 a ton, delivered in England or New York.

Antimony is another metal which greatly advanced in price owing to demands for war purposes. Its principal use in war material is to harden the lead bullets

used in shrapnel. During the war the price advanced from about 18 to 55 cents a pound for the best brands, and from 16 to 39 cents for the ordinary brands of antimony.

Antimony usually occurs in nature as stibnite, the sulphide of antimony, and is a common mineral in British Columbia, occurring in association with lead and zinc ores. It does not, however, as a rule, occur in large quantities, but attempts are now being made in a few places to sort it out from its associated minerals. Two cars of antimony ore are reported to have been shipped from the *Alps-Aituras* property on a fork of Carpenter creek, in the Slocan Mining Division; this ore was shipped to Scotland and carried from 50 to 55 per cent. antimony.

Reports of small shipments from other claims have been heard, but details have not yet been secured.

A deposit of hydromagnesite near the town of Atlin was worked to some extent this year by Armstrong and Morrison, of Vancouver. It is known that a few hundred tons was shipped, but details regarding the shipment have not yet been received. This occurrence of magnesite was fully described by the Provincial Mineralogist in the Minister of Mines' Report for 1904.

The uses to which the mineral is put are for the manufacture of refractory brick, for furnace-linings, etc.; in the manufacture of paper stock by the sulphite process, and as a non-conducting covering for steam boilers and pipes.

Coal and Coke.

It is estimated that the gross production of coal was 1,960,804 long tons, of which 414,140 tons was made into coke, leaving the net production at 1,546,664 tons. These figures show a decrease, as compared with 1914, of 205,624 tons gross and of 264,303 tons net. The quantity of coke made was about 248,424 tons, which is an increase of about 13,847 tons as compared with 1914. For purposes of comparison the following table is shown:—

	Est. 1914.	1914.	1915.	1912.	1911.	1910.
Coal, gross..... tons, 2,240 lb.	1,960,804	2,166,428	2,570,760	3,025,709	2,297,718	3,139,235
Loss made into coke .. "	414,140	355,461	438,577	396,905	104,656	329,189
Coal, net..... "	1,546,664	1,810,967	2,137,488	2,628,804	2,193,062	2,809,046
Coke made. "	248,424	254,577	298,015	264,393	66,006	218,029

In these figures the output for the month of December has had to be estimated, consequently the final figures may vary from them slightly.

Summarizing the Provincial production of coal, the following table shows the estimated output:—

	Tons of 2,240 lb.
From Vancouver Island collieries	1,000,779
From Nicola and Similkameen collieries	101,060
From Crowsnest District collieries	849,965

Total quantity of coal mined 1,960,804
 Less made into coke (calculated) 414,140

Net quantity of coal produced 1,546,664

In addition to the above net production of coal, there was made the coke production shown in the following table:—

	Tons of 2,240 lb.
From Vancouver Island collieries	9,248
From Nicola and Similkameen collieries	nil
From Crowsnest District collieries	239,173
Total	248,424

As will be seen from the above figures, the net coal production this year is expected to have been some 204,000 tons less than it was in 1914, and less than it has been for the last eight years.

The consumption of coal in the Province during the past two years has been sadly interfered with by the war, through its retarding or stopping of many industries; this has had a reflex action on the transportation lines, which are the largest consumers of coal.

The market for the Coast collieries was seriously affected by the diminished sales of bunker coal to ocean steamers as a result of war conditions on the Pacific Ocean steamer trade.

The competition of fuel-oil has been keenly felt, and the adoption of this fuel by the three transcontinental railways for use in British Columbia has removed a steady and growing market for coal.

Coke.—The total production of coke this year, amounting to some 248,424 tons, is an increase over that of 1914 of some 13,850 tons (2,240 lb.), despite the fact that the Hosmer plant—which last year made an output of over 34,000 tons of coke—was closed down. This total production, while not as great as for the years 1912 and 1913, is nevertheless 10 per cent. greater than the average output for the last ten years.

The high market price of copper has kept the copper-smelting plants of the Interior very busy, with a consequent increased demand for coke, while, on the Coast, the copper-smelting plant of the Granby Company at Anyox has occasioned the restarting of the Canadian Collieries coke-ovens at Comox, where this past year 9,240 tons of coke was made.

VANCOUVER ISLAND COLLIERIES.

The Vancouver Island collieries made a gross coal-output of 1,000,779 tons of coal, or about 92,000 tons less than in 1914.

Western Fuel Co.—This company mined this past year about 411,470 tons of coal, an increase over the previous year of about 100,000 tons; for this increase the Nanaimo Colliery is to be credited with 72,000 tons and the new Reserve Colliery with 28,000 tons; this latter colliery is situated about five miles from Nanaimo and has this year become a producer.

The Nanaimo Colliery, in the City of Nanaimo, is entered by No. 1 or Esplanade shaft, which is connected by underground workings with a shaft on Protection Island and another on Newcastle Island. The workings are at a depth of from 600 to 1,250 feet and are very extensive, including a large submarine area. The coal-workings are in the Douglas seam and also in the Newcastle seam, which lies some 70 feet deeper; this property has been in operation since 1881.

The Reserve Colliery is a new property in which operations were begun in 1910 by sinking shafts to a depth of about 1,050 feet, to the Douglas seam, in the centre of a 2,500-acre area of virgin coalfield; the coal-seam has a thickness of 14 feet of good coal. Two shafts were put down, 350 feet apart, and connected underground by a rock tunnel. The general installation of plant and of the shaft-bottom is probably the most modern and nearest to perfect in British Columbia.

Ventilation is secured by two 90-inch Sirocco fans, rope-driven from a 24- x 30-inch engine. The tipples is of thoroughly modern design, capable of handling 2,000 tons of coal in nine hours.

Canadian Collieries (Dunsmuir), Ltd.—This company is the successor of the Wellington Colliery Company formerly owned by the Dunsmuir interests, and operates two collieries, one situated at Cumberland, seventy miles north of Nanaimo, and the other at Extension, about six miles south-west of Nanaimo.

The Comox Collieries, situated around Cumberland, are connected by a standard-gauge railway with the seaboard at Unlou bay, where are situated the loading piers and also a coal-washery and a battery of coke-ovens, which latter, after several years of idleness, have again been started to supply coke for the Anyox copper-smelter.

The mines operated during recent years are the Nos. 4 and 7 slopes and the Nos. 5, 6, and 8 shafts.

There has not been much change made in the plant since 1913, when electric power was substituted for steam and much new machinery and mine and railway equipment put in. Since this extensive equipment has been completed, the market conditions have been such that the demand for coal has not been sufficient to admit of the mines being worked at anything approaching full time. The output in 1913 was over 500,000 tons, but it is only expected to be about 200,000 tons this past year, a decrease from last year of some 134,000 tons.

At the company's Extension Colliery four mines have been in operation in recent years, and here conditions seem to have been more favourable, an output of about 165,000 tons having been made in 1915, which is an increase of 35,000 tons over that of the preceding year.

A standard-gauge railway connects this colliery with the harbour at Ladysmith and also with the E. & N. Railway, and here a coal-washery, extensive docks, and storage-bins have been erected.

Pacific Coast Coal Mines, Ltd.—This company operates a property at South Wellington, near Nanaimo, and also one at Morden. The production from the former property was seriously interfered with by water breaking into it from an adjacent abandoned and flooded mine, so that the output this year is about 25,045 tons less than last year.

The Morden mine began to produce this year, making an output of 22,500 tons, which practically offsets the decrease at South Wellington.

There was mined this year about 127,500 tons of coal, only 3,145 tons less than the previous year. This output is, however, far short of the 1911 output of 208,110 tons, showing that this company, like others, has suffered from the unfavourable market conditions for the last few years.

The company is also developing and equipping a colliery at Squash, on the northern part of Vancouver Island, which is not as yet producing.

Vancouver-Nanaimo Coal Mining Co.—This company operates the New East Wellington Colliery, or Jingle Pot mine, as it is locally called, situated two miles from the city of Nanaimo, and is working the Old Wellington seam, of which, however, the company has only a small area; the exhaustion of this is quite within sight, as all the working-places have reached the boundaries and the work now consists of extracting the pillars. The output in 1915 was about 46,034 tons, as compared with 107,158 tons in 1914.

NICOLA AND SIMILKAMEEN COALFIELDS.

These coalfields produced in 1915 about 101,000 tons of coal, as against 138,531 tons in 1914, a falling-off in output of 37,471 tons, which must be attributed to a limited local market and apparently high freight rates to the Coast.

In the Nicola District three companies produced coal in 1915—viz., Middlesboro Colliery, Inland Coal and Coke Company, and the Pacific Coast Colliery Company—making a joint output of 88,385 tons of coal, as against an output of 114,546 tons in 1914.

The Middlesboro Colliery is estimated to have produced this past year 54,500 tons of coal, a decrease of only 6,205 tons.

The Inland Coal and Coke Company is credited with having mined 32,820 tons of coal, a decrease of 20,461 tons.

The Pacific Coast Colliery Company is developing its property, but managed to produce 1,065 tons, an increase of 505 tons over the previous year.

In the Similkameen section the only company credited with a coal production is the Princeton Coal and Land Company at Princeton, which, in 1915, mined 12,075 tons, a decrease from the previous year of 6,800 tons.

The Coalmont Colliery did not produce coal in 1915; this property has been taken over by a Vancouver syndicate and is still under development.

Here again lack of market has been the trouble, due to lack of direct railway communication, but this is now at least partly remedied, as during the past year the Kettle River Valley Railroad has been built, passing through Princeton, and giving direct communication with the Boundary District and connection, via Merritt for the present, with the Coast. This should greatly enlarge the available market, while the railway itself will consume a large amount of coal.

The Princeton coal is lignitic in character, and, while not better than other coals for steam purposes, is very popular as a domestic fuel.

EAST KOOTENAY COALFIELD.

There were only two companies producing in this field in 1915—the Crow's Nest Pass Coal Company, operating collieries at Coal Creek (Fernie) and at Michel, and the Corbin Coal and Coke Company, with its colliery at Corbin.

The Hosmer mines, owned by the C.P.R. Natural Resources, was closed in 1914 and has been at least temporarily abandoned.

The closing-down of this colliery, which in 1913 mined 217,528 tons of coal and made 59,071 tons of coke, makes a great difference to the coal-output for the district, and particularly so as the Canadian Pacific Railway, which formerly consumed most of the coal from this colliery, now obtains its fuel-supply from a colliery in Alberta.

There was mined in the district in 1915 some 840,965 tons of coal, of which approximately 397,035 tons was used in making coke—of which 230,178 tons (2,240 lb.) was produced, leaving the net coal production as 452,000 long tons.

In 1914 the gross coal mined was 955,183 tons; the net coal production was 500,722 tons and the coke produced amounted to 234,577 tons.

This shows for 1915, as compared with 1914, a decrease of 105,218 tons of gross coal mined and a decrease of 146,702 tons of net coal produced, but an increase of 4,601 tons in the production of coke.

This increase in the coke produced indicates that the coke demand formerly supplied by the Hosmer mines is now being filled by the Crow's Nest Pass Coal Company.

Crow's Nest Pass Coal Co.—This company worked in 1915 eight mines at its Coal Creek Colliery and four at its Michel Colliery. Coke-ovens were operated at both Fernie and Michel. The gross output of coal was 707,016 tons, against 778,408 tons in 1914, an increase of 18,607 tons. The quantity of coke made was 230,178 tons, as compared with 187,866 tons in 1914, an increase of 30,312 tons, which more than compensated for the loss of production at the Hosmer ovens, which in 1914 made 34,711 tons.

Of the eight mines operated at Coal Creek in 1915, that known as No. 1 East, one of four on the south side of the valley, was the largest producer. It is at an elevation of 90 feet above the central tippie and 800 feet east of it. It was opened by means of a rock tunnel, which cut the coal at 215 feet from the entry. Both main and counter tunnels were driven 3,500 feet towards the south. The cost of upkeep of the return airway having been excessive, owing to pressure of the upper part of the large seam (the airway had been driven in the lower part of the seam), the timbers were drawn and the top coat to the main roof was dropped. The roof is of hard sandstone, so no timber is required to keep it up; the permanent air-course now provided will cost little to keep it in good order. Late in the year there was installed an endless-rope haulage system, operated by an engine placed outside the mine, to deliver the coal from inside the mine right to the central tippie.

Much good work has also been done in the company's mines at Michel Colliery, which, like Coal Creek, is now in shape for production on a much larger scale than in past years, large new coal areas having been opened. Of the four mines in operation, that known as New No. 8 is most noteworthy. No. 8 seam has been redeveloped above old No. 8 workings, sealed off on account of fire. Two tunnels have been driven, and from these a four-ways system of levels is projected, the two lower now

well on the way, and Nos. 3 and 4 being developed by the advancement of backway incline raises that are being driven. A three-track tram-line connects with a Phillips cross-over tippie, at the head of a gravity-incline, down to the endless-haulage system, thence to the main tippie. A pair of counterbalanced 7-ton skips operated from two 8-foot drums, controlled directly from the top loading-station and automatically loading and discharging, are capable of handling, under active working conditions, 300 tons of coal an hour. The extension of coal-producing operations into the large field here entered constitutes one of the most important recent developments at the Michel Colliery.

Corbin Coal and Coke Co.—This company operated two mines at its Corbin Colliery in 1915—namely, No. 4 mine, located near the tippie, and No. 3 mine, a short distance to the south.

The company mined in 1915 about 32,955 tons of coal, a decrease, as compared with the previous year, of 21,337 tons.

No. 4 mine is situated between No. 1 mine (not worked this year) and the tippie; the workings are in what is known as the Prime seam, which stands nearly vertical, and are on the room-and-pillar system, the levels being connected by raises.

Three new tunnels, opened on the seam at a higher elevation, are connected by a surface incline to the tramway below, leading to the tippie.

This mine produced in 1915 from underground workings about 28,745 tons of coal.

No. 3 mine, also known as the "Big Showing," is worked partly underground and partly by an open-cut on the surface. The underground workings are carried on by the room-and-pillar system; the surface workings, which can only be operated when there is little or no snow to interfere, is an open quarry, a light surface harden having been removed. Here the coal is broken by ordinary quarrying methods, loaded by hand into 1-ton bottom-dump cars, which are trammed a short distance and dumped direct into the railroad-cars.

The output of this mine this past year was about 24,210 tons.

Structural Materials, etc.

The output during 1915 of all structural materials, such as cement, lime, building-stone, sand and gravel, brick, and other clay products, shows a considerable decrease from that of the previous year. This is due to the cessation of building operation, especially in the Coast cities, which commenced to decline early in 1914 and was almost entirely suspended during 1915; to a large extent this depression in the building trades is owing to the conditions brought on by the war.

The output for 1915 is estimated at \$1,500,000, as against \$2,852,917 in the preceding year and \$3,398,100 in 1913. The diminution of production has been general in all kinds of material, with the exception of rough building-stone, which shows a cross production for 1915 valued at \$275,000 or nearly three times what it was the previous year; this is accounted for by the use of several thousand tons of large granite blocks for the Government piers at the Outer Wharf, Victoria. The outputs of sand and gravel and of brick show heavy decreases, and the cement production is only about one-half what it was in 1914. As far as can be learned, none of the gypsum companies or marble-quarries made any appreciable output.

About 90 per cent. of the output of structural materials is made in the Coast District, and practically all of this is used in the Coast Cities.

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 1915, 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. 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 the first two Divisions mining operations are restricted almost entirely to placer-mining, there being little, if any, other productive mining, but in the Omineca Division lode-mining is now more important, due to the advent of railway facilities in the southern portion of the Division.

The conditions affecting placer-gold mining in this district have already been referred to under the subhead of "Placer Gold," and, while the conditions were not particularly favorable this past season, it would appear that the gold-output is materially larger than it has been for some years past.

Cariboo Mining Division.

The hydraulic properties operated by John Hopp, which include *Stouts Gulch*, *Lowhee*, and *Mosquito Creek*, are reported to have done exceedingly well this past year, better than ever before.

Leo Gee Wing's *Point claim*, on Slough creek, was operated under the management of Joseph Wendle, and is reported to have taken out more gold this year than any previous year, thus justifying the more up-to-date equipment installed in 1914.

The company's water-storage facilities are not as good as might be desired, so that the melting of the snow gradually, as it did last season, was a very material assistance.

No information has been received regarding the Lightning Creek Hydraulic, and it is believed the property made no serious output; the manager, Mr. Bonner, has been out of the country all the season.

Quesnel Mining Division.

In the Quesnel Division none of the larger companies that formerly made large outputs worked last season.

The old Hobson property at Bullion, which has been the subject of dispute: ownership for a couple of years, was prospected last season by one of the claimants—Mr. Ward. Since then the stakings of John Hopp *et al.* have been recognized by the Government, and the chances are that next season will see the property working again.

In the vicinity of Quesnel and around Quesnel Forks an unusually large number of individual miners have been working in a small way, and the bank at Quesnel reports having bought nearly \$80,000 worth of gold in small lots.

About the usual amount of work was carried on around Keithley creek, but no large amount of gold was taken out.

During the season there was a stampede into Swamp river, which flows southward into Cariboo lake; subsequent investigation, however, did not confirm reports brought out by the first prospectors and the excitement died away.

Omineca Mining Division.

The Omineca Mining Division this year made a total production of metalliferous minerals valued at about \$600,000, which is considerably larger than in any previous year. Placer-mining is not now very important in this Division, the production for last year being estimated at about \$12,000.

In the Omineca River region, so far as is known, only one placer-mining company was working. This was the Kildare Mines, Limited, on Slate creek, which employed thirty-three men during the season, presumably mainly on development-work.

The Cassiar Hydraulic Mining Company, Limited, on Kleanza creek, also carried on operations with seventeen men and made a small clean-up.

On Lorne creek the Dry Hill Hydraulic Mining Company continued work with twenty-three men, and it is supposed the erection of a long flume-line was proceeded with.

Hazelton-Telikwa Region.—It is in the vicinity of Hazelton and Telikwa that the only important productive lode-mining of the Division is carried on. In the first half of the year but little was done, but during the last six months quite a number of properties made shipments; most of these were small, however, the bulk of the tonnage coming from one mine—the *Rocher Déboulé*. In all, thirteen properties made shipments, as compared with four in 1914.

The Montana Continental Development Company, which operates the *Rocher Déboulé* mine under lease, completed the tramway system and other developments about the middle of the year, and at once commenced shipping to the Grinnhy Company's smelter at Anyox. Before the end of the year 17,000 tons was shipped, which contained 8 per cent. copper, together with some gold and silver values.

The *Silver Standard*, on Glear mountain, resumed operations towards the end of the year and shipped 154 tons, containing about 27,000 oz. of silver, besides lead. This ore is high-grade silver-lead-zinc ore and is shipped to Trail for treatment.

On Nine-mile mountain the *Black Prince*, *Silver Bell*, *Silver Cup*, and *Sunrise* were operated by leasers and shipments made; this is also silver-lead ore. From Hudson Bay mountain, twenty miles from Telikwa, shipments were made from the *Coronado* and *Victory* groups. A shipment of silver-bearing bornite, amounting to 40 tons, is reported from the *Hunter* group, in Hunter basin.

A fair amount of prospecting, assessment-work, and development-work is also believed to have been done throughout the district. On the *Red-Rose* group, which is situated a short distance from the *Rocher Déboulé* mine, development-work has been attended, it is said, with very satisfactory results. The ore carries values in copper and gold, and when means of transportation have been obtained shipments will commence.

CASSIAR DISTRICT.

The extensive area known as Cassiar District includes the following Mining Divisions: Atlin, Llard, Stikine, Skeena, Queen Charlotte, and Porland Canal.

Atlin Mining Division.

The Atlin District during 1915 maintained the rank which it has enjoyed for some years past as the chief producer of placer gold in the Province, and is estimated to have produced \$355,000 worth of gold, which represents about 47.7 per cent. of the Provincial output.

Pine Creek.—The Pine Creek Power Company—a company organized and operated some years past by J. M. Ruffner—was the largest operator on this creek during the past season; the mining was chiefly confined to hydraulic mining on the ground known as the *Guggenheim* claims on Tar flats, which the Pine Creek Power Company has been working for some years back on a lease from the owners. J. M. Ruffner, who was the organizer of the company and manager since its incorporation, retired during the season of 1914, and was succeeded by Frank Breeze, formerly

book-keeper and assistant to his predecessor, who continued in the management during 1915.

Moshannon and Besbrook worked some thirty-one men throughout the season, but no details of the work done, nor of the amount of gold recovered, have as yet been received.

Three or four properties on this creek were very profitably worked by "laymen."

Spruce Creek would appear to have been one of the busiest creeks in the Division this past season, and is credited with an output of gold approximating \$110,000, produced by some twenty-three companies or partnerships. Of this, the largest contribution came from the *Joker* and *Poker* leases, worked by thirty-eight "laymen," followed, in order of importance of output, by the *Gladstone* lease, the *Chicago Bill*, *Peterboro'*, *Biocfontein*, *Hardscrabble*, and *Polar Star*.

Boulder Creek saw seven small properties being worked by the owners or "laymen," with fair success in a small way.

Ruby Creek.—Three concerns operated here throughout the season, the chief operations being on the *Rose*, where some seventeen men were at work and are expected to have produced nearly \$70,000.

McKee Creek.—The Delta Gold Mining Company operated on this creek during the season, employing about eighteen men and taking out, it is estimated, approximately \$35,000 in gold. No particulars of the work done have yet been received.

Birch, Otter, and Wright Creeks.—On Birch creek three properties were worked—the *Romance Forks*, and *Long Walk*—employing some eight or ten men and producing somewhere about \$10,000 in gold. On Otter creek nine men were at work on the *London*, chiefly on preparatory work, while five men were at work hydraulicking on the *Raven* with fair results. On Wright creek hydraulicking was carried on by four men on the *Jasper* lease, while the *Southern Cross* claim was worked by the owner. No returns have as yet been received as to the results of the work.

Various Creeks.—A couple of leases on Volcanic creek were prospected and one on Graham creek, but no returns have been received from them.

On Rose creek two claims were worked by the owners, and on Wilson creek three claims.

On Gold Run two properties were worked by "laymen," who were drifting.

On Bull creek a number of leases were prospected, but with what result is not yet known.

O'Donnell River.—The O'Donnell Placer Company operated on this stream drifting and hydraulicking, employing some fifteen men, but, as far as can be learned, with anything but satisfactory returns this season. Prescott and partners—some five men in all—worked one of the *Gold Hill* leases, taking out a fair amount of gold. Some seven or eight individual miners also worked on their leases, but no returns were received from them.

MINERAL CLAIMS.

Lode-mining has not as yet received any relatively large amount of attention in the Atlin Division; the only property making any production is the *Engin*, 2^d group, on Taku arm, where Captain Alexander had the usual complement of men at work and is reported to have run his 2-stamp mill, making, it is estimated, an output of gold worth about \$20,000.

The property was examined during the summer by an engineer for an American company, with an idea of its purchase and subsequent development along systematic lines and with proper equipment, but no reliable information has been received as to the result of the investigation.

McDonald and Story have been working on the *Silver Queen* and *Ruby Silver* claims, near Lake Bennett, where they have discovered molybdenite. McDonald also has in the same vicinity a deposit carrying antimony ore. Both these properties have been seeking a market for their product, which, however, is not to be had for such ores unless in a highly concentrated state.

Armstrong and Morrison, of Vancouver, became interested in the hydromagnesite deposits adjacent to the Atlin townsite, and this past summer mined and transported to Vancouver between 600 and 700 tons of the material, in an attempt to find a profitable market for it.

In the Rainy Hollow section of the Division a certain amount of prospecting and assessment-work has been carried on, but no productive mining.

Stikine and Liard Mining Divisions.

Mining in the Stikine and Liard Divisions consists entirely of placer-mining, and most of this is within the boundary of the latter Division. The south-eastern portion of Stikine includes a large part of the Groundhog coalfield, which was fully described in the 1912 Report. No work of any importance has been done in this coalfield during the last two years. On the Tahitan river, in Stikine, Indians worked the bars for a short time, but with indifferent success.

In the Liard Division the principal placering operations are carried on by the Boulder Creek Mining Company, which operates an hydraulic plant on Thibert creek, also described in the 1912 Report. Owing to the extremely dry summer, this company was held back considerably by a shortage of water, only getting in twenty-nine days' work during August, September, and October. Richer ground than usual must have been worked, as the output for the season was about the same as in the previous year.

Bail and Finn, drifting about a mile above the Boulder Creek Company's property, struck ground which was fairly rich in coarse gold, but spotted, and while their progress was slow on account of boulders encountered, still they managed to make a grub-stake.

Mitchel Bros. did some prospecting on Deloire creek, and also Adsit and Calvert on Mosquito creek.

On Dease creek four small operators were at work, but the returns were not very large. Two outfits were at work on McDame creek, merely engaged in prospecting.

Nothing further has been heard regarding the drilling operations on the flats at the mouth of Dease creek.

The production for the Division is estimated at \$30,000.

Portland Canal Mining Division.

The Mining Recorder reports that the following properties in this Division shipped ore during 1915: *Montana* group, Marmot river, 16 tons; *Kansas* group, Bear river, 20 tons; *Silver Top* group, Salmon river, 4 tons; *Missouri* group, Salmon river, 5½ tons. This is said to have been silver-lead-zinc ore, but no returns have yet been received from the owners.

No work was done by the Portland Canal Tunnels Co. in the long crosscut tunnel which intersected the veins during the previous year.

The amount of prospecting and assessment-work done was probably less than in previous years.

Queen Charlotte Mining Division.

Very little information has been received as yet regarding mining on Queen Charlotte Islands during the past year, but it is not believed that very much was done, other than prospecting development.

The *Ikeda* mines were worked on a larger scale than for some years previously; a production of about 355 tons of 15-per-cent. copper ore was made and shipped to the Anyox smelter.

The *Early Bird*, on Gold harbour, Moresby Island, milled 5 tons of gold ore, yielding 28 oz. of gold.

Boring for coal and oil was proceeded with to some extent, but not as vigorously as in former years.

Skeena Mining Division.

The Skeena Mining Division has now become one of the important producing sections of the Province, owing to the operation of the *Hidden Creek* mine and the smelting-works of the Granby Company at Anyox, Observatory inlet. The production of copper from this mine in 1915 was larger than that of any other group in the Province, and it is almost certain that in 1916 a still larger output will be made. The mine has been described in several of the Annual Reports of this Department, the last being in 1914.

The tonnage treated in 1915 was about 661,980 tons, from which it is estimated there was recovered, approximately, 4,900 oz. gold, 167,000 oz. silver, and 21,800,000 lb. copper. The annual report of the company for the fiscal year ended June 30th, 1915, contains much information, and from it the following notes have been taken:—

"The mining costs for the twelve months have been \$1.03 per dry ton landed in the cars on the railroad to the smelter. This amount includes the handling of 29,310 tons of waste and a development charge of 10 cents per dry ton. . . . The further exploration of the mineral area by diamond-drilling in and surrounding the mine was not attempted during the year. The ore reserves, with the deductions of shipments, remain at practically the same figures as reported for the previous year. To the reserves of the *Hidden Creek* mine should be added at this time the developed tonnage at the *Bonanza* mine. The latter mine is also in the immediate vicinity of the smelter and can be handled under the same organization. The following is then a summary of our ore reserves tributary to the smelter at Anyox:—

	High Grade.		Low Grade.		Total.	
	Tons.	Cu. %	Tons.	Cu. %	Tons.	Cu. %
Hidden Creek	9,205 837	2.17	8,628 000	0.63	17,833 837	1.43
Bonanza	414,775	2.66	489,580	0.70	904,355	1.60
Totals	9,620,612	2.19	9,117,580	0.63	18,738,192	1.45

"The development-work has consisted of 1,204 feet of drifting and crosscutting, with 1,732 feet of raising; a total of 2,936 linear feet. . . .

"Considerable construction was completed, including a new hunk-house, additional cottages, and a substantial electric sub-station. There is at the present time in process of erection a second crusher-station and ore-bins, which will enable us to introduce a more economical system of crushing and shipping. This plant also makes possible a large additional storage of crushed ore. The storage is much needed in order to more closely approach the ideal condition of handling with our mine haulage a fixed number of tons a day. We are now mining and shipping at the rate of 2,000 tons a day, which is our designed output. This we expect to increase to average 3,000 tons a day upon the blowing-in of the recently added fourth furnace."

The ore reserves were carefully estimated during the year by two independent engineers—C. M. Weid and F. B. Weekes—in order to check the company engineers' estimate. Their figures agree very closely with those worked out by the company.

The report dealing with the smelter at Anyox, by Superintendent A. J. Bone, details the various mechanical and metallurgical difficulties encountered during the first year of operation, but says everything is now running very smoothly. To quote from the report: "At the conclusion of the year, and barely fifteen and one-half months since the original start was made, it is apparent from all angles that we are approaching that condition of smooth, steady running which characterizes operations of long-established plants. The ores smelted covered a wide range in analysis, from low silica, low alumina, requiring quartz and a little coke to smelt, to the other extreme of high silica, high alumina, taking a basic flux and higher coke. Of late

the tendency has been toward higher silica content. We are also receiving about 100 tons daily of siliceous custom ore. The result of these conditions is to curtail the use of quartz in the blast-furnaces and increase the consumption of lime rock and basic 'Mamie ore,' and consequently the percentage of coke."

In addition to the ore from the company's mine at Hidden creek, the Anyox smelter treated a small amount of custom ore from the Omineca Division and from Alaska, and also some from the company's *Midas*, *Mamie*, and *It-Dean* mines, in Alaska. Limestone and silica quarries on Alice arm are operated by the company according to the needs of the smelter for these materials for fluxing purposes.

Several other properties on Alice arm are known to have been developed to some extent, but details have not yet been received. A molybdenite property on Alice arm, controlled by J. D. Ross, of Seattle, has been developed and is being equipped with a small concentrating plant, which is expected to be in operation before long.

No information has been received of any extensive development-work being done on the claims along the Skeena river.

PRINCESS ROYAL ISLAND.

The *D.L.S.* group at Surf Inlet, Princess Royal Island, which has been under bond for the past two years to the Tonopah-Belmont Development Company, of Tonopah, Nevada, was purchased by that company at the end of the year. The price paid was \$150,000 for an 80-per-cent. interest, the original company—the Surf Inlet Gold Mines, Limited—retaining one-fifth of the stock. In addition to this, the Tonopah Company agreed to put up a 250-ton mill, the construction of which will be started immediately. This will mean that a new gold-producing mine, in a hitherto unproductive region, will soon be added to the shipping mines of the Province.

The Tonopah Company will have spent, by the time the mill is completed and with development and purchase moneys, close to \$1,000,000, and it is therefore to be presumed that they have, in the development-work, proved up a considerable tonnage of ore.

The ore-bodies consist of veins and masses of quartz carrying pyrite, in sheared zone fissures in granite, and are sometimes of considerable size. The values are in gold and possibly a very little silver, occurring partly in the pyrite and partly free. It is not known what type of mill is to be erected, but it should be a comparatively easy ore to treat.

EAST KOOTENAY DISTRICT.

This district includes Fort Steele, Windermere, and Golden Mining Divisions. In recent years there has been but little mineral production in Windermere and Golden Divisions; it was expected that immediately after completion of the Kootenay Central Railway, from the Canadian Pacific main line southward through the valleys of Columbia and Kootenay rivers to the Crowsnest Railway east of Cranbrook, there would be mining activity in Windermere Division, but this expectation has not yet been realized to any considerable extent. In Fort Steele Division the position is, on the other hand, satisfactory as regards metalliferous mining, since the production of silver and lead was larger in 1915 than in any other year since 1900.

The coal production from this Division in 1915 was less than the previous year, chiefly owing to the shutting-down of the Hosmer mines; but the coke production, however, shows a slight increase.

Ore and concentrates shipped to the Consolidated Mining and Smelting Company's smelting-works at Trull in 1915 from East Kootenay totalled 44,547 tons, as compared with 33,784 tons in 1914. The mines that shipped in 1915 were: *Sullivan*, 44,084 tons; *St. Eugene*, 288 tons; *Monarch*, 167 tons of concentrates; and *Silver King*, 8 tons. In 1914 the shippers were the *Sullivan*, 35,835 tons, and the *St. Eugene*, 940 tons. The *Sullivan* and *St. Eugene* are in the Fort Steele Division, the *Silver King* in the Windermere, and the *Monarch* in Golden. The *Monarch* shipped 337 tons of concentrates to the United States.

Sullivan Mine.—Approximate metal contents of 44,084 tons of ore shipped in 1915 are estimated to have been about 26,300,000 lb. of lead and 474,000 oz. of silver. The total quantity of ore shipped from this mine in all years to the end of 1915 has been 275,000 tons, containing about 146,000,000 lb. of lead and 2,800,000 oz. of silver. The total length of development-work done in it is about 30,000 lineal feet, or 5.68 miles. In the Consolidated Mining and Smelting Company's last annual report, issued in December, the manager stated that in the last fiscal year "development has been confined principally to the old tunnel-level and the level 100 feet below it, and some promising bodies of ore have been opened in the drifts and by diamond-drilling (of which 3,838 feet was done). A tunnel has been started at a depth of 700 feet below these upper workings, which it is intended will be the main working-tunnel of the mine. This tunnel will be between 8,000 and 9,000 feet long before it reaches the present workings of the mine. An electrically driven shovelling-machine has been installed for handling the rock from this tunnel." The machine referred to is known as a Myers-Whaley "mucking-machine," and its operation in this mine is reported to have been giving much satisfaction.

The general manager of the Consolidated Company says in his annual report: "During the year considerable experimental work was carried on in the production of electrolytic zinc, and spelter of a good grade has been produced at the rate of about $\frac{1}{2}$ ton per day from zinc contained in the *Sullivan* ore. The results have been promising enough to warrant the building of a larger plant, and, on account of exceptional circumstances, a plant of 25 to 35 tons capacity of spelter per day has been designed and is now being erected. It is hoped that this will be in operation early in the year. The operation of this plant should make available a very large amount of complex ore at the *Sullivan* mine, and the extraction of this ore will probably lead to the development of further bodies of lead ore in the same mine."

Construction-work on the electrolytic plant at Trull is being rushed, and it is expected that by March the plant will be in operation. The company has a contract with the Imperial Government to take all the zinc they produce in 1916 at a fixed price.

St. Eugene.—Very little work was done in this mine in 1915, no new shoots of ore having been discovered as a result of the comparatively small amount of exploration done during the last year or two.

Other Mining Properties.—No important progress at either the *Aurora* or the *Society Girl* was made last year. Attention was directed toward low-grade gold-ore bodies on Perry creek, and to copper-ore occurrences in the neighbourhood of St. Mary's river, but no important results have yet been achieved, so far as known.

The *Monarch* mine, at Fiehl, in the Golden Mining Division, has been steadily worked since the early summer by the Great Western Mines Development Company, Limited, a Vancouver company. This property has been worked intermittently for many years, producing lead ore and concentrates carrying very low silver values. The ore carries zinc, but until the arrival of high zinc prices prevailing this year it was not possible to ship the zinc at a profit. This year, however, 337 tons of zinc concentrate was shipped, for which a good contract had been obtained. There is a considerable tonnage of low-grade zinc ore on the dump which may later on be put through the 40-ton concentrator. Development has been continued with, it is said, satisfactory results.

In the Windermere District the *Lead Queen*, on Frances (No. 3) creek, was bonded by Burgess and Barry, of Atholmer, and work commenced in a small way on the property. The construction of a fourteen-mile wagon-road was started and should now be nearly finished. Shipments of ore will commence as soon as the road is completed. The ore is galena and will be hand-sorted to a product assaying 40 to 60 oz. silver and 50 to 60 per cent. lead. No very large ore reserves have been proven on the property as yet, but development will be pushed ahead.

A small shipment of 8 tons of silver-lead ore from the *Silver King* represented a clean-up of the dumps of prospect-holes, etc.

Work on the *Hot Punch* and *Black Diamond* properties was discontinued owing to financial difficulties of the leasing companies. Neither are in shape as yet to make much production, but these and several other properties in the district could possibly be operated by leasers in a small way at a profit.

The characteristic ore-bodies of the district are small veins carrying pockets and shoots of silver-lead-zinc ore, often carrying grey-copper and being quite rich.

The *Partridge* mine, on Toby creek—at one time a considerable shipper—was examined by the Consolidated Company, but no work was done on it.

Placer-mining.—It was reported that better returns from placer-gold mining on various streams in Fort Steele Division were obtained in 1915 than for several previous years. The value of the gold recovered has been estimated at \$10,000.

COAL-MINING.

Two coal companies operated in the Crow's Nest coalfield in 1915—namely, the Crow's Nest Pass Coal Company and the Corbin Coal and Coke Company. The first-mentioned company worked eight mines at its Coal Creek Colliery and four at its Michel Colliery. Its gross output of coal was estimated at 797,010 tons, as compared with 778,408 tons in 1914; there was, consequently, an increase last year over 1914 of 18,607 tons. About 397,000 tons was made into coke, leaving a net production of rather more than 400,000 tons of coal, against 482,000 tons in 1914. The increased output of coke, however, more than compensated for the decrease in coal sold as such, for there was made in 1914 only 199,866 tons of coke, as compared with an estimated quantity of 239,178 tons in 1915, the increase for last year thus being 39,312 tons. The completion of a permanent air-course for No. 1 East mine and the installation of an endless-rope haulage system, to deliver coal from inside this mine right to the central tipples, were the chief features of progress at the Coal Creek Colliery. At the Michel Colliery the most noteworthy work done during the year was that in connection with the redevelopment of No. 8 seam above the old No. 8 workings that were sealed off on account of fire. It is stated that the extension of coal-producing operations into the large field the new No. 8 has entered constitutes one of the most important recent developments at the Michel Colliery.

At both collieries large new coal areas have been opened, and it is claimed that the company's mines are now in such effective working condition as would admit of 5,000 to 6,000 tons of coal a day being produced were there a demand for that quantity.

COKE-MAKING.

Since the closing of the Hosmer Company's ovens in 1914 the only coke-making operations carried on in this district are those at the Crow's Nest Pass Coal Company's ovens at Ferule and Michel respectively. Coke made by this company finds its chief market at the smelters in Boundary District and at Trill, in West Kootenay, both in British Columbia. A much smaller demand from the United States is supplied after requirements of smelting-works in the Province have been met.

It is worthy of mention that of a total of approximately 3,330,000 tons of coke made in British Columbia in all years to the end of 1915, about 2,002,000 tons was made at the Crow's Nest Pass Coal Company's ovens.

WEST KOOTENAY DISTRICT.

The importance of West Kootenay District as a metalliferous-mining region will be evident when it is stated that the total value of its mineral production during the last five years, 1911-1915, has exceeded \$31,000,000, or an average of approximately \$6,270,000 a year for that period. Its metalliferous products are gold, silver, lead, copper, and zinc, which constitute all the metals of commercial importance produced in the Province. Its most productive mining camp is Rossland, in Trill Creek Division, the gross value of the mineral production of which, for the twenty-two years mining has been in active progress there, has now reached a total of

\$40,000,000. Slocan, Ainsworth, and Nelson Divisions, in each of which are productive mines, are in this district. Several other Divisions are also within its boundaries, but these have not in recent years made any considerable output of minerals.

Ainsworth Mining Division.

The larger producers in this Division in 1915 were the No. 1, Bluebell, Cork-Provance, Ulica, and Retallack & Co.'s mines. At least ten other properties sent out more or less ore, but generally their output was small. The following shipments are expected to have been made from mines in this Division to Trail, taking the properties in alphabetical order:—

	Tons.
Alpine	4
Bluebell (concentrates)	1,614
Bon Ton	6
Charleston	13
Cork-Provance	956
Early Bird	78
Gallagher	13
Helena	7
Marlin	9
No. 1	6,771
Panama	35
Retallack & Co.	175
Silver Hoard	77
Spokane-Trinkel	20
Ulica	475
Wellington	7

Bluebell.—The production of this mine in 1915 was small in comparison with that of 1914. Owing to war conditions having adversely affected the metal markets, production was suspended in August, 1914, and was not resumed until September, 1915, so that the reduced output for the latter year was that of little more than three months.

Consolidated Co.'s Mines.—In 1914 the Consolidated Mining and Smelting Company produced ore at its *Highland, No. 1*, and *Banker-Macatro* mines until the general suspension in the district in August. It was not until March, 1915, that ore from any of the company's Ainsworth properties was again received at Trail. From that time until the end of the year 6,771 tons from the No. 1 mine reached the smelting-works, but not any from the other mines just mentioned. The company's general manager reported for the fiscal year ended September 30th last: "At Ainsworth the company's mines were closed during the greater part of the year, a few men being employed at the *Highland* in driving No. 5 tunnel, which is intended to open the veins 110 feet below the lowest previous workings of the mine. Ore has been encountered in this tunnel, but no development has yet been done on it. The prospects are encouraging."

Cork-Provance.—Much energy was displayed by the local company which in 1914 was organized and acquired these mines and the *Cork* concentrating-mill. Attention was largely concentrated on the further development of the *Cork* mine and on increasing the water-supply for milling purposes, and otherwise making the mill equal to dealing with a larger quantity of ore. Besides the 956 tons of silver-lead ore received at Trail, there was shipped 44 tons of zinc ore, so that the year's output was just 1,000 tons, as compared with 63 tons in 1914. It is expected that zinc as well as lead ore will be shipped in larger quantity in 1916; so far, the zinc tailing from two of the jigs has been stored for future further treatment.

Florence Mining Co.—This Spokane company, which is operating the *Hope* group of claims, situated about three miles north of the town of Ainsworth, did much development-work in 1915 and opened ore in sufficient quantity to induce the manage-

ment to make arrangements for the use of the *Highland* concentrating-mill to make a marketable product. One mile of wagon-road was constructed to connect the mill with the Government road to Princess Creek landing, arrangements were made to obtain power from the South fork of Woodberry creek, housing accommodation was provided at the mine for twenty-five more men, and generally matters were advanced to a stage that admitted of production being commenced at the end of the year. The first shipment of ore under these new conditions has since been made.

Ulca.—The *Ulca*, situated on Paddy's mountain, six miles by road from the Twelve-mile stopping-place (renamed Adamant by the Canadian Pacific Railway Company) on the Kaslo & Slocan Railway, is one of the progressive mines of the district. Under ordinary conditions its output has latterly been about 60 tons of shipping-ore a month, in the proportion of 3 tons of lead ore to 2 of zinc. The output for 1915 was 475 tons of silver-lead ore shipped to Trail and about 200 tons of zinc ore to the United States. The ore is hand-sorted and runs high in silver. The zinc ore shipped averaged 32.5 per cent. zinc and 126 oz. silver a ton. Development-work is being pushed ahead; mine buildings, compressor, sawmill, etc., have been provided; earlier transportation difficulties have been overcome, and now prospects are stated to be favourable for the regular maintenance of production.

General.—In what is known as Alsworth camp, the part of the Division near the town of Alsworth, is situated the *Silver Hoard*, an ore from which concentration experiments were made in 1915 at Rossland and in Montana. It has since been announced that a mill will be erected and equipped next spring along lines advised as a result of the concentration experiments. The work of driving a long crosscut tunnel on the *Skyline*, a well-known Crown-granted property long unworked, was commenced. Prospecting and development-work was done on a number of claims in the neighbourhood of Poplar creek and other streams in the upper part of the Division. More attention was paid to mining properties on or near the South fork of Kaslo creek than for several years, and the outlook is promising for more activity in that part of the Division in 1916. About Whitewater and in Jackson basin there are signs of a revival of interest. From Retallack & Co.'s *Whitewater* mine there were shipped 175 tons of silver-lead and about 600 tons of zinc ore.

Having a regular railway service, from Kaslo on Kootenay lake to Rosebery on Slocan lake, and thence to Nakusp on Arrow lake, is a decided advantage to those engaged in mining in the part of Alsworth Division through which the Kaslo & Slocan Railway has been reconstructed.

Slocan Mining Division.

Ore production in Slocan in 1915 was, on the whole, about normal, that is as regards silver-lead ore. Shipments of lead ore and concentrate to Trail in 1914 from mines in this Division totalled 14,352 tons; in 1915 the total was about 13,047 tons, but in addition there was 1,500 or 1,000 tons shipped to the United States from the *Surprise* mine, which, up to October 28th, had milled approximately 9,000 tons of ore and had shipped 1,415 tons of silver-lead ore and concentrate and 2,000 tons of zinc concentrate. Taking into account also the lead-zinc ore milled as well as the silver-lead, it is probable that later returns will show a larger total quantity of ore mined than in 1914. Several of the 1914 producers are not on the 1915 list, notably the *Richmond-Eurcka* and the *Van-Rol*, and the much smaller shippers, *Antoine*, *Cinderella*, *Colonial*, *Evening*, *Freddie Lee*, *Lone Bachelor*, and *Noonday*. Against these, however, may be placed others that were added to the 1915 shipping-list—namely, the *Galena Farm*, *Idaho-Alamo*, *Mountain Con*, *Reco*, *Wakefeld*, and several smaller shippers, including the *Buffalo*, *Mercury*, *Molly Hughes*, and *Rio*. The mines from which more than 100 tons of ore was received at Trail in 1915 were as under:—

	Tons.
<i>Hewitt-Lorna Doone</i>	641
<i>Lucky Thought</i>	101
<i>Mountain Con</i>	129

	Tons.
<i>Rambler-Cariboo</i>	2,160
<i>Ruth-Hope</i>	553
<i>Slocan Star</i>	986
<i>Standard</i>	7,930
<i>Wonderful</i>	190

The small shippers were as follows: *Black Grouse* (a new find), 11 tons; *Buffalo*, 14 tons; *Galena Farm*, 20 tons; *Home Rule*, 2 tons; *Ivanhoe*, 18 tons; *Mercury*, 17 tons; *Molly Hughes*, 18 tons; *Reco*, 73 tons; *Rto*, 13 tons; and *Wakefield*, 32 tons.

The *Neison Daily News* gives the following Slocan mines as zinc-ore shippers in 1915: *Galena Farm*, 248 tons; *Heclitt*, 1,563 tons; *Lucky Jim*, 1,020 tons; *Rambler-Cariboo*, 934 tons; *Ruth*, 84 tons; *Slocan Star*, 440 tons; *Standard*, 4,813 tons; *Surprise*, 781 tons; total from Slocan mines, 11,802 tons. Revised returns may be expected to cause some changes in these figures.

Bear Lake to Sandon.—Work was resumed at the *Lucky Jim* after temporary settlement of financial troubles. There is much zinc ore developed in the mine. Arrangements were made for concentration of ore at the *Ivanhoe* mill, Sandon, but three days after milling of the ore was commenced the mill was destroyed by fire. After several weeks' delay J. P. Keane got the Rosebery zinc-concentration plant running, and before the end of October *Lucky Jim* ore was being concentrated there.

The *Rambler-Cariboo* shipped 2,160 tons of silver-lead ore and concentrate to Trail in 1915, against 1,934 tons in 1914. In addition, zinc concentrate was sent to United States smelters to a stated total quantity of 934 tons. The *Rto*, above the *Rambler-Cariboo*, was further developed by lessees, who took out a little ore. Late in the year development-work on the *Soko* group, in the same neighbourhood, was arranged for.

About Sandon and Cody.—Development to the deep of the *Payne* mine was continued; the raise from the 1,500-foot level, which is a crosscut drift driven about 3,600 feet into the mountain, to the old 800-foot level, was completed, and an intermediate opened from the raise to cut ore followed down 34 feet in a winze from the 800-foot level. This object was achieved.

The *Ruth Mines, Limited*, operating the *Ruth* and *Hope* groups of claims near Sandon, continued driving a lower crosscut adit (No. 5) commenced in August, 1914, extending it to about 1,700 feet from the portal. Some 400 feet of drifting was done, and for half that distance there was a small shoot of ore, sometimes clean and again mixed. It was expected that a raise 450 feet to No. 4 level would be completed by the end of the year. The concentrating-mill at Sandon was remodelled, an aerial tramway was constructed from the portal of No. 5 to the mill, and in the autumn ore-concentration was again being done after a long period of inactivity at the mill. The silver-lead concentrate averages 135 oz. silver a ton and 60 per cent. lead; the zinc product contains 120 oz. silver a ton and 37 per cent. zinc.

The position at the *Slocan Star* mine, as indicated by the company's published reports, is substantially better than at the end of 1914. During the calendar year 1915 there was received at Trail from this mine 986 tons of silver-lead ore and concentrate; besides this, there was some zinc concentrate shipped to the United States. Production in 1914, up to the time of suspension of operations in August on account of the war, comprised 868 tons of lead ore and concentrate shipped to Trail and 664 tons of zinc concentrate. The grade of ore and concentrate is shown in the following excerpts from the annual report for the fiscal year ended October 31st, 1915: "Shipments of crude ore from development for the year were: Lead ore, 204 dry tons, assaying 88.94 oz. silver to the ton, 59.86 per cent. lead, and 6.94 per cent. zinc, and 43.40 dry tons zinc ore, assaying 12.015 oz. silver to the ton and 43.65 per cent. zinc. . . . The mill ran 251 shifts of eleven hours and milled 17,837 tons of dry ore, an average of 71 tons a shift, producing 635.5 tons of lead concentrate, averaging 66.55 oz. silver to the ton, 58.33 per cent. lead, and 8.15 per cent. zinc; also 1,400 tons

zinc concentrate, assaying approximately 15 oz. silver a ton and 32 per cent. zinc. Milling costs averaged 87½ cents a ton of ore milled, and mining and tramming \$1.55 a ton, making a total of \$1.92½ a ton for mining and milling."

The management of the *Surprise* mine shipped its lead as well as its zinc product to the United States in 1915. Shipments of lead ore from this mine to Trail in 1914 totalled 516 tons, but not any was sent there in 1915. Returns of shipments made since the end of October have not yet been received, but the output of the mine for ten months was approximately 9,300 tons, of which about 9,000 tons was milled, the remainder having been sorted lead ore, shipped crude. The total quantity shipped to October 28th was 1,415 tons of lead product (30 cars of concentrate and 7 cars of crude ore), and 64 cars containing 2,000 tons of zinc concentrate. Zinc concentrate was shipped to the Empire Zinc Company, Collinsville, Oklahoma, and the lead product to the American Metal Company, Newark, New Jersey. It may be of interest to note that the average metal contents of the ore milled were: Silver, 27.8 oz. to the ton; zinc, 10.7 per cent.; and lead, 8.7 per cent.; the average recovery was: Silver, 75 per cent.; zinc, 57 per cent.; and lead, 92.5 per cent. The ore was concentrated at the *Ivanhoe* mill, Sandoz, until fire destroyed that concentrator; afterward the *Rambler-Cariboo* mill was used for an agreed part of each month. The owners of the *Surprise* mine are Congressman Wm. Kent, of Kentfield, Marin County, California, and Alex. Smith, of Toronto, Ontario.

The *Noble Five* group was not among the ore-shippers in 1915, but deep-level development-work was continued under the direction of Paul Lincoln, manager. The crosscut adit, which was in about 900 feet at the close of 1914, was extended to 2,300 feet from the portal. At 1,800 feet in, the *Noble Five* vein was reached; a strong vein, 18 feet wide, heavily mineralized, chiefly with iron. It was drifted on 150 feet and it still retained its size and character, but was explored too far west to enter the ore-shoot opened in the old *Noble Five* workings, 1,200 feet above. Late in the year the adit was being further extended to cut the *Last Chance* vein at about 2,000 feet below where it was worked by the *Last Chance* company. The adit is 2,500 feet lower than the apex of the ridge above and east of Cody gulch. It is planned to raise from the adit to workings in which milling-ore is known to occur. Among the objects in view in driving this low-level crosscut is to avoid the danger to which employees are every winter exposed in the snowslide season, a number of men having lost their lives when going to or from the upper camp during the long period since the *Noble Five* was opened; further, when the raise shall be through to the upper workings, it will be practicable to work the mine throughout the year, and, as well, to handle the ore at lower cost. It is of interest to know that the machine-drills used in the crosscut adit mentioned are operated by air compressed at the mill in Cody and delivered through 3,000 feet of pipe to the portal of the adit, and thence more than 2,000 feet to the working-face.

The *Noonday*, situated a mile or so west of Cody, is opened by three adits. No. 1 reached the vein at 75 feet in, No. 2 at 165 feet, and No. 3 at 290 feet. The vein has been drifted on 350 feet north-east and 800 feet south-west on No. 2 level, above which there is about 100 feet of stoping-ground. No. 3 is 140 vertically or 100 feet on dip of vein below No. 2; when visited in October the drift south-west on No. 3 was in 120 feet, with about 100 feet more to be driven to get under the ore-shoot opened in No. 2. A wagon-road was constructed last year up to the mine, and buildings have been erected for the accommodation of the men employed.

A vein on the *Aldree Fraction*, next to the *Freddie Lee*, situated above the *Colonial*, at a high elevation on the mountain across the creek from the *Noonday*, was followed for 200 or 300 feet and some high-grade silver-lead ore taken out, but the ore-shoot had been small along the drift run up to the end of October. From the *Mountain Con*, in the mountains to the southward, there was shipped one car of high-grade ore in May and two cars in October. Of the latter, one car of 40 tons averaged 1,059 oz. silver to the ton and 41 per cent. lead, and the other car, of 39 tons, 685 oz. silver to the ton and 19.1 per cent. lead. Six men were working leases on the *Reco*—

four on the *Reco* vein and two on the rich *Reco-Goodenough* vein. Ore had been taken out and was waiting for snow for rawhiding down to Sandoe. The *Dunedin* was worked through what is known as No. 4 tunnel of the *Reco*. Work on the *Twilight* was chiefly driving a new tunnel to get under a shallow shaft in which, at 20 feet depth, there is a good showing of ore.

Above Sandon work was continued on the *Wonderful*, the face of the drift being about 350 feet below the surface, in a nice vein in which galena occurs in irregular bunches. The ore shipped averaged about 80 oz. silver to the ton and 50 per cent. lead. Leasers worked on the *Yakima*, of the *Ivanhoe* group, and got out a little ore. Three men worked last summer on the *Lane Bachelor*.

Three Forks and Alamo.—About two car-loads of antimony ore was brought down to Three Forks from the *Alps-Alturus* group, distant thirteen miles, situated at the head of a tributary creek of the North fork of Carpenter creek. One car-load was shipped to England and, it was reported recently, the second car was sent to Chicago; particulars of metal contents have not been obtained. A find of dry silver ore on the *Black Grouse* was made in the autumn and a shipment of 11 tons sent to Trall. McPherson was at work on a claim above the *Jo Jo*, near the *McAllister*. Over the divide, in the extreme western part of Alnaworth Division, is situated the *Panama*, which H. Giegerich and J. P. Miller have been developing. A crosscut cut the vein at 60 feet in; after drifting for 400 feet a raise was sunk 40 feet, and a drift run for 60 feet at that depth. The ore extracted lately averaged about 250 oz. silver to the ton, while that mined earlier ran only 150 oz., so a general average of 200 oz. is estimated. From a 60-foot shaft sunk in the vein 1,800 sacks of ore, about 63 tons, was taken out earlier. That ore contained a little lead.

Thos. Avlson and associates took out from the *Idaho* about 300 sacks of silver-lead ore and did a little development-work in this mine. From the neighboring *Alamo* mine they extracted 900 sacks of ore and did some work from No. 3 tunnel, chiefly raising and stoping.

Concentrator at Rosebery.—The zinc-concentrating mill at Rosebery was described by the Provincial Mineralogist in the Annual Report for 1911. It was erected by the owners of the *Monitor* and *Ajux* mines primarily for treatment of ores from those properties, but also with the expectation of doing business as a custom plant for concentrating lead-zinc ores of Slovan District. It was operated for a short time and then closed, and had remained unused for several years; but after the destruction of the *Ivanhoe* mill, of which he had been lessee, J. P. Keane arranged to continue in the Rosebery mill the custom concentrating business he had established at Sandon. The chief change made in the plant by Mr. Keane was the substitution of Wilfley tables for the Lührig vanners included in the original concentrating equipment of the mill. Under the new auspices the first car of concentrate made was loaded and billed out on October 30th, 1915. The product was from *Lucky Jim* ore; it contained 42 per cent. zinc; the shipment was consigned to the zinc-smelting works at Keosha, Kansas, U.S.A.

Near New Denver.—Work was continued on the *Cypella*; a little ore was taken out from the *Molly Hughes* and shipped to Trall; two men worked on the *Fairy Queen*, a promising prospect on Trout creek, on the west side and near the head of Slovan lake; six men were employed at the *Apey*, in Deaver canyon, at which the lower tunnel is in 450 feet and a raise connects with the upper tunnel 235 feet above, where quartz containing silver and gold was being extracted in the latter part of the year; tunnel-driving was continued on the *Marion*; a contract was let for driving 150 feet in No. 2 crosscut adit of the *Hartney*, and leasers took out a little ore from the *California*.

Silverton and Four-mile Creek.—Milling operations were resumed by the Standard Silver-Lead Mining Company about the middle of the year after a suspension of production since August, 1914, and by the end of 1915 there had been shipped to Trall 7,910 tons of silver-lead ore and concentrate containing 8,481,000 lb. of lead and 747,000 oz. of silver, and to the United States 4,406 tons of zinc concen-

trate containing 3,778,000 lb. of zinc and 102,000 oz. of silver. About 6,000 feet of development-work was done, of which about 2,000 feet was drifting and crosscutting in the *Alpha* mine, situated at a higher elevation than the original *Standard* mine. No important body of ore has yet been found in the *Alpha* by the Standard Company. Of the older levels of the *Standard*, Nos. 3, 4, and 5, most development-work in 1915 was done on No. 4, which was extended, crosscuts were driven from it, and raises made. Work done on Nos. 5 and 6 was drifting, crosscutting, and raising. Most of the large quantity of ore taken from the mine during the several years of its highest production was mined above No. 6 level. Not less than 1,600 feet of work was done on and from No. 7, this consisting of drifting and crosscutting about 800 feet and as much raising. Ore was found in a raise and it was drifted on between 100 and 200 feet, while an intermediate level between Nos. 7 and 6 was driven in ore for at least 100 feet, and stopes were opened from it. The ore at both east and west extremities of this shoot was slucky, but the heart of it gave much silver-lead ore. Work was stopped in No. 8 level at the beginning of February, and it was not until September that the miners were put back into this lowest level of the mine; the adit was extended and both crosscutting and raising was done, the raise going up in ore, of which there was not more than 3 feet in its widest part. In January, however, it was reported that a much better shoot of ore had been encountered on this level, but no particulars have been received. At the company's concentrating-mill, which was operated continuously during the latter half of the year with excellent results as regards concentration of ore, a small experimental flotation plant was put in with the object of making tests in the direction of a higher saving of the zinc in the ore. Dividends were paid by the Standard Company during the last four months of the calendar year, the total amount distributed during that period having been \$250,000.

Very little information has been obtained relative to the *Hewitt-Lorna Doone* group of the Silverton Mines, Limited, or the company's concentrating-mill situated on Four-mile creek four miles up the creek from Silverton. The total of silver-lead concentrate received at Trail in 1915 from this property was 641 tons. No. 8 level of the mine was in 1,800 feet in October, this level giving a depth of 1,200 feet. An extensive area of ground in which there is known to be a large quantity of high-grade ore has been opened by the later development of this property, there being shipping-ore of good quality down to the lowest level yet opened in the mine. A flotation process has been successfully used in connection with the concentration of the *Hewitt-Lorna Doone* ores, but particulars have not yet been made public.

Work at the *Lucky Thought* in 1915 was chiefly in No. 3 adit and raising to the level above. A road was constructed up the mountain almost to the entrance to the mine. Silver-lead ore shipped to Trail totalled 101 tons. The property is being explored by the Consolidated Mining and Smelting Company under option of purchase.

On the opposite range of mountains, situated 600 feet higher up than the *Alpha* workings, is the *Echo*, upon which much exploratory work was done during 1915. A big vein extends from the *Standard* through the *Alpha* and *Echo* and, it is claimed, on over the divide to the *Idaho-Alamo* properties. When visited at the beginning of November a lower tunnel was in 500 feet and an upper one 100 feet. The vein-filling was chiefly a black graphitic rock in which ore was found to occur in bunches, but no considerable body of ore had been encountered up to the time mentioned. Fourteen tons of ore was shipped from the *Buffalo* and 32 tons from the *Wakefield*; the latter well-known old mine has been acquired by local men, who took out a car of ore early in the autumn. The *Comstock*, near the headwaters of Four-mile creek, was worked by leasers, who shipped a small lot of ore which, however, did not reach Trail until January. South-east of Silverton there is the *L.H.*, on which, since the British Columbia Copper Company relinquished its hold, some further development has been done by its owners.

The *Galena Farm* group of five Crown-granted claims, situated a mile and a half south-east of Silverton, which had been idle for a number of years, was one of the mines in this part of the Slocan at which there was much activity during 1915. A crosscut adit driven 800 feet cut the vein at 75 feet below the old 100-foot level; and drifting on the vein was in progress in the last few months of the year. A raise has been made from the lowest to the 100-foot level, and thence to the surface, to get under the old dump stated to contain about 3,000 tons of ore which it is intended to convey to the concentrating-mill through the new raise and lower tunnel. The 100-foot level, driven on the vein for 350 feet, shows the average width of the vein to be about 7 feet, all milling-ore. The plan of working under consideration last October included stopping ore from the 100-foot level to the surface, and extending the lower drift as well. Later, the ore will be followed down, and if conditions shall be found to warrant such an undertaking, a crosscut adit will be driven between 4,000 and 5,000 feet to get under the present workings at 600 feet greater depth. Improvements made on the surface in 1915 comprise the erection of a number of new buildings, repair of old boarding and other houses, construction of about one mile of wagon-road to provide an easier grade for hauling to and from Silverton than that of the old road, repair of dam, and putting in a new 12-inch pipe-line about 2,000 feet, also an 8-inch line of similar length to utilize for running the dynamo the overflow water from the compressor. The new concentrating-mill machinery and plant includes crushers, sorting-belt, classifiers, trommels, jigs of Hartz type, etc. Middling is reground in Huntington mill, elevated and trommelled; coarser size is sent to a movable screen jig; smaller size to hydraulic classifier and thence to Wilfley tables, of which there are ten making two products—namely, silver-lead and zinc concentrates.

Slocan City Mining Division.

The output of ore from mines in the Slocan City Division was even smaller in 1915 than in 1914—only 234 tons as compared with 505. Ore receipts at Trall in 1915 from this part of the district were as follows: From the *Alice S.*, 16 tons; *Black Prince*, 21 tons; *Enterprise*, 138 tons; *Hamilton*, 18 tons; *McNeish*, 4 tons; and *Ottawa*, 35 tons. The *Eastmont*, which in 1914 shipped 152 tons, was not on the 1915 shipping-list; the *Ottawa's* comparatively large output of 289 tons in 1914 was also lacking in 1915. These losses in output notwithstanding, the outlook for the Division at the end of 1915 was believed to be more promising than a year earlier, for there was activity on several properties to which had been sent supplies for the full winter season.

The *Ottawa*, situated about five miles from Slocan City, had been a productive mine prior to the several years of inactivity that preceded its passing to the possession of the Consolidated Mining and Smelting Company, which acquired it in 1913 and has since developed in it some shoots of high-grade ore. Work was suspended in the autumn of 1914, shortly after the outbreak of war in Europe, but was resumed in 1915, though there has been but little ore production since. Development is being continued. The *Alice S.*, on Springer creek, was worked in 1915 by its owners, a New Jersey, U.S.A., company. A crosscut was driven 110 feet to the vein and development was continued by drifting both ways, altogether about 300 feet on the vein, and a raise was made 70 feet to the surface. Sixteen tons of ore taken out in the course of development was shipped to Trall to ascertain its value in bulk. Another crosscut was commenced at a vertical depth of 90 feet below the upper one, with an estimated distance of 248 feet to be driven to reach the vein. Buildings erected include houses for the accommodation of the men employed—eight were working last season—and an ore-house. A mile and a half of wagon-road was made to connect with the Slocan City-Springer Creek road.

Adjoining the *Alice S.* is the *Black Prince*, which J. T. Tipping is working under lease and bond; the property is on the divide between Springer and Lemon creeks. Development was commenced in June, and in November there was shipped to Trall

a car of dry ore estimated to average 200 oz. silver a ton, 6 per cent. lead, and 22 per cent. zinc. The work done included driving the lower tunnel to cut the vein at 125 feet deeper than the old workings; for 50 feet a drift was in ore. When cross-cutting in old workings from No. 3 a shoot of high-grade ore was encountered and men were put on stoping. A raise was made 40 feet from No. 3, and it was intended to continue raising if the ore should be found sufficient to warrant this further development. Mr. Tipping also drove a tunnel on his own claim, the *Gordon*, adjoining the *Black Prince*.

Barber and Taylor worked on the *McCoy* under lease, and took out some ore of good grade; they got in supplies to allow of continuing work throughout the winter. Wafer and Johnson found ore on the *Gladys*, on which they had been working a year or more. Geo. Long had three men working on the *Lily B.*; a cross-cut was driven to the vein and ore was mined, with prospects sufficiently good to induce the getting-in of supplies for continuing work all through the winter.

No information was obtained concerning the *Enterprise*, on Ten-mile creek, except that 138 tons of ore was shipped to Trall, as compared with 50 tons in 1914. There were other properties worked in Slocan City Division relative to which particulars were not received, but generally there was expectation that more mining will be done in the Division in 1916 than in any of several recent years.

Nelson Mining Division.

Mining in Nelson Division did not fully recover in 1915 from the adverse effects of the war, which in the second half of 1914 seriously affected ore production at the larger producing mines in the northern half of the Division. This is manifest when a comparison is made of production figures for the two years respectively. The output of the *Silver King* in 1914 was 13,457 tons; of the *Queen Victoria* it was 7,920 tons; and of the *Molly Gibson* 509 tons of concentrates. In 1915 no ore was shipped from either the *Molly Gibson* or the *Silver King*, and only 830 tons from the *Queen Victoria*. The decrease in production from these three mines was, therefore, 21,886 tons. The production at Ymir, and at Deer and Sheep creeks, near Salmo, was also considerably smaller, for the *Yankee Girl*, Ymir, which in 1914 shipped 230 tons, did not make any production in 1915, while the *Zincton* mine shipped only 16 tons to Trall, against 429 tons in 1914, and the *H.B.* mine's output of lead ore was 380 tons in 1915, against 2,004 tons in 1914. Without figures to tell what the position is in connection with the *Mother Lode* and *Queen* mines, at Sheep creek, no similar comparison can be made here, but it is known that the former mined and milled considerably less ore in 1915 than in 1914, though it is thought probable the latter's production was not far from being equal to its 1914 quantity of ore crushed and gold recovered. On the other hand, the *Granite-Poorman* mines were worked in 1915 and resumed production of gold.

Molly Gibson.—In the Consolidated Mining and Smelting Company's last annual report only a brief reference was made to this silver-lead mine, as follows: "At the *Molly Gibson* a few men have been worked on the tunnel from the surface with fairly satisfactory results, but no ore has been shipped, and the mill has not been operated." The footage of development-work done was 350 feet.

Queen Victoria and Eureka.—A comparatively small quantity of ore was shipped to Greenwood smelting-works from the *Queen Victoria*, near Beasley Siding, this production having been made by men who leased the mine from the British Columbia Copper Company. After that company relinquished its hold on the *Eureka*, situated on Eagle creek, that property was bonded by F. Keffer and H. Johns, who had, during the two or three years the company was doing exploratory work, supervised operations, and so were well informed as to conditions in the mine. In 1915 it was rebonded to the Pingree Mines Company, of Victoria, which is driving a crosscut adit to open the mine at approximately 200 feet deeper than the main working-tunnel, which follows the ore for about 900 feet. Besides providing for drainage, there now being an excessive flow of water into the upper workings, the new adit will make accessible for exploration a large section of new ground. The Pingree Company

plans to construct an aerial tramway from the mine down to the Canadian Pacific Railway on the opposite side of Kootenay river; also to install an electrically driven compressor, power to be obtained from the Nelson City power system by connecting with its main transmission-line that passes some distance below the *Eureka* mine.

Granite-Poorman.—This property, formerly operated by the Kootenay Gold Mines, Limited, was worked in 1915 under lease and bond by the Crilly-Wilson Syndicate and sub-lessees. The most important development-work done under the new regime was that of sinking a shaft on the *Hardscrabble* to a depth of 110 feet, following down a quartz vein, in places 3 feet in width, of ore of good grade. A level has been opened at 100 feet depth, and the showing of ore continues to be good as the drift is advanced. The sub-lessees working in the *Greenbarn* mine are also getting out ore and are planning extended development to cut the ore-shoot on another level. Ore is also being extracted from the *Poorman* mine. The *Granite* 20-stamp mill has been overhauled and the machinery and plant put in good running-order. About thirty men have been regularly employed in mines and mill.

Smaller Gold-mines.—For nine months of 1915 the *California* was worked under lease with an average of eight men employed. No. 2 tunnel was extended 180 feet, and a raise was made 60 feet in ore to connect with an 80-foot winze sunk from No. 1 tunnel. A new cabin was built. Ore shipped to Trail totalled 110 tons, stated to average in value \$35 a ton in gold and 3 oz. in silver. In the *Venus* ore was stopped during the first half of 1915; operations were discontinued in June. Twenty-five tons of ore was sent to Trail from the *Eschequer*, near the *Venus*. Three men were regularly employed throughout the year at the *Perrier*; some shaft-sinking and drifting were done and some ore milled. A new mill building and an assay office were erected late in the year. Other surface improvements were made, including completion of a pipe-line and installation of a Pelton wheel which runs a three-drill compressor and two vanners. An hydraulic jet-pump was also installed.

Silver King-Dandy Group.—These properties were not worked in 1915. It is not known why the Consolidated Mining and Smelting Company, which controls them, did not resume work after metal-market matters became normal.

La France Creek.—No ore has yet been shipped in quantity from mineral claims up this creek, there not being suitable facilities available for its conveyance a distance of eight miles down to Kootenay lake. A considerable amount of development-work has been done and it is claimed that the mineral showings are good.

Near Hall's Siding.—The *Fern* mine and some neighboring mineral claims were carefully examined last summer for Spokane men, who afterward bonded the *Gold King* group and made preparations for prospecting and developing some known occurrences of ore. After a road had been made 2,000 feet to connect with the Government wagon-road to Nelson, a vein was opened at intervals along the surface for about 1,000 feet, a prospect-shaft was sunk and an adit driven. Assay returns ranged up to \$25 in gold and 7 oz. silver a ton; it is stated that the average of 168 samples assayed was \$13.85 in gold and 2 oz. silver a ton. A steam-power plant, including compressor, hoist, and sinking-pump, was put in, and at the end of the autumn eight men were being employed on the property. One member of the syndicate operating the *Gold King* leased the *Fern* mine and had two men doing development-work in it.

Ymir and Neighbourhood.—The *Porto Rico*, situated between Hall's and Ymir, was again worked for a short time and a little gold was recovered, but seemingly results did not justify continuance of operations.

In Ymir camp three properties in particular have had attention in recent years—namely, the *Wilear*, seven or eight miles from Ymir, up the South fork of Wildhorse creek, and the *Dandee* and *Yaukee Girl*, both within a mile or so of Ymir. Only the last-mentioned property was worked continuously in 1915. Little, if any, ore was shipped during the year from the *Yaukee Girl*, operations having been largely restricted to driving a lower adit to the vein at a depth of 900 feet below the upper main level, and drifting both ways from where the vein was intersected, this drift

opening much ore and adding considerably to the prospective value of the mine. Grading was completed for a hydro-electric power and mill installation, the intention being to bring water from Wildhorse creek in 6,500 feet of 3- x 2-foot flume to a penstock, and thence by pipe-line 1,200 feet to the water-wheel, under 240-foot head. Preparations were being made to provide cheaper means of transportation from the mine to the Ymir Railway Station, in which connection towers were constructed for an aerial tramway, to be one mile in length. The outlook for this mine is regarded as being distinctly good. Work on other mining properties in Ymir camp consisted, for the most part, in doing the annual assessments.

About Salmo.—Production of lead ore at the *Emerald, H.B., Zincton, and Leadville* mines was continued, though in smaller quantity than in 1914 in several instances, besides which much zinc-carbonate ore was shipped. The *Emerald* mine produced most of the lead ore in 1915, its output having been 1,290 tons, as compared with 1,186 tons in 1914. This mine is situated on Iron mountain, about eight miles south-east of Salmo; it is operated by the Iron Mountain Mines, Limited, and the management plans next spring to install a hydro-electric plant on either Sheep creek or Lost creek, both within two miles of the mine, and transmit electric current to a 50-ton concentrating-mill to be erected at the mine.

The *Leadville, Zincton, and H.B.* are contiguous properties situated on Deer creek, about three miles from the junction of that stream with Sheep creek. Of the three mines, the *H.B.* was the only comparatively large shipper in 1915, having sent to the United States zinc ore to an estimated total of approximately 4,000 tons, which is stated to have averaged about 30 per cent. zinc. Ore has been mined from Nos. 2 and 3 levels; recently the work was commenced of driving a crosscut adit from Deer creek; it has been calculated that 1,700 feet will have to be driven to get under the ore previously opened by the levels just mentioned, below the lower of which the new adit will be about 850 feet, vertical depth, which will give a total depth of 1,150 feet. The ore shipped in recent months was delivered to zinc-smelters at Iola, Kansas, and Bartlesville, Oklahoma. The *Leadville* did not send any ore to Trall in 1914, but in 1915 it shipped 140 tons to the smelter there. The *Zincton* sent only 16 tons, as compared with 420 tons in 1914.

In the *Queen* mine, Sheep creek, stoping ore from the big shoot opened on the 600-foot level was continued, much of the output of 1915 having come from the stopes off that level. The total amount of gold recovered in gold bullion and from concentrates was over \$100,000. Development at the 700-foot level was reported at the end of the year to have had promising results, ore assaying well, having been entered in the latter part of December. It is expected that the ore-shoot, which on the 600-foot level ranged in width up to 35 feet, will also be big on the seventh level, in which case profitable results may also be looked for in 1916. As in other years, the ore mined was crushed in the *Yellowstone-Queen* 20-stamp mill.

The *Motherlode* stamp-mill was operated only for a part of the year, so the quantity of gold recovered was proportionately smaller than in previous years. The *Kootenay Belle* was idle throughout the year. It is reported that gold to the value of between \$4,000 and \$5,000 was recovered at the *Ore Hill* and *Summit*, situated on Vernon mountain, high up above the *Queen-Yellowstone* group; in addition, there was concentrate to be shipped later to a smelter. Work was done on the *Golden Fawn*, under lease; the amount of gold obtained was not ascertained. More prospecting was done on the *Reno*, on which occur several veins which make this property a promising one. Other claims in the same neighbourhood were also worked. Lath Bras, had a few tons of ore packed down to the wagon-road at Sheep creek, and hauled thence to the railway for shipment to Trall; this ore came from the *Spokane* group, on Canyon creek, which flows east from the divide at the head of Sheep creek, and it served as a bulk test to give a good idea of its metal contents. There was little work done in the *Bayoune* region, farther eastward.

The *Relief* mine seems to have been the only producer in Erie camp in 1915; its output was of a value of about \$25,000, nearly all in gold. A greater production would have been made but for the following reasons: First, that water was short

last season for power and concentration uses; and, next, that while improvements were being made to the mill plant, operations were necessarily curtailed. Five stopes have been opened from the No. 4 tunnel, ore in the face of which is stated to average in value \$16.50 a ton. During the year No. 4 adit was extended about 450 feet; much new tramway-track and pipe were put in; two ball-bearing ore-cars were added to the mine equipment; a blacksmith-shop, 18 x 24 feet, was erected and supplied with all requisite tools, etc.; the tramway from mine to mill was improved, part of it having been double-tracked, with a length at each end covered in; an ore-sorting bin was constructed, and other improvements were made. Additions to mill plant and machinery included a duplex Dorr classifier; a 4 x 20-foot tube-mill; cyanide plant; a Jenckes 80-horse-power steam-boiler, and a 70-horse-power steam-engine. The amount of expenditure on recent additions and improvements to mine and mill is stated to have been \$30,000. It is expected that, with the increased milling facilities above mentioned, the mill capacity will prove to be about 50 tons a day, and that about 90 per cent. of the gold contained in the ore will be saved.

Molybdenite.—Some particulars of the deposit of molybdenite ore at Lost creek, distant by wagon-road about fourteen miles from Salmo, were printed in the Annual Report of the Minister of Mines for 1914. Since then the Canadian Mining Institute has published a paper entitled "Notes on the *Molly* Molybdenite Mine, Lost Creek, Nelson Mining Division, B.C.," prepared by Dr. Chas. W. Drysdale, of the Geological Survey of Canada, from which the following excerpt has been made: "On March 10th, 1914, the property was leased to G. H. and J. P. Bell, of Salmo, and active development-work was thereafter carried on. On April 9th, 1915, Bell Bros. shipped to Denver, Colorado, one car containing 24 tons of the molybdenite ore; this ran 12.86 per cent. molybdenite, and 90 per cent. of this was paid for at the rate of 50 cents a pound. In addition, 2 tons of samples of the ore was shipped to New York by the owners; this ore averaged 9.5 per cent. molybdenite, which was sold for \$1 a pound. Several thousand tons of unfilling-ore which would probably run about 4 per cent. molybdenite lies on the mine dumps. During the spring of 1915 the property was bonded by a Vancouver syndicate for \$100,000; development is now in progress, and the installation of a small concentrating plant is contemplated."

Trail Creek Mining Division.

While this Division comprises a considerable area of country, there is little productive mining done in any other part of it than Rossland camp. As in other recent years, practically all the ore produced in 1915 came from the operating mines situated on Red Mountain, in the immediate neighbourhood of the town of Rossland. These are the *Centre Star* and *Le Roi* groups, owned by the Consolidated Mining and Smelting Company of Canada, and the *Josie* group, which is the property of the *Le Roi No. 2, Limited*, of London, England. The only other production made in Rossland camp in 1915 was the insignificant quantity of 5 tons from the *Phoenix*, in the South Belt.

The following table gives the figures of ore mined at Rossland during the years 1914 and 1915; all this ore is shipped to Trail as crude ore, excepting a small tonnage (from 6,000 to 10,000 tons yearly) milled by the *Le Roi No. 2*, the concentrates from which also go to Trail:—

	1914, Tons.	1915, Tons.
<i>Centre Star-War Eagle</i> group	173,966	180,508
<i>Le Roi</i> group	96,686	131,319
<i>Josie</i> group (<i>Le Roi No. 2, Ltd</i>) (ore and concentrates)	26,886	22,305
South Belt—		
<i>Bluebird</i>	18	...
<i>Phoenix</i>	4	5
Totals	297,200	334,137

It is of interest to note that in only one other year of the twenty-two years during which Rosslund mines have produced ore has the 1915 output been exceeded; that was in the year 1903, the officially recorded quantity for which was 300,780 tons. The gold recovered that year, however, was less than that of 1915 by an estimated quantity of more than 10,000 oz.

As the production and other figures for the fiscal year of the chief producing company, ended September 30th, 1915, vary to only an unimportant extent from those of the calendar year 1915, it is quite probable that a review of the fiscal year's progress as stated in the last annual report of the Consolidated Company, and information relative to ten months' operations of the *Le Roi No. 2, Limited*, will serve equally well to give a fair idea of progress and results in the calendar year 1915.

Consolidated M. and S. Co.—Production of ore at the Consolidated Company's mines during the last fiscal year was: From *Centre Star-War Eagle* group, 180,410 tons; from *Le Roi*, 134,758 tons. Development-work done during the same period was as follows:—

	Driftin: and Crosscutting.	Raising.	Sinking.	Total.	Diamond- Drilling.
	Feet.	Feet.	Feet.	Feet.	Feet.
<i>Centre Star</i>	11,619.5	1,015	300.5	12,944.0	11,580.8
<i>Le Roi</i>	2,260.0	245	90.5	2,604.5	10,906.7

Le Roi No. 2, Ltd.—Particulars of operations and results for ten months, to the end of October, 1915, are as follows:—

During the ten months the total footage of development-work done was 2,242 feet. Diamond-drilling done during six months totalled 3,825.5 feet. The quantity of ore shipped crude was 15,681 tons; there was milled 9,467 tons of second-class ore, from which was obtained 828 tons of concentrate, also shipped to the smelter. The metal contents of the ore shipped crude were: Gold, 7,901 oz.; silver, 23,780 oz.; copper, 870,268 lb. The average contents per ton of the concentrate, as indicated by assays, were: Gold, 0.5078 oz.; silver, 0.829 oz.; copper, 30.44 lb.

It is noteworthy that before the close of the period under review stoping had been commenced on the 1,600-foot level of the *Annie* claim of the *Josie* group, which is the lowest level of the mine. In September work was resumed on the *No. 1* claim of the group. Development-work was done on the *California* and *Giant*, two claims which adjoin on the west the *Josie* group and which are held under option of purchase.

Instruction was given to a number of the company's employees in "first aid to the injured," and the classes were well attended. Two teams were practising early in November in preparation for an expected local competition in first-aid work.

Reduction-works at Trail.—The practical transformation that during recent years has been effected at the Consolidated Mining and Smelting Company's copper and lead-smelting works and electrolytic lead-refinery at Trail is strikingly evident to every one familiar with the important changes that have taken place. The greater part of the works has been rebuilt, enlarged, and modernized. The especial advances made in 1915 were the greatly increased use of the Cottrell dust-collecting system, the installation of copper-converters, and the considerable progress made with the erection of buildings and installation of machinery and plant in connection with the electrolytic zinc-refinery now being prepared for early operation.

A few weeks ago an announcement was made in the press in connection with a recently issued circular to shareholders relative to the company's operations during the fiscal year ended September 30th, 1915. This circular indicated the remarkable expansion in the capacity for production of the company's mines and works. It stated that when plans then in process of execution shall have been carried out,

the lead-producing capacity of the plant at Trail will have been increased 60 per cent., and that, too, on a more economical basis than in the past. This further information was given: "Not only is the company in a position to produce zinc commercially, but at the request of the Shell Committee at Ottawa a zinc-production plant is being installed at Trail, this to have a daily capacity of 35 tons of refined zinc. The zinc-output for 1916 has been ordered by the committee at profitable prices. The Shell Committee also requested that the company should undertake the refining of copper—a new Canadian industry. While this new departure will be carried forward on a limited scale at first, it is expected to develop and involve the treatment of much of the matte and blister-copper taken from British Columbia copper-reduction works. The committee has ordered at fair prices the output of refined copper for 1916."

The considerably increased provision made for the use at Trail of the Cottrell process for the electrical precipitation of fume is a noteworthy advance, since the use of this process greatly facilitates the separation of valuable materials from waste gases and smoke from roasters, furnaces, and converters; these materials are lead, zinc, and a little silver, much of which might easily be lost if the fume and dust were not cheaply and effectively saved on its passage through flues and stacks to the open air. At Trail the Cottrell dust-collecting plant on the lead-furnaces has been nearly doubled in size, and a new plant put in to treat fumes from the roasting department. Another plant is being constructed for fumes from the copper-converters and a part of the roaster gases, and still another for the zinc-refinery plant. In this connection the following brief excerpt from an address delivered recently in New York on the subject of "Recovery from Waste Gases" is made: "The recovery of these materials often would be warranted for the additional revenue which they would produce even under present circumstances; in others it is desirable to develop processes for separating the constituents of the collected fume and dust. Investigations at one smelter showed that metals having a gross value of approximately \$4,000 a day were being discharged into the atmosphere. The expense of collecting, smelting, refining, and marketing the valuable ingredients becomes an important item, and thus it behoves metallurgists, chemists, and engineers to devise cheaper methods of dealing with such problems."

After having for years shipped to Tacoma, Washington, U.S.A., the product of its copper blast-furnaces in the form of matte, the Consolidated Company has at length made provision for producing blister-copper at Trail. Two 12-foot Great Falls type copper-converters for converting copper matte have been installed, together with the requisite blowing-engine, which is a turbo-blower of 15,000 cubic feet capacity, driven by floating gears from a 900-horse-power motor.

Much experimental work having been done at Trail in connection with refining zinc electrolytically, and spelter of good quality having been produced to the amount of about $\frac{1}{2}$ ton a day, from ore from the company's *Sullivan* mine, the building and equipment of works, to have a capacity of possibly 35 tons of spelter a day, was commenced last autumn. The zinc-refinery buildings include structures for grinding, roasting, leaching, electrolyzing, and melting plants, motor-generator building, and transformer-station, together with fine systems, Cottrell dust-collecting plant, and a concrete stack 200 feet high and 12 feet inside diameter. It is planned to have the plant ready for operation early in 1916. It is, perhaps, well to mention that, up to date, experiments in connection with the production of electrolytic zinc have practically been confined to the company's own ores, so that as yet it is not possible to say what can be done by this method with the prevailing zinc-lead ores of Kootenay District. The zinc-refinery buildings are of steel and tile construction. The plant covers approximately 6 acres of ground.

Other West Kootenay Divisions.

In Arrow Lake Division work was done on the *Millie Mack*, situated in the neighbourhood of Burton. So far as known, no progress was made at the *Big Ledge* zinc claims, on Bald mountain, on the West branch of Plugston creek.

A revival of interest in mineral claims in Revelstoke Division is reported, chiefly in connection with bonding properties on which development-work is to be undertaken next spring. Work was done last season on various placer leases in the Big Bend country and some gold was recovered. From the old *Lunark* mine, near Illecillewaet, there was received at Trail in December 90 tons of ore, as compared with 100 tons in 1914. It is stated that a tramway about three miles long has been completed, and that more ore will shortly be sent down to the railway for shipment to the smelter.

By a coincidence, exactly the same quantity of ore from Trout Lake Division, 85 tons, was received at Trail in 1915 as in 1914. With the exception of 3 tons from the *Ethel*, west of Trout lake, the small production was from the properties of the Ferguson Mines, Limited, near Ferguson.

There was little, if any, mining done during the year in the Lardeau Mining Division.

BOUNDARY DISTRICT.

Mention was made in last year's Preliminary Review of the fact that for the first time since the production of copper was commenced in the district, in 1900, the copper-output of Boundary District had been in 1914 less than one-half of the total production of the whole of the Province. For 1915 the comparison is more unfavourable to the district, for its copper production for the year was less than one-third of that of the Province as a whole, the estimated output of Boundary having been only about 17,520,000 lb. out of the total for the Province of 57,000,000 lb. The combined ore-output of the three Divisions—Grand Forks, Greenwood, and Osoyoos—was approximately 1,217,000 tons, as compared with 1,003,000 tons in 1914, an increase of 124,000 tons in quantity, but there does not appear to have been a corresponding increase in metals produced. Gold seems to have been 2,000 oz. and silver 40,000 oz. less, though copper made a gain of over 1,100,000 lb. The loss in gold is attributable to the fact that no ore was produced from the *Rauchide*, and to a smaller production from the *Jewel* mine; and that in silver to similar causes and to decreased production from the *Mother Lode*, from which also less copper was obtained, while the *Rauchide* as well was missed from the 1915 copper-producers. On the other hand, the Granby Company's mines showed higher figures for all three metals, their increases having been about 8,000 oz. of gold, 2,000 oz. of silver, and 3,400,000 lb. of copper. Estimated production in 1915 of the three Divisions is as follows: Ore, 1,217,000 tons; gold, 82,000 oz.; silver, 307,000 oz.; copper, 17,520,000 lb.

Granby Consolidated Mining, Smelting and Power Co.—Approximate figures of production in 1915 from this company's group of mines at Phoenix are: Ore shipped, 1,035,000 tons. Metals produced: Gold, 36,000 oz.; silver, 104,000 oz.; copper, 16,046,000 lb. The output of ore was comparatively small at the beginning of the year, but by May all the blast-furnaces at the company's smelting-works at Grand Forks were running, so ore production was by that time back to full-time quantity. There was little out of the ordinary happened at the mines. One of the large jaw-crushers previously in use there was sent to the company's property at Anyox, Observatory Inlet. An electrically operated shovel, obtained some time previously, but not used in 1914 to any considerable extent, was given a thorough working test, and proved satisfactory. It is a Bucyrus 40-horse-power shovel, with 1½-yard dipper. The use of this shovel made it desirable to provide cars better adapted for removing to the dump large masses of waste, handled by the shovel with chains, so six automatic side-dumping steel cars, each of 10-ton capacity, designed by the mine superintendent, were made in the mine-shops and were found to answer admirably the purpose in view in making them. These cars have the door so arranged that when open it will allow the passage of a rock 4 feet in diameter.

The following excerpt from the mine superintendent's annual report shows one beneficial effect of the higher price obtained for copper: "On account of the high price of copper obtained during the past few months we have shipped about 85,000 tons of ore, from which a recovery of about 10 lb. of copper and a correspondingly low amount of gold and silver have been obtained. This ore was from areas where

diamond-drill holes had shown the mineral zone to be of too low a grade to be included in the ore reserves. It also included sections which had to be mined, but which under ordinary conditions would have been handled as waste. The inclusion of this low-grade ore resulted in a reduction in the recovery from total ore shipped from 17 to 16 lb. of copper a ton. On the other hand, the ore reserves are increased by this amount. Development-work further increased the reserves by 66,782 tons, making a total increase of 151,872 tons. The present condition of the ore reserves is, therefore, as follows: Ore remaining in *Gold Drop* mine, 61,400 tons; in *Iron-sides* mine, 4,171,005 tons; total ore in reserves (at July 1st, 1915), 4,232,405 tons. We estimate that from this ore a recovery of 17 lb. of copper a ton can be maintained. There is in addition a considerable quantity, perhaps 500,000 tons, of ore which will average 0.7 per cent. in copper and 40 cents a ton in gold and silver."

From the annual report it is also learned that for the last fiscal year, in which 610,998 tons of ore was shipped from the company's mines at Phoenix, the average cost per ton of ore, crushed, on railway-cars, including all mine development, was 83.1 cents. This included as well the cost of disposal of 77,329 tons of waste. The general manager made the following comment: "The cost of 85 cents per ton of ore shipped is about 5 cents a ton higher than the average for the previous five years. This is due partly to the shut-down in the fall of 1914, and subsequent starting of operations in the winter, but it also reflects the increasing expense of extraction attending decreasing ore reserves, and wherever possible this tendency is being offset by improving and cheapening the methods of extraction."

The first two blast-furnaces at the company's smelting-works near Grand Forks were blown in on August 21st, 1900; other furnaces were added from time to time, until in 1905 there were eight in all at these works. The general manager says: "At Grand Forks the smelting operation is a simple one, all of the difficulties of treatment and handling of the Phoenix ores having been solved years ago; this, with practically no expense for new construction, makes possible costs very substantially under those of recent years at this plant." The smelter superintendent reported: "The average smelting cost for the year was \$1.187 a ton, as against \$1.217 for 1914 and \$1.214 for 1913. There has been no new construction during the year, but repairs have been kept up and the plant is in first-class operating condition. Our costs are lower this year than of any of the previous years." The average of coke used per ton of ore was 13.17 per cent. There was smelted: Granby ore, 611,007 tons; foreign ore, 6,537 tons; Anyox matte, 6,359 tons; converter slag and matte, 23,826 tons; and fire-dust, 1,522 tons.

British Columbia Copper Co.—This company operated only during the second half of 1915. With that for the months of November and December estimated, the approximate quantity of ore from British Columbia mines smelted at the smelting-works at Greenwood during the period July 26th to December 31st, inclusive, was 113,135 tons, as follows: Ore from *Mother Lode* mine, 100,620 tons; Boundary Falls smelter clean-up, 2,194 tons; *Sunset*, 429 tons; *Queen Victoria* (Nelson Division), 830 tons; *Tipperary*, 62 tons. Metals recovered from these ores were: Copper, 1,527,917 lb.; silver, 14,732 oz.; gold, 3,946 oz. There was also ore from the United States smelted, but the quantity was not ascertained. There was little of interest outside of matters incidental to ordinary operations happened at the company's mines and smelting-works during the year, except that on November 25th the upper or custom ore-bins at the smelter were destroyed by fire, and that reconstruction was in progress at the end of the year.

Other Properties.—There was not much productive mining done at other properties in the central part of the district. At the *Jewel* gold-mine and stamp-mill development was continued during the greater part of the year on the 500-foot level. The only information obtained was to the effect that the approximate value of the gold bullion recovered in 1915 was \$50,000, and that the mill was closed and the mine leased. Small gold-silver mines that shipped ore included: *Skylark*, 225 tons; *E.P.U.*, 100 tons; and *Strathmore*, 27 tons.

Granby River.

While ore was mined at the *Union*, in Franklin camp, to an estimated quantity of 520 tons, there was, on the whole, less activity in that camp in 1915 than had been expected there would be. The *Union* group of mineral claims is described and illustrated in a bulletin, recently issued by this Bureau, entitled "The Mineral and other Resources of the North Fork of Kettle River." Of the ore produced in 1915, about 400 tons was shipped to the Granby Company's smelting-works at Grand Forks and the remainder to the Consolidated Company's smelter at Trail. A good idea of the average value of the ore is conveyed in a report by the mine superintendent, in which it was shown that the average gold and silver contents of more than 200 tons of ore shipped to Grand Forks was 0.45 oz. gold and 45 oz. silver a ton. The cost of hauling twenty-five miles to the railway was \$13.50 a ton, freight by rail to smelter was \$1.50, and charge for smelting \$6.75; total freight and treatment costs, \$21.75 a ton, which is a rather heavy handicap on mining in Franklin camp. A car-load shipment was made to Trail from the *Maple Leaf*, which group, lying contiguous to the *Union* group, is also described in the bulletin. The *Gloucester* group was bonded by the Granby Company and some development-work done. The *Little Bertha*, also on Granby river, but much nearer to Grand Forks, and another property in the neighbourhood, each made a small shipment to the Granby smelter.

Westkettle River.

Ore receipts at Trail from mining properties near Beaverdell and Carmi, respectively, were again small. They were: *Carmi*, 117 tons; and *Sally*, 164 tons. In the latter part of the year the Kettle Valley Railway from Princeton, Similkameen, to Pentictou, in the Okanagan valley, and thence to Midway, where it joins the Canadian Pacific Railway to Greenwood, Grand Forks, Trail, and Nelson, was operated on a regular three-times-a-week schedule, but the establishment of this means of regular communication with three places at each of which there is a smelter did not serve to stimulate ore production from mines and mineral claims situated in that part of the country through which the railway passes. However, it is expected that, now that an uninterrupted railway service is established, there will be more encouragement to owners of mining properties to get out ore, and that hereafter production will be less meagre than it was last year.

Osoyoos Mining Division.

While there was a slight revival of interest in mining in parts of this Division that had not seen mining activity for some time, production was small in those parts. In Camp Hedley, on the contrary, the Hedley Gold Mining Company continued energetically its gold-mining and milling operations, with the usual profitable results.

Camp Fairview was one part of the Division in which there was a little improvement, for there further development was done on the *Susie* claim, a shaft having been sunk 160 feet on the incline and a crosscut made to the hanglag-wall of the vein, with indications that there is here an ore-body of good size.

On Kruger mountain there does not seem to have been much done at the *Dividend-Lake View* or other lode mines, but from Spotted lake, in that neighbourhood, a considerable quantity of magnesium sulphate was hauled to Oroville, Washington, and shipped thence by rail to a United States firm that found use for this product.

Five men were employed on the *Horn Silver* group of four claims, situated fifteen miles south of Keremeos; 115 tons of ore shipped thence to the Granby Company's smelting-works at Grand Forks yielded a total of 23 oz. of gold and 7,779 oz. of silver. Two adits have been driven, No. 1 105 feet and No. 2 75 feet lower, about 50 feet. The ore ranges in gross value up to \$30 a ton. A light tramway was constructed 3,000 feet to the wagon-road, and over this ore to the amount of 10 tons an hour is conveyed at a cost of 45 cents a ton. This development is of interest as being the first productive lode-mining done in this part of the Division.

On claims in Olahn camp, where copper ore has long been known to occur, interest was shown in molybdenite ore also found there. Some properties were examined and reported on, and work was done for part of the year under a bond.

There was little mining done in Camp Hedley during the year outside of that done by the Hedley Gold Mining Company, as summarized below.

Hedley Gold Mining Co.—Mining in 1915 was done chiefly in the *Nickel Plate* mine of the *Nickel Plate-Sunnyside* group, and most of the development was in the lower levels. The main shaft of that mine is known as the *Dickson Incline*; it is a large shaft and has been sunk about 800 feet. Stollions have been cut at two levels and ore has been stoped from both. The work done during the year had for its especial object the development of ore the occurrence of which had been previously indicated by diamond-drilling, so that it might be ascertained what approximate quantity of ore was contained in the reserves of that part of the property. In carrying out this object there was much crosscutting and drifting done in the ore-bodies opened, besides which diamond-drills were freely used.

Production figures have not yet been given out, but it is understood that they were about the same as those for 1914, which were as follows: There was crushed and treated in that year in the company's 40-stamp mill and cyanide plant 78,404 tons of ore; average assay value \$10.80 a ton, total assay value \$847,349.39. Of this there was recovered \$644,851.58 by concentration and \$152,480.18 by cyanidation; total value recovered, \$797,340.76. It is of interest to note that the total production from these mines from 1904 to the end of 1915 has been approximately 582,000 tons of ore crushed and \$6,023,000 recovered, or practically an average of \$11.00 a ton over the whole of that period. The company's printed annual reports for five years, 1910-14, give figures that total as follows: Tons of ore crushed, 324,388; total receipts, \$3,563,008.45; expenditures, \$1,711,553.03; net profit, including \$40,692.00 interest received on money in bank, \$1,761,455.42; dividends paid, \$1,488,000. The total of dividends paid in 1915 was similar to that in 1914—namely, \$300,000—which is at the rate of 25 per cent. on the company's issued capital.

The company's new hydro-electric power system, briefly described in the Annual Report for 1914, the operation of which was commenced on January 2nd, 1915, was found fully equal to expectations and worked satisfactorily throughout the year.

Recent additions to mill plant and machinery were as follows: A Traylor 24- x 30-inch jaw-crusher; a second 5- x 22-foot tube-mill, with Montana-Tonopah lining; a Dorr classifier, which works with the tube-mill in a continuous system and gives excellent results; four more cyanide-tanks, of Pacific Coast fir, two being of dimensions 34 x 18 feet and two 30 x 16 feet; a third Oliver continuous filter, 8 x 12 feet, of latest design; and other plant. Two extensions of the lower part of the mill building, each 40 x 80 feet, were erected to house the new machinery, etc.; also a building over the new crusher, which was installed above the stamps.

Similkameen Mining Division.

The most notable event in this Mining Division during 1915 was the opening of the Kettle Valley Railroad between Pentlcton, at the foot of Okanagan lake, and Merritt, on the Nicola branch of the Canadian Pacific Railway at Princeton.

By this means the Similkameen was afforded a competing line of transportation and direct rail connection with other portions of the Province, instead of being compelled to use the indirect route via the Great Northern Railway to Oroville, in the State of Washington. It was expected that, during the latter portion of the past year, the railroad that has been built jointly by the Kettle Valley and Canadian Pacific Railway Companies from Princeton to Hope, on the Fraser river, would have been also opened for traffic and thereby have furnished a shorter and more direct route to the Coast than is at present furnished by the Kettle Valley and Canadian Pacific Railway routes via Merritt and Spences Bridge, but, owing to unavoidable delays in the construction of bridges and snow-sheds on the Coquilhalla summit, this long-anticipated route cannot be opened for traffic until 1916.

Had normal conditions prevailed during the past year, there is little doubt but that a branch line of railway would have been built from Princeton to Copper Mountain, but, while such a line is practically assured, the general business depression will delay construction for some time to come, and, in consequence, the progress of developing the copper properties on that mountain will be somewhat slower than was anticipated.

Coal-mining has not been as active as was expected, the operations having been largely confined to the development-work necessary to open the new mine at Princeton by the Princeton Coal and Land Company, Limited, as the fires that occurred in the old workings were of such a disastrous character as to require the sealing-up, by concrete stopplugs, of such large areas of those workings as to cause the management to determine to forestall any future trouble by isolating the old mine and surrounding it with a barrier of solid coal, 150 feet wide, both along the strike for a distance of 1,650 feet and on the dip for a distance of 1,500 feet, by opening a new slope into the virgin coalfield to the east. This work was practically completed during the year 1915 and all preparations made to mine in the new area and transport the coal through the new slope.

In lode-mining the operations were confined to development-work, performed almost entirely on the properties purchased by the British Columbia Copper Company on Copper Mountain, where that company continued prospecting with diamond-drills, deep trenching, and sinking some shafts. As a result of these operations, the management estimates the tonnage of copper ore, that may be said to have been blocked out, to reach approximately 10,000,000 tons, carrying an average content of 1.8 per cent. copper and about 50 cents a ton in gold and silver values combined. The management contemplates having glass models constructed which will show vertical sections of the various drill-holes, and these should prove a very valuable and convenient record for future reference. This work has been confined to the *Sunset* and surrounding mineral claims on Copper Mountain.

No mill- or smelter-construction work has yet been begun, although such was anticipated at the beginning of 1915, but abnormal conditions in financial centres have prevented the commencement of new construction-work, although it is understood that the company's plans for such are complete and only await the return of a normal situation in this respect.

In *Volgt* camp, on Copper Mountain, all operations have been awaiting the consummation of negotiations on which *Emil Volgt* has been engaged in the East during the greater portion of the year.

On *Kennedy* and *Holmes* mountains, as well as on *Whipsaw* summit, the annual assessment-work has been performed on the several mineral claims, and on some of these there have been serious attempts made to carry out systematic development-work, in order to have the properties in shape to be examined by engineers for prospective purchasers.

Placer-mining on the *Tulameen* and *Similkameen* rivers and *Granite* creek has been more extensively carried on by individual miners during 1915 than for some years past, for the reason that the general low stage of water in all of the streams permitted sluicing on bars, near the middle of the streams, that, in normal seasons, are covered with too great a depth of water. While the extreme low stage of water was a blessing to the individual miner with a sluice-box, that condition had a reverse effect on the operations of the hydraulic mining companies, as they were compelled to suspend operations because sufficient water could not be obtained for hydraulic operations.

Lambert and *Stewart*, on *Granite* creek, worked the entire season ground-sluicing, and just before the close of the season had advanced their bed-rock flume to a point where bed-rock is exposed. A partial clean-up was made and about \$2,000 secured.

Nicola Mining Division.

The only production from metalliferous mines in this Division were two sample shipments from the *Copper King* group, on *Ten-mile* or *Gnichon* creek, and a ship-

ment of high-grade ore from the *Copper Star* mineral claim, situated at the extreme north end of the Aspen Grove camp. Aside from the work at these two localities, there has been but very little activity in metalliferous mining in the Nicola Division.

No work was done on the gypsum-deposits near Merritt.

The coal-mining industry in the Nicola-Coldwater coalfields was not as prosperous as during 1914. The reasons for this are attributable by the colliery managers chiefly to the substitution of fuel-oil on locomotives, as the bulk of the demand for the coal in this field was, in the past, for firing locomotives. The depressed conditions have been taken advantage of by the managements of the Middlesboro' Collieries and the Inland Coal and Coke Company to open new mines in virgin ground, in order to be in readiness to take advantage of any market offering.

The production from the collieries of the district will be found elsewhere in this review under the subhead of "Coal."

Vernon Mining Division.

Placer gold valued at about \$3,000 was recovered on Slwash creek previous to July last, when operations were closed down because of a lack of sufficient water to pipe with. These operations were conducted by the Union Hydraulic Mining Company, with headquarters in Spokane.

At the *Houashee* mine, about fifty miles east of Vernon, development-work was being actively carried on until about July last, when work was suspended and the manager left for his headquarters in Minneapolls.

At the *St. Paul* mine work was carried on for a portion of the season, the ore mined, about 150 tons, being treated in a 2-stamp mill on the property.

Kamloops, Ashcroft, and Yale Divisions.

The *Iron Mask* has been the only mine producing in the Kamloops District during 1915. Development-work on quite an extensive scale was done on the 750-foot level of this mine, and a long tunnel started on that level towards the *Erin* mine, about 1,500 feet distant, which it is proposed to connect with the *Iron Mask*, and install a new shaft between the two properties, by raising from the tunnel-level to the surface. This shaft will, when completed, become the main outlet for ore from both mines. Almost 2,000 tons of ore and concentrates were shipped.

In the Highland Valley portion of the Ashcroft Mining Division there has been greater activity than in any other section. Several properties have been bonded by outside syndicates, and shipments of about 100 tons of high-grade copper ore have been made from the *Storia* group by Stuart Henderson, of Victoria, also about 50 tons from the *Glossie* group by Carlson, Vosburg, Gerle, and Dunlevy, who had bonded the property from J. W. Burr, the original owner, but failed to meet the payments.

In the Yale Mining Division the most noteworthy occurrence during 1915 was the discovery of high-grade copper ore outcroppings near Jones lake, in the range of mountains between the Fraser river and Chilliwack lake. The claims staked are said to be about eighteen miles distant from Hope in an air-line.

Because of the extreme low water in the Fraser river, several placer-miners have been taking advantage of the opportunity to clean up ground near the middle of the river which, during normal seasons, is unapproachable because of the depth of water and the rapidity of the current.

LILLOOET DISTRICT.

During the season of 1915 the Lillooet District received its first railway connection with the seaboard, when the Pacific Great Eastern Railway, in the early part of the season, completed its tracks to the town of Lillooet and later continued its service as far as Clinton.

Formerly, the lack of transportation facilities deterred even the development of the mineral prospects which have been located adjacent to the railway, and the

mineral output of the district has been restricted to a limited amount of gold, either placer or produced by small stamp-mills crushing quartz.

The advent of the railway will, it is expected, stimulate the prospecting for and development of lode mines in this district, in which, for geological reasons, there is a probability that they exist.

It is as yet too soon to expect any great results from this cause, and at present the only part of the district in which any serious attempt at lode-mining is being made is on Cadwallader creek, where, in 1914, the *Coronation* milled some 120 tons of quartz, carrying about \$40 to the ton in gold.

While this property did not make any output in 1915, a small force of men has been at work developing, with, it is reported, very satisfactory results.

Development was also carried on at the *Pioneer* by Fergusson *et al.*, where considerably increased ore-bodies have been proven, equally high in grade to those formerly known. A stamp-mill and cyanide plant is now being erected, and a force of men is at work in the mine under the superintendence of Charles Copp.

The *Wayable* has been under development all the season by Paxton and associates. A lot of some 20 tons of ore was treated in a test stamp-mill and yielded about \$16.50 to the ton.

The comparatively large amount of development-work done in the past few years has not shown the camp to be of greater extent than given in the 1910 Report of this Department, but it has shown up a number of veins heretofore unknown and has proved some known veins to extend farther than expected.

The placer-gold output of the district is expected to be somewhat greater than for some years back, chiefly due to the exceptionally low water exposures in the rivers, thus permitting individual placer-miners and Indians to work them.

COAST DISTRICT.

There are seven Mining Divisions in the region included under the heading of "Coast District"—namely, Victoria, Alberni, Clayoquot, Quatsino, Nanaimo, Vancouver, and New Westminster Divisions. The chief mineral production is coal and gold-copper ore in Nanaimo Division; copper ore and structural materials in Vancouver Division; and lime, cement, and clay products in Victoria Division. In addition, there has been development of mining claims in New Westminster, Alberni, and Victoria Divisions and other parts of the district; some of these claims, it is hoped, will become productive properties.

Vancouver Mining Division.

The only production of metalliferous mineral from this Division during 1915, so far as now known, was from the *Britannia* mine, situated on Howe sound. Exact figures of the year's output have not been received, but it is estimated that about 200,000 tons was shipped, containing 400 oz. gold, 55,000 oz. silver, and 10,000,000 lb. copper. This shows a decrease, as compared with the previous year, of about 2,000,000 lb. of copper and corresponding decreases in tonnage and amounts of precious metals. The mine was closed for a short time in the early months of the year owing to a snowslide, and this accounted for the decreased production.

During the last three years the *Britannia* mine, under the management of J. W. D. Woodie, has been developed, equipped, and enhanced in value in a way that is but little known, even in the near-by city of Vancouver. The company's policy has been to work along quietly and to avoid publicity as far as possible.

The changing of the former aerial tramway system to an electric railway and incline gravity tramway has been completed. The old 800-ton mill was in operation throughout the year, and the first 1,000-ton unit of what will eventually be a 4,000-ton mill was completed and commenced operations late in the year. This mill is situated on the side-hill, in such a way as to allow of a complete gravity system of handling the ore in its passage from crude ore at the top to concentrates at the bottom. Throughout the mill the construction-work is of the highest order and the

design is in every way up-to-date and modern. The old mill has provided the means of testing the ore thoroughly, so that the most efficient machinery could be installed in the new mill. The process used is a water-concentration by means of jigs and tables, followed by a treatment of the tailings by the oil-flotation system of the Minerals Separation Company. The fine crushing is done in tube-mills, in which harder lumps of the ore are used as pebbles, thus saving the cost of imported pebbles and increasing the output.

Power is obtained by the hydro-electric development of several water-powers, there being in all eight dams, either constructed or under construction. The most important of these is the Utopia dam, at the head of Britannia creek. Twenty-five hundred horse-power is now developed and this will be raised to 5,000. Steam-power is used as an auxiliary, there being three 500-horse-power Babcock and Wilcox high-pressure boilers, with necessary engines; oil-fuel is used in the boilers.

Mining operations are now mainly confined to the *Fairview* mineral zone, which is developed by five levels below the outcrop—500, 600, 700, 850, and 1,050 feet respectively. The new main level, which is 1,200 feet below the fifth level, is to be the main working-level of the mine. It has been driven in 4,336 feet and a 1,200-foot raise put up to the No. 5 level. All construction-work has been most thorough and the equipment throughout very complete. Provision for the storage of a considerable amount of reserve broken ore has been made by means of raises and ore-chutes.

No authoritative figures as to the tonnage of proven ore in the company's ground are known. It is believed, however, that 3,000,000 tons of ore is in sight and that a further tonnage of 10,000,000 tons can be classed as probable ore. The tonnage of further possible ore is considerable, as the whole mountain is more or less mineralized. The ore milled in recent years averages about 0.33 oz. silver to the ton and 2.75 per cent. copper. The concentrates, which are shipped to Tacoma for smelting, contain about 1.8 oz. silver to the ton and 15 per cent. copper. The mill makes an extraction of about 94 per cent. of the copper contents and 95 per cent. of the silver. Gold values in the ore are almost negligible.

The company owns two townships, one at the mine and one at the mill, both of which are directly controlled by the company, to which all the buildings belong. The towns are well laid out and neatly kept, and it is noteworthy that no saloon is allowed. The expenditures made by the company on behalf of its men, in the way of providing its employees with recreation and amusement, have been very generous and leave but little to be desired. Baseball and tennis grounds are provided, also a roller-skating rink and dance-hall, and all employees get free firewood. A hospital with medical and nursing staff is maintained, largely at the company's expense.

Nanaimo Mining Division.

TEXADA ISLAND.

The only metalliferous mining of importance done in 1915 in Nanaimo Mining Division was that of the Tacoma Steel Company at its *Marble Bay* mine, near Vananda, Texada Island. Information concerning coal-mining operations in this Division has already been given. Notes on several metal-mines and the lime-quarries on Texada Island, comprising a report by D. G. Forbes, were printed in the Annual Report for 1913.

Marble Bay Mine.—Returns from this mine have not yet been received, but it is believed the output in 1915 was about one-quarter less than in the previous year. The quantity of ore estimated to have been shipped to the smelting-works at Tacoma is about 10,000 tons, containing 1,400 oz. gold, 14,000 oz. silver, and 550,000 lb. copper. Very little has been heard regarding developments during the year, but it is believed that shaft-sinking was continued and diamond-drilling and other development-work carried on.

A small tonnage of ore is reported to have been shipped from the *Little Billie*, a property adjoining the *Marble Bay* and worked in former years. This tonnage was

750 tons, and the ore is gold-silver-copper ore of about the same character and grade as that shipped from the *Marble Bay*.

It is not believed that the *Cornell*, which was operated under lease in 1914, shipped during 1915.

Nothing further has been heard of the marble-quarry at the south end of Texada Island.

Vancouver Island.

Very little productive lode-mining has been done for some years on Vancouver Island. The only property, as far as at present known, that shipped during the year 1915 was the *Willow Grouse*, on Sooke peninsula, which has been operated all the season by the Willow Grouse Syndicate, consisting of local men, and which shipped by scow to the Tacoma smelter about 530 tons of ore, averaging about 8 per cent. copper, with some 50 cents a ton in precious metals.

Other properties in this vicinity are under development.

The *Kallapa*, on Meares Island, which in 1914 shipped 1,200 tons of ore, was closed down all this past year, but the owner writes that probably it will be started up again in the spring of 1916.

On Cowichan lake the *Blue Grouse* mineral claim is under development by a local company, and a very fair body of chalcopyrite ore has been partially developed.

Some further development-work has been done on the *Merry Widow* and *Old Sport* claims in the Quatsino Mining Division, where a large amount of very fair copper ore has been developed by diamond-drilling. The property is some twenty miles from navigable water, and is consequently without value until a railway can be constructed to salt water. Efforts are being made to have this railway built, but, as far as can be learned, no definite arrangements to that end have been effected.

Some development-work was done by the Valdes Island Copper Company on its properties at Valdes and Steep Islands, and it was reported that a small amount of ore was shipped, but no confirmation of this nor further details have as yet been received.

The lime, cement, and clay-products interests had a very discouraging year and did not make any more than half the output of the previous years, which is to be accounted for by almost a cessation of the building trades. Further particulars of these industries have been noted earlier in this bulletin.

Coal-mining has been carried on at all the Island collieries during the year, but a greatly diminished production was made. Particulars as to coal-mining are given in the previous pages of this bulletin.

PROFITS OF MINING COMPANIES.

The following statement shows the dividends declared by metalliferous-mining companies during the calendar years 1913, 1914, and 1915:—

Name of Company.	1913.	1914.	1915.
British Columbia Copper Co., Greenwood	\$88,756
Consolidated Mining and Smelting Company, Trail	348,264	\$464,376	\$468,425
Granby Con. Mining, Smelting, and Power Co., Grand Forks.	800,911	440,955	440,955
Hedley Gold Mining Co., Hedley.....	360,000	300,000	300,000
Le Roi No. 2, Ltd., Rossland	43,830	58,440
Rambler-Cariboo Mines, Ltd., Three Forks.....	25,000
Standard Silver-Lead Mining Co., Silverton.....	650,000	475,000	250,000
Totals	\$2,390,761	\$1,680,331	\$1,588,820

The amount of \$1,586,820 shown above as distributed profits for the year 1915 by no means represents the total of net profits earned during that year. A glance at the published accounts of several of the companies for their respective last fiscal years will make it clear that in these several instances there was as well a substantial sum placed to the credit of Profit and Loss Account. The Consolidated Company's accounts to the end of September, 1915, showed net profits of \$795,411, while the calendar year's total of dividends declared was but \$464,398. The Granby Company, which did not have a full operating year, made a profit of \$929,165 and disbursed only \$449,955 in dividend distributions. The Hedley Gold Mining Company in 1914 made net profits totalling \$388,229, and in 1913 the amount was \$405,255, while the total of dividends paid in those years totalled \$300,000 and \$360,000, respectively. In other instances, also, notably that of the Standard Company, profits were made that are not here shown in detail.

While little information is published usually relative to the earnings of coal-mining companies operating in the Province, it is known that in the case of the Crow's Nest Pass Coal Company, if not in other instances, fairly satisfactory headway has been made in recent years. The following statement, for which the president of the company was quoted as authority, was published lately: During the last three years the Crow's Nest Pass Coal Company has paid off all its bills and accounts payable, amounting in 1912 to a total of \$1,081,690. The liability on these accounts was reduced to \$811,605 in 1913, to \$498,241 in 1914, and the balance was entirely cleared off in 1915. A further statement quoted was that "Since January 1st, 1915, the company has paid off all its indebtedness and it now has a substantial balance at its credit in the bank. All the bonds against its subsidiary companies have been paid, so that there are now no bonds outstanding against any of the companies, nor is there any preferred stock. As far as we can judge, the prospects for the coming year are quite as good as, if not better than, the year just closed."

Generally, it may be said that the outlook for the larger operating mining companies of British Columbia is more promising than at the beginning of several successive late years. There is good demand for the metals they produce, prices subject to fluctuations are higher than at this time last year, operating conditions are favourable to a comparatively large production, and there is no present prospect of any set-back to interfere with the progress that it is now confidently expected will be made in 1916.

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