

ANNUAL REPORT  
OF THE  
MINISTER OF MINES

FOR THE  
YEAR ENDING 31ST DECEMBER

1919

BEING AN ACCOUNT OF  
MINING OPERATIONS FOR GOLD, COAL, ETC.

IN THE  
PROVINCE OF BRITISH COLUMBIA



PRINTED BY  
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C. :  
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.  
1920.

To Colonel the Honourable EDWARD GAWLER PRIOR,  
A Member of the King's Privy Council for Canada,  
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1919 is herewith respectfully submitted.

WILLIAM SLOAN,  
Minister of Mines.

Minister of Mines' Office,  
March 24th, 1920.



Rock Candy Mine (Fluorspar) Mill, near Grand Forks.

U.S. Bureau of Mines

*To the Honourable William Sloan,  
Minister of Mines.*

SIR,—I have the honour to submit herewith my Annual Report on the Mining Industry of the Province for the year ending December 31st, 1919.

The statistical tables give the total mineral output of the Province to date, and show in considerable detail the actual mineral production of the past year, as based on smelter or mill returns; also, a summary of the production of each of the last four years, thus illustrating by comparison the progress made in productive mining during this period.

To facilitate comparison with information previously given, I have retained, as closely as was possible, the general form already established for such tables and for the Report.

I have the honour to be,

Sir,

Your obedient servant,

WILLIAM FLEET ROBERTSON,

*Provincial Mineralogist.*

*Bureau of Mines, Victoria, B.C.,*

*March 24th, 1920.*

# MINERAL PRODUCTION OF BRITISH COLUMBIA.

## METHOD OF COMPUTING PRODUCTION.

In assembling the output of the lode mines in the following tables, the established custom of this Bureau has been adhered to, viz.: The output of a mine for the year is considered that amount of ore for which the smelter or mill returns have been received during the year. This system does not give the exact amount mined during the year, but rather the amount credited to the mine on the company's books during such year.

For ore shipped in December the smelter returns are not likely to be received until February in the new year, or later, and have, consequently, to be carried over to the credit of such new year. This plan, however, will be found very approximate for each year, and ultimately correct, as ore not credited in one year is credited in the next.

In the lode mines tables, the amount of the shipments has been obtained from certified returns received from the various mines, as provided for in the "Inspection of Metalliferous Mines Act, 1897." In calculating the value of the products, the average prices for the year in the New York Metal Market have been used as a basis. For silver 95 per cent., for lead 90 per cent., and for zinc 85 per cent. of such market prices have been taken. Treatment and other charges have not been deducted, except that in copper the amount of metal actually recovered has been taken, thus covering loss in slags.

TABLE I.—TOTAL PRODUCTION FOR ALL YEARS UP TO AND INCLUDING 1919.

Gold, placer.....	\$ 75,722,603
Gold, lode.....	100,272,431
Silver.....	50,432,304
Lead.....	43,821,106
Copper.....	153,680,965
Zinc.....	16,818,487
Coal and coke.....	199,123,323
Building-stone, bricks, etc.....	29,991,757
Miscellaneous minerals, etc.....	786,918
Total.....	\$670,649,894

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1919 (INCLUSIVE).

1852 to 1892 (inclusive).....	\$ 81,090,069
1893.....	3,588,413
1894.....	4,225,717
1895.....	5,643,042
1896.....	7,507,956
1897.....	10,455,268
1898.....	10,906,861
1899.....	12,393,131
1900.....	16,344,751
1901.....	20,086,780
1902.....	17,486,550
1903.....	17,495,954
1904.....	18,977,359
1905.....	22,461,325
1906.....	24,980,546
1907.....	25,882,560
1908.....	23,851,277
1909.....	24,443,025
1910.....	26,377,066
1911.....	23,499,072
1912.....	32,440,800
1913.....	30,296,398
1914.....	26,388,825
1915.....	29,447,508
1916.....	42,290,462
1917.....	37,010,392
1918.....	41,782,474
1919.....	33,296,313
Total.....	\$670,649,894

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1917, 1918, and 1919. It is difficult to get absolutely complete statistics regarding building-stone, lime, bricks, tiles, and other miscellaneous products, but the detail figures shown in Table V. are as nearly accurate as can be obtained.

TABLE III.

## QUANTITIES AND VALUE OF MINERAL PRODUCTS FOR 1917, 1918, AND 1919.

	Customary Measure.	1917.		1918.		1919.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold placer .....	Ounces.....	24,800	\$ 496,000	16,000	\$ 320,000	14,325	\$ 286,500
" lode.....	" .....	114,523	2,367,190	164,674	3,403,812	152,426	3,150,645
Silver.....	" .....	2,929,216	2,265,749	3,498,172	3,215,870	3,403,119	3,592,673
Lead.....	Pounds .....	37,307,465	2,951,020	43,899,661	2,928,107	29,475,968	1,526,855
Copper.....	" .....	59,007,565	16,038,256	61,483,754	15,143,449	42,459,339	7,939,896
Zinc.....	" .....	41,848,513	3,166,259	41,772,916	2,899,040	56,737,651	3,540,429
Coal.....	Tons, 2,240 lb.	2,149,975	7,524,913	2,302,245	11,511,225	2,267,541	11,337,705
Coke.....	" .....	159,905	959,430	188,967	1,322,769	91,138	637,966
Miscellaneous pro- [ducts.].....	" .....		1,241,575		1,038,202		1,283,644
			\$37,010,392		\$41,782,474		\$33,296,313

TABLE IV.

## OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

NAMES.	DIVISIONS.			DISTRICTS.		
	1917.	1918.	1919.	1917.	1918.	1919.
CARIBOO DISTRICT.....				\$ 529,897	\$ 383,996	\$ 196,801
Cariboo and Quesnel Mining Division .....	\$ 152,756	\$ 83,500	\$ 73,500			
Omineca Mining Division.....	377,141	300,496	123,301			
CASSIAR DISTRICT.....				8,485,438	9,178,441	6,402,082
EAST KOOTENAY DISTRICT.....				5,056,782	7,259,897	6,612,954
WEST KOOTENAY DISTRICT.....				5,972,545	6,113,279	4,669,090
Ainsworth Division .....	750,514	663,388	405,478			
Slocan and Slocan City .....	3,554,055	3,675,762	2,900,087			
Nelson .....	403,436	396,697	76,719			
Trail Creek .....	1,197,283	1,357,571	1,275,538			
Other parts .....	67,257	19,861	11,268			
BOUNDARY-YALE DISTRICT.....				5,055,403	4,961,452	2,527,514
Osoyoos, Grand Forks, and Greenwood Divisions.....	4,253,965	3,897,826	1,637,827			
Similkameen, Nicola, Vernon..	571,300	909,869	759,637			
Yale, Ashcroft, Kamloops.....	230,138	153,757	130,050			
LILLOOET DISTRICT.....				73,175	57,746	62,684
COAST DISTRICT (Nanaimo, Al- berni, Clayoquot, Quatsino, Victoria, Vancouver).....				11,837,152	13,827,663	12,825,188
				\$37,010,392	\$41,782,474	\$33,296,313

TABLE V.  
MISCELLANEOUS PRODUCTS AND TOTALS OF PRODUCTION, 1919.

DISTRICT AND DIVISION.	Cement.	Lime and Lime-stone.	Building-stone.	Riprap.	Crushed Rock, Flux.	Sand and Gravel.	Pottery and Clay.	Fire, Face, and Red Brick.	Total Building Materials.	Miscellaneous Minerals.	Total Miscellaneous Products.	Total Output of Collieries.	Total of Metalliferous Minerals.	Totals for Divisions.	Totals for Districts.
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
CARIBOO															196,801
Cariboo and Quesnel		500		3,000					3,500		3,500		70,000	73,500	
Omineca		500							500		500	8,760	114,041	123,301	
CASSIAR													177,000	177,000	6,402,082
Atlin, Stikine-Liard, Skeena, Nass River, Portland Canal, Queen Charlotte...				4,000	167,695				171,695	6,000	177,695		6,047,387	6,225,082	
EAST KOOTENAY															6,612,954
Fort Steele		1,500							1,500	15,300	16,800	2,764,824	3,672,881	6,454,505	
Windermere-Golden													158,449	158,449	
WEST KOOTENAY															4,669,090
Ainsworth										1,230	1,230		404,248	405,478	
Slocan & Slocan City													2,900,087	2,900,087	
Nelson & Arrow Lake		1,500		1,000		600		1,000	4,100		4,100		72,619	76,719	
Trail Creek													1,275,538	1,275,538	
Other Divisions						4,661			4,661		4,661		6,607	11,268	
BOUNDARY-YALE															2,527,514
Grand Forks															
Greenwood		13,048		1,000					14,048	93,779	107,827		1,530,000	1,637,827	
Osoyoos															
Similkameen															
Nicola		2,000		1,000					3,000	1,500	4,500	745,210	9,927	759,637	
Vernon															
Yale															
Ashcroft		1,000		1,000				1,652	3,652	3,600	7,252		122,798	130,050	
Kamloops															
LILLOOET										3,000	3,000		59,684	62,684	62,684
COAST DISTRICT	260,000	184,490	15,750	21,240	76,102	62,345	97,777	224,125	941,829	10,750	952,579	8,456,877	3,415,732	12,825,188	12,825,188
Totals	260,000	204,538	15,750	32,240	243,797	67,606	97,777	226,777	1,148,485	135,159	1,283,644	11,975,671	20,036,998	33,296,313	33,296,313

TABLE VI.—PLACER GOLD.

Table VI. contains the yearly production of placer gold to date, as determined by the returns sent in by the banks and express companies, of gold transmitted by them to the mints, and from returns sent in by the Gold Commissioners and mining Recorders. To these yearly amounts one-third was added up to the year 1878; from then to 1895 and from 1898 to 1909, one-fifth; and since then one-tenth, which proportions are considered to represent, approximately, the amount of gold sold of which there is no record. This placer gold contains from 10 to 25 per cent. silver, but the silver value has not been separated from the totals, as it would be insignificant.

YIELD OF PLACER GOLD TO DATE.

1858.....	\$ 705,000	1874.....	\$1,844,618	1890.....	\$ 490,435	1905.....	\$969,300
1859.....	1,615,070	1875.....	2,474,004	1891.....	429,811	1906.....	948,400
1860.....	2,228,543	1876.....	1,786,648	1892.....	399,526	1907.....	828,000
1861.....	2,666,118	1877.....	1,608,182	1893.....	356,131	1908.....	647,000
1862.....	2,656,903	1878.....	1,275,204	1894.....	405,516	1909.....	477,000
1863.....	3,913,563	1879.....	1,290,058	1895.....	481,683	1910.....	540,000
1864.....	3,735,850	1880.....	1,013,827	1896.....	544,026	1911.....	426,000
1865.....	3,491,205	1881.....	1,046,737	1897.....	513,520	1912.....	555,500
1866.....	2,662,106	1882.....	954,085	1898.....	643,346	1913.....	510,000
1867.....	2,480,868	1883.....	794,252	1899.....	1,344,900	1914.....	565,000
1868.....	3,372,972	1884.....	736,165	1900.....	1,278,724	1915.....	770,000
1869.....	1,774,978	1885.....	713,738	1901.....	970,100	1916.....	580,500
1870.....	1,336,956	1886.....	903,651	1902.....	1,073,140	1917.....	496,000
1871.....	1,799,440	1887.....	693,709	1903.....	1,060,420	1918.....	320,000
1872.....	1,610,972	1888.....	616,731	1904.....	1,115,300	1919.....	286,500
1873.....	1,305,749	1889.....	588,923				
				Total.....			\$75,722,603

TABLE VII.—PRODUCTION OF LODE MINES.

YEAR.	GOLD.		SILVER.		LEAD.		COPPER.		ZINC.		TOTAL VALUE.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
1887.....		\$	17,690	\$ 17,331	204,800	\$ 9,216		\$		\$	26,547
1888.....			79,780	75,000	674,500	29,813					104,818
1889.....			53,192	47,873	165,100	6,498					54,371
1890.....			70,427	73,948	Nil.	Nil.					73,948
1891.....			4,500	4,000	Nil.	Nil.					4,000
1892.....			77,160	66,935	808,420	33,064					99,999
1893.....	1,170	23,404	227,000	195,000	2,135,023	78,996					297,400
1894.....	6,252	125,014	746,379	470,219	5,662,523	169,875	324,680	16,234			781,342
1895.....	39,264	785,271	1,496,522	977,229	16,475,464	532,255	952,840	47,642			2,342,397
1896.....	62,259	1,244,180	3,135,343	2,100,689	24,199,977	721,384	3,818,556	190,929			4,267,179
1897.....	106,141	2,122,820	5,472,971	3,272,836	38,841,135	1,390,517	5,325,190	266,258			7,052,481
1898.....	110,061	2,201,217	4,292,401	2,375,841	31,698,559	1,077,581	7,271,678	874,781			6,529,420
1899.....	138,515	2,857,573	2,939,413	1,663,708	21,862,436	878,870	7,722,591	1,351,453			6,751,604
1900.....	167,153	3,453,381	3,958,175	2,309,200	63,358,621	2,691,887	9,997,080	1,615,289			10,099,757
1901.....	210,384	4,348,608	5,151,333	2,884,745	51,582,908	2,002,733	27,603,746	4,446,963			13,688,044
1902.....	236,491	4,888,269	3,917,917	1,941,328	22,536,381	824,832	29,636,057	3,446,673			11,101,102
1903.....	232,831	4,812,616	2,996,204	1,521,472	18,089,283	689,744	34,359,921	4,547,535			11,571,367
1904.....	222,042	4,589,608	3,222,481	1,719,516	36,646,244	1,421,874	35,710,128	4,578,037			12,309,085
1905.....	238,060	4,933,102	4,339,417	1,971,818	56,580,708	2,399,022	37,692,251	5,876,222			15,180,164
1906.....	224,027	4,630,639	2,990,262	1,897,320	52,408,217	2,587,578	42,990,488	8,288,565			17,484,102
1907.....	196,179	4,055,020	2,745,448	1,703,825	47,738,703	2,291,458	40,832,720	8,166,544			16,216,847
1908.....	255,582	5,232,880	2,631,339	1,321,483	43,195,733	1,632,799	47,274,614	6,240,249			14,477,411
1909.....	238,224	4,924,090	2,532,742	1,239,270	44,396,346	1,709,259	45,597,245	5,918,522	8,500,000	400,000	14,191,141
1910.....	267,701	5,538,380	2,450,241	1,245,016	34,653,746	1,386,350	38,243,934	4,871,512	4,184,192	192,473	13,228,731
1911.....	228,617	4,725,613	1,892,364	958,293	26,872,397	1,069,521	36,927,656	4,571,644	2,634,544	129,092	11,454,063
1912.....	257,496	5,322,442	3,132,108	1,810,045	44,871,454	1,805,627	51,456,537	8,408,513	5,358,280	316,139	17,662,736
1913.....	272,254	5,627,490	3,465,856	1,968,606	55,364,677	2,175,832	46,460,305	7,094,489	6,758,768	324,421	17,190,838
1914.....	247,170	5,109,090	3,602,130	1,876,736	50,625,048	1,771,877	45,009,699	6,121,319	7,866,467	346,125	15,225,061
1915.....	250,021	5,167,934	3,366,506	1,538,991	46,503,560	1,939,200	56,918,405	9,335,500	12,982,440	1,480,524	19,992,149
1916.....	221,932	4,587,934	3,301,923	2,059,739	48,727,516	3,007,463	65,379,364	17,784,494	37,163,930	4,043,985	31,453,014
1917.....	114,523	2,367,190	2,029,216	2,285,749	37,807,465	2,025,020	59,007,565	16,038,256	41,848,513	3,166,259	26,788,474
1918.....	164,074	3,403,812	3,498,172	3,215,370	43,899,661	2,828,107	61,483,754	15,143,449	41,772,916	2,899,040	27,590,273
1919.....	162,426	3,150,645	3,403,119	3,592,673	29,475,968	1,526,855	42,453,339	7,939,896	56,737,651	3,540,429	19,750,498
To 1.....	4,861,849	100,272,431	83,239,331	50,432,304	997,562,596	43,821,106	880,456,333	153,680,966	225,812,751	16,818,487	365,025,293

TABLE VIII.—COAL AND COKE PRODUCTION PER YEAR TO DATE.

COAL.		
Year.	Tons (2,240 lb.).	Value.
1836-1881.....	1,873,907.....	\$ 6,003,245
1882.....	282,139.....	846,417
1883.....	213,299.....	639,897
1884.....	394,070.....	1,182,210
1885.....	265,596.....	796,788
1886.....	326,636.....	979,908
1887.....	413,360.....	1,240,080
1888.....	489,301.....	1,467,903
1889.....	579,830.....	1,739,490
1890.....	678,140.....	2,034,420
1891.....	1,029,097.....	3,087,291
1892.....	826,335.....	2,479,005
1893.....	978,294.....	2,934,882
1894.....	1,012,953.....	3,038,859
1895.....	939,654.....	2,818,962
1896.....	896,222.....	2,688,666
1897.....	882,854.....	2,648,562
1898.....	1,135,865.....	3,407,595
1899.....	1,306,324.....	3,918,972
1900.....	1,439,595.....	4,318,785
1901.....	1,460,331.....	4,380,993
1902.....	1,397,394.....	4,192,182
1903.....	1,168,194.....	3,504,582
1904.....	1,253,628.....	3,760,884
1905.....	1,384,312.....	4,152,936
1906.....	1,517,303.....	4,551,909
1907.....	1,800,067.....	6,300,235
1908.....	1,677,849.....	5,872,472
1909.....	2,006,476.....	7,022,666
1910.....	2,800,046.....	9,800,161
1911.....	2,193,062.....	7,675,717
1912.....	2,628,804.....	9,200,814
1913.....	2,137,483.....	7,481,190
1914.....	1,810,967.....	6,338,385
1915.....	1,611,129.....	5,638,952
1916.....	2,084,093.....	7,294,325
1917.....	2,149,975.....	7,524,913
1918.....	2,302,245.....	11,511,225
1919.....	2,267,541.....	11,337,705
Total.....	51,614,370.....	\$175,814,183
COKE.		
Year.	Tons (2,240 lb.).	Value.
1895-97.....	19,396.....	\$ 96,980
1898 (estimated).....	35,000.....	175,000
1899.....	34,251.....	171,255
1900.....	85,149.....	425,745
1901.....	127,081.....	635,405
1902.....	128,015.....	640,075
1903.....	165,543.....	827,715
1904.....	238,428.....	1,192,140
1905.....	271,785.....	1,358,925
1906.....	199,227.....	996,135
1907.....	222,913.....	1,337,478
1908.....	247,399.....	1,484,394
1909.....	253,703.....	1,552,213
1910.....	218,029.....	1,308,174
1911.....	66,005.....	396,030
1912.....	264,333.....	1,585,998
1913.....	286,045.....	1,716,270
1914.....	234,577.....	1,407,462
1915.....	245,871.....	1,475,226
1916.....	267,725.....	1,606,350
1917.....	159,905.....	959,430
1918.....	188,967.....	1,322,769
1919.....	91,138.....	637,966
Total.....	4,055,475.....	\$23,309,140

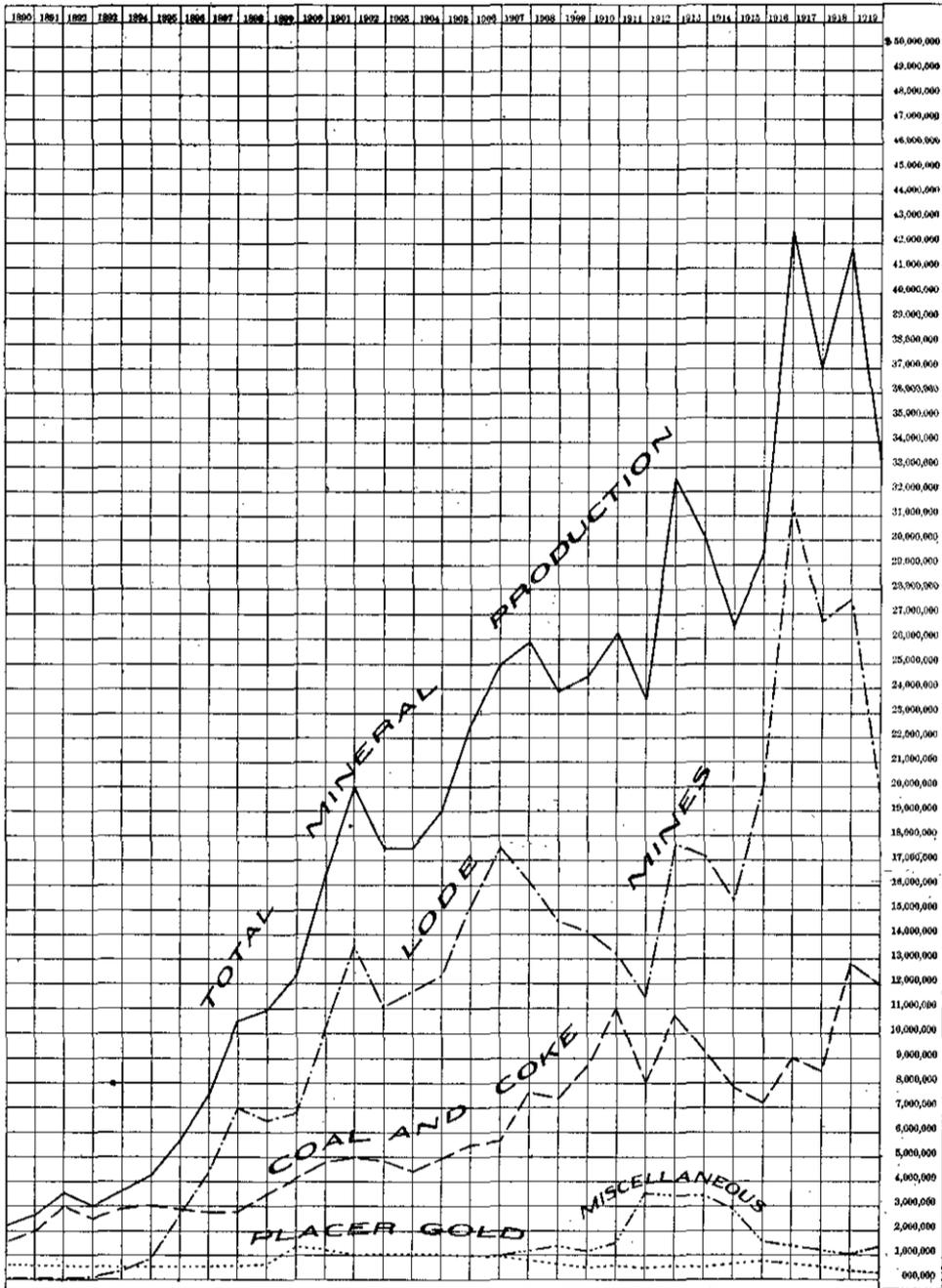
TABLE IX.—PRODUCTION IN DETAIL OF THE

DISTRICT.	YEAR	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces	Value.	Ounces.	Value.	Ounces.	Value.
				\$		\$		\$
<b>Cariboo</b> .....	1916		8,900	178,000				
Cariboo and Quesnel Divisions .....	1917		7,500	150,000				
	1918		4,000	80,000				
	1919		3,500	70,000				
Omineca Division .....	1916	17,782	850	17,000	1,303	26,983	112,635	70,262
	1917	4,159	600	12,000	981	19,244	82,311	63,663
	1918	6,956	400	8,000	985	20,360	84,125	77,336
	1919	4,051	400	8,000	147	3,038	72,573	76,615
<b>Cassiar</b> .....	1916	282	18,025	360,500	786	15,213	3,664	1,905
Atlin, Stikine, and Liard Divisions.....	1917	88	15,600	212,000	1,000	20,670		
	1918	73	11,025	220,500	446	9,219	1,115	1,025
	1919		8,850	177,000				
<b>Skeena, Nass, Portland Canal, and Queen Charlotte Divisions</b> .....	1916	732,880			3,806	78,670	256,802	160,193
	1917	821,819			9,805	202,669	343,805	265,933
	1918	956,231			48,016	992,491	416,616	382,995
	1919	760,057	850	17,000	60,076	1,241,771	920,413	971,680
<b>East Kootenay</b> .....	1916	98,846	200	4,000			509,693	317,946
Fort Steele Division.....	1917	114,891	300	2,000			180,168	139,380
	1918	187,950	50	1,000			281,467	240,394
	1919	145,033	50	1,000			205,500	218,946
Windermere-Golden .....	1916	2,183					29,178	18,201
	1917	2,354					79,685	61,636
	1918	3,020					91,784	84,377
	1919	2,697			2	41	68,634	72,457
<b>West Kootenay</b> .....	1916	77,841			45	930	821,202	200,366
Ainsworth Division.....	1917	82,481			1	20	224,461	173,621
	1918	44,937			18	872	228,699	210,243
	1919	30,157			26	537	167,453	176,780
Slocan and Slocan City.....	1916	123,886			64	1,323	1,480,571	923,589
	1917	149,895			18	372	1,547,576	1,197,050
	1918	142,700			67	1,385	1,873,236	1,722,066
	1919	139,824			95	1,964	1,555,714	1,643,423
Nelson and Arrow Lake Divisions .....	1916	20,695	50	1,000	4,107	84,891	32,547	20,808
	1917	10,738	50	1,000	2,521	52,109	46,229	35,758
	1918	15,348	50	1,000	7,155	147,894	136,738	125,703
	1919	5,694	25	500	297	6,139	44,280	48,747
Trail Creek Division.....	1916	308,924			129,790	2,682,750	132,080	82,391
	1917	109,171			33,290	688,104	47,112	36,441
	1918	112,349			43,745	904,200	47,203	43,394
	1919	88,266			50,229	1,038,233	27,788	29,336
Revelstoke, Trout Lake, and Lardeau .....	1916	521	50	1,000	22	455	22,419	13,986
	1917	634	50	1,000	62	1,282	37,733	29,187
	1918	255	50	1,000	35	723	11,761	10,812
	1919	47	50	1,000	8	165	2,994	3,161
<b>Boundary Yale</b> .....	1916	1,343,853	50	1,000	75,628	1,563,231	280,578	175,025
Grand Forks, Greenwood, and Osoyoos Divisions.....	1917	779,845	50	1,000	58,644	1,210,104	220,213	170,335
	1918	692,504	50	1,000	65,853	1,144,147	227,113	208,785
	1919	252,106	50	1,000	32,874	679,506	222,680	235,083
Similkameen, Nicola, and Vernon Divisions.....	1916	1,416	450	9,000	32	661	830	618
	1917	1,384	400	8,000	111	2,294	3,470	2,684
	1918	73	250	5,000	1	21	131	120
	1919	154	50	1,000	25	517	6,323	7,203
Yale, Ashcroft, and Kamloops Divisions.....	1916	7,414	150	3,000	570	11,782	4,215	2,629
	1917	9,254	100	2,000	1,355	28,008	3,525	2,727
	1918	30,826	50	1,000	815	16,846	1,317	1,211
	1919	29,871	100	2,000	627	12,960	2,098	2,213
<b>Lillooet</b> .....	1916	2,400	250	5,000	2,625	54,259		
Lillooet and Clinton Divisions.....	1917	4,700	800	6,000	3,092	63,912	276	213
	1918	3,858	50	1,000	2,473	51,117	412	379
	1919	4,720	375	7,500	2,508	51,799	365	385
<b>Southern Coast</b> .....	1916	15,771	50	1,000	2,382	49,236	17,954	11,200
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria Divisions)	1917	19,221	50	1,000	2,813	58,145	25,727	19,900
	1918	13,289	25	500	2,515	61,985	23,040	21,181
	1919	7,657	25	500	1,164	24,030	9,936	10,490
Mainland (Vancouver and New Westminster Divisions)	1916	434,064			822	16,991	98,165	61,235
	1917	662,100			980	20,257	86,925	67,236
	1918	731,900			3,050	63,043	93,385	85,849
	1919	642,635			4,350	89,815	94,870	100,154
<b>TOTALS</b> .....	1916	3,188,865	29,025	580,500	221,932	4,587,394	3,301,923	2,059,739
	1917	2,761,579	24,800	496,000	114,523	2,367,190	2,929,216	2,265,749
	1918	2,892,849	16,000	320,000	164,674	3,403,812	3,498,172	3,215,870
	1919	2,112,976	14,325	283,500	162,426	3,160,645	3,403,119	3,592,673

METALLIFEROUS MINES, ETC., FOR 1916, 1917, 1918, AND 1919

LEAD.		COPPER.		ZINC.		TOTALS FOR DIVISIONS.				TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1916.	1917.	1918.	1919.	1919.
	\$		\$		\$	\$	\$	\$	\$	\$
						178,000				184,041
							160,000			
								80,000		
									70,000	
224,451	18,853	1,046,072	447,764	168,616	18,345	594,157				
271,885	21,506	852,373	231,675	364,697	27,548		375,641			
123,568	8,242	643,843	158,578	313,112	21,730			294,246		
180,455	9,347	15,205	3,030	224,539	14,011				114,041	6,224,387
7,260	448					373,066				
		11,160	2,749				332,670			
								233,493		177,000
1,077	66	24,065,995	6,546,432			6,785,361				
		27,978,015	7,604,424				8,073,026			
		30,190,606	7,435,946					8,811,432		
		20,411,421	3,816,936						6,047,337	3,831,330
24,156,143	1,490,917	5,654	1,538	14,840,000	1,614,592	3,428,993				
13,996,640	1,107,134	9,679	2,631	20,715,690	1,567,804		2,818,429			
18,695,565	1,246,994	1,768	435	26,704,806	1,858,813			3,342,136		
10,723,493	555,737			46,460,703	2,899,149				3,672,881	
571,244	35,257	3,400	925	210,000	22,348	77,231				
1,774,649	140,375	12,649	3,436	18,000	1,862		206,809			
2,659,210	177,369							261,746		
1,659,279	85,951								158,449	4,659,699
7,841,869	484,000			625,971	68,106	753,402				
6,395,350	505,872			918,601	69,501		749,014			
6,103,262	407,288			640,991	44,485			662,888		
4,336,602	224,636			36,785	2,295				404,248	
14,415,645	839,734			17,864,357	1,942,554	3,757,191				
11,808,019	934,014			18,789,573	1,421,619		3,553,665			
14,575,379	972,778	242		14,107,632	979,073			3,374,762		
12,156,845	623,725		60	10,015,624	624,975				2,900,087	
1,240,734	76,582	176,383	47,980	3,470,036	377,540	608,296				
2,605,606	206,108	50,946	13,847	982,809	74,322		333,144			
1,611,106	107,465	24,933	7,126					389,183		
292,010	15,126	21,964	4,107						72,619	
		4,200,746	1,142,686			3,907,836				
		1,730,088	470,238				1,194,783			
		1,654,356	407,468					1,355,071		
		1,112,133	207,969						1,275,538	
206,741	12,780					23,200				
395,521	31,270			33,279	2,518		65,257			
30,773	5,387			6,325	439			18,261		
44,035	2,221								6,607	1,662,725
14,922	921	17,626,623	4,794,794			6,594,971				
36,548	2,891	10,329,765	2,307,630				4,191,960			
47,733	3,184	9,940,125	2,448,253					3,305,369		
43,200	2,238	3,273,655	612,173						1,530,000	
		182,683	49,690			59,859				
10,697	846	87,326	23,735				37,559			
		11,928	2,938					8,079		
4,594	238	5,180	969						9,927	
47,380	2,924	436,594	173,166			193,501				
12,690	1,004	700,199	190,314	27,564	2,085		226,138			
23,465	1,526	525,730	129,500					148,557		
		556,681	104,098						122,798	59,684
						59,259				
							70,125			
								52,496		
									59,694	3,415,732
		869,877	236,624			298,060				
		1,461,704	397,291							
		926,836	223,292				476,336			
		432,252	80,831					301,958		
		15,965,388	4,342,905			4,421,131				
		15,794,830	4,293,035				4,330,528			
		17,548,127	4,322,104					4,470,996		
		16,629,848	3,109,732						3,298,851	
48,727,516	3,007,462	65,379,364	17,784,494	37,168,980	4,043,985	32,063,514				
37,307,465	2,951,020	59,007,565	16,038,256	41,848,513	3,168,259		27,284,474			
43,899,681	2,928,107	61,483,764	15,143,449	41,772,916	2,899,040			27,910,278		
23,475,968	1,526,855	42,459,339	7,939,896	56,737,651	3,540,429				20,036,998	20,036,998

TABLE X.—SHOWING MINERAL PRODUCTION OF BRITISH COLUMBIA.



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## PROGRESS OF MINING.

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The gross value of the mineral production of the Province for the year 1919 was \$33,296,313, a decrease from that of the preceding year of \$8,486,161, or equivalent to a decrease of about 20 per cent.

This decrease in production, as compared with the preceding year, loses its adverse significance when it is considered that the 1919 production is still materially greater than that of any year prior to 1916, and that the larger productions of the years 1916-17-18 were due to the stimulus of war and the inflated prices attendant thereon.

So that any feeling of regret at this year's output being less than that of the previous three years is completely obliterated by the consideration of the removal of the cause of the abnormal outputs of these three years—the war—and it becomes a matter of congratulation that, with the return of something approaching normal conditions, we should still find this year's mineral-output showing a very material increase over those of former normal years.

The gross value of the metallic minerals produced in 1919 was \$20,036,998, which represents a decrease from last year of \$7,873,280, a decrease of about 28 per cent.

It is apparent, therefore, that the decrease for the year is chiefly due to the smaller production of the metallic minerals from the lode mines, which calls for some explanation.

It will be noted from the accompanying table showing the details of production that this year's decrease is almost entirely due to copper—to the lesser quantity produced and the lower market price obtained for such product. To this must be added the consequent lessening of the production of both gold and silver to the extent that these metals would be contained in the decrease of tonnage of copper ore mined.

As the position of the copper-output is the important feature for consideration in this year's summary of production, it may be well to outline the conditions surrounding the marketing of this metal during the past few years.

Copper is such an essential war metal that all the Allied nations had felt obliged to accumulate within their borders a sufficient supply of the metal for war needs for a considerable time in advance, in case transportation facilities should cease.

The sudden coming of the Armistice in the fall of 1918 found all the great nations with these very large stocks of copper on hand, and no further demand for war supplies. It was estimated roughly that the stocks on hand were sufficient to supply the demands on a peace basis for about two years without further production by the mines.

As a consequence of the war the copper market of the world has been, during the whole of the year 1919, in a thoroughly demoralized condition and with no certainty as to the near future.

During the latter part of the war the market price of copper had been fixed by the United States Government, and, as the United States produces about two-thirds of the world's copper-supply, the American price formed the basis of the world price. The price thus set during the latter months of the war was 26 cents a pound at New York.

With the sudden disappearance of the cause of the great consumption, and with large stocks already distributed, it became at once evident that the fixed war price could not be maintained.

On the other hand, the producers, who had greatly increased their plants and outputs under the pressure of war's demands, found themselves with immense stocks on hand, and an accumulating increased output which had been produced under war conditions as to costs, and which they could not sell, except at a loss and much below the fixed war price.

The producers made an attempt, through combination, to maintain the fixed price, but the consumer did not have to buy, and consequently, as a matter of fact, practically no sales took place for some months around the end of 1918.

The great producers' combination immediately set about reducing their production to a point much below normal, hoping that the immediate coming of peace, with its expected greatly increased industries and the rehabilitation from war's devastations, would soon exhaust existing stocks.

This hope was to a great extent frustrated by the unexpected delay in settling the peace terms, and the slowness with which the expected rejuvenation of the peace industries has been taking place, due to the almost universal social unrest.

The burden of maintaining a profitable price over such an unexpectedly long time became too great for the producers, and they were, to a certain extent, forced to realize on their holdings at a reduced market price.

Whether the present price has reached bottom or whether it is being partially sustained artificially is unknown; hence the continuing demoralization of the market; but it seems certain that the present price obtainable is not high enough to permit of a continuation of production under the present scale of higher wages and high costs of necessary mining supplies. This latter phase is being reflected in a slightly rising market price during the last month of the year. Should this rise not continue until it reaches the present cost of production, it will mean continued curtailment of production and the eventual elimination of the less economically well-conditioned producers.

Such is the uncertainty attending the market conditions of the near future, in the light of which it is impossible to predict, with any degree of certainty, what output in copper our British Columbia mines will make during the coming year. Should the market price improve somewhat, or should the items affecting the cost of production diminish, we can confidently predict a much increased output, for the mines are in a position to make it, should the conditions render it commercially profitable so to do.

Generally the outlook for 1920 is most reassuring. The opening of new camps in the Portland Canal district has been the outstanding event of the past few months. There is no doubt that this district will be subjected to extensive prospecting and development this year. In short, there is every reason to believe that 1920 will be most important to the Province in point of mining development.

The production of gold, both placer and lode, shows a decrease of about \$286,667, as is fully pointed out in the detailed notes on that metal. With the value of the product fixed, while the abnormally high prices of all items entering into the costs of production remain as they are, the condition of this branch of the industry never can be satisfactory.

The output of silver shows an increase as regards the value of the product. Silver is the only metal in the list the price of which may be considered abnormally high, and from the present outlook this high price seems likely to continue for some years, to the great advantage of the mines producing the metal.

In British Columbia our silver is almost entirely derived from ores carrying also other metals which have not increased in value.

The production of lead shows a decrease, due partly to strikes at some of the larger producing mines, and on account of the low price of the metal due to an overstocked market.

As regards quantity and value, zinc shows a largely increased production as compared with 1918. A considerable portion of the ore mined or concentrates produced found their way to the United States for smelting.

The collieries of the Province about held their own as far as production was concerned during the past year. The Coast collieries show an increase, but the Crownsnest collieries show a slight decrease in coal produced and a large decrease in the amount of coke produced, due to a long-continued period of labour trouble, to some extent due to the large percentage of aliens employed in and about these mines. Due to this fact the total value of the products of the collieries this year is about \$858,323 less than in 1918.

Increases in the selling-prices of coal have been allowed at various times in the past few years by the Dominion Government Fuel Controller, until as nearly as can be calculated the average price of coal for the year, over the Province as a whole, has been about \$5 a ton, and the similar average price for coke about \$7 a ton.

The total gross amount of coal mined in the Province during the year was 2,408,948 tons (2,240 lb.), of which there was used for making coke some 141,407 tons, leaving a net production of coal, used as such, of 2,267,541 tons. The amount of coke produced was 91,138 tons (2,240 lb.). The increased selling-price of coal and coke has previously been discussed.

The value of the net coal production for the year was \$11,337,705 and of coke \$637,966, making the value of the production of the collieries \$11,975,671.

British Columbia has very large areas of undeveloped and unprospected mineral lands, and the return of peace will hasten the development of her mineral resources. There will be a considerable accession to the ranks of the prospectors and more capital will be available for mining development.

The following table shows the number of mines which shipped ore during the year 1919, the districts in which they are situated, and the tonnage produced in each district, together with the number of men employed, both above ground and underground.

In explanation of the table it should be said that, in its preparation, a mine employing twelve men for four months is credited in the table with four men for twelve months, so that the total given is less than the actual number of individuals who worked in the mines during the year.

TABLE SHOWING DISTRIBUTION OF SHIPPING MINES IN 1919.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1919.	MEN EMPLOYED IN THESE MINES.		
				Below.	Above.	Total.
CARIBOO DISTRICT:						
Omineca .....	4,051	5	1	13	44	57
CASSIAR DISTRICT:						
Atlin, Stikine .....	..	..	..	..	..	..
Queen Charlotte, Portland Canal, Skeena, and Nass River .....	760,057	12	7	397	313	710
EAST KOOTENAY DISTRICT:						
Fort Steele .....	145,039	4	3	217	166	383
Windermere-Golden .....	2,697	6	2	34	33	67
WEST KOOTENAY DISTRICT:						
Ainsworth .....	30,157	22	10	127	95	222
Slocan and Slocan City .....	139,824	33	20	417	206	623
Nelson and Arrow Lake .....	5,694	8	3	38	37	75
Trail Creek .....	88,266	5	5	249	89	338
Revelstoke, Lardeau, and Trout Lake .....	47	2	..	5	2	7
BOUNDARY-YALE DISTRICT:						
Greenwood, Grand Forks, and Osoyoos .....	252,106	29	11	290	170	460
Similkameen, Nicola, and Vernon .....	154	3	1	7	7	14
Yale, Ashcroft, and Kamloops .....	29,871	3	1	33	27	60
LILLOOET DISTRICT .....	4,720	4	4	12	17	29
SOUTHERN COAST DISTRICT, V.I. ....	7,657	7	5	22	50	72
SOUTHERN COAST, MAINLAND .....	642,635	1	1	385	276	661
Total .....	2,112,975	144	74	2,246	1,532	3,778

In the following table of the non-shipping mines the returns are necessarily incomplete, as they include only the mines reporting to the Department, and not the prospects and properties under preliminary development, which in the aggregate give employment to a large number of men.

TABLE SHOWING NON-SHIPPING MINES AND MEN EMPLOYED.

DISTRICT.	NUMBER OF MINES.			MEN EMPLOYED.		
	Working.	Idle.	Total.	Below.	Above.	Total.
CARIBOO AND CASSIAR .....	11	15	26	46	23	69
EAST KOOTENAY .....	4	9	13	3	10	13
AINSWORTH .....	11	18	29	24	18	42
SLOCAN .....	16	22	38	82	48	130
NELSON .....	11	15	26	46	32	78
TRAIL CREEK .....	..	8	8	..	..	..
REVELSTOKE-LARDEAU .....	7	7	14	19	5	24
BOUNDARY-YALE .....	9	54	63	14	34	48
LILLOOET .....	1	4	5	2	..	2
SOUTHERN COAST .....	7	21	28	31	44	75
Total .....	77	173	250	267	214	481

## SUMMARY OF STATISTICAL TABLES.

Referring to the preceding tables of the mineral production of the Province, the following is a summary of their contents:—

TABLE I. shows the total gross value of each mineral product mined in the Province up to the end of 1919, aggregating \$670,649,894. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of \$199,123,323; followed next in importance by copper at \$153,680,965, and next in order is lode gold at \$100,272,431, with placer gold in fourth place at \$75,722,603.

TABLE II. shows the value of the total production of the mines of the Province from 1852 to 1892 (inclusive) and for each year from 1893 to 1919 (inclusive), during which period the output increased tenfold, and reached a gross production for the year 1919 of \$33,296,313.

The value of the total mineral production of the Province up to the end of 1919 was \$670,649,894.

TABLE III. gives the quantities in the customary units of measure, and the values, of the various metals or minerals which go to make up the total of the mineral production of the Province, and also, for the purpose of comparison, similar data for the two preceding years.

The table shows that there has been this year a decrease in the production of placer gold of \$33,500 and a decrease in output of lode gold of \$253,167, making a total decrease of \$286,667 in the total production of the precious metal.

The amount of silver produced this past year was 3,403,119 oz., having a gross value of \$3,592,673, a decrease in the number of ounces produced of 95.053; but the value of the production in 1919 was \$376,803 greater than in 1918, due to a prevailing higher market price for silver in 1919.

The table shows an output of lead amounting to 29,475,968 lb., valued at \$1,526,855, a decrease of \$1,401,252, due to the drop in the market price of the metal.

The production of copper this year was 42,459,339 lb., valued at \$7,939,896, a decrease in amount of 19,024,415 lb., or about 30.9 per cent. The value of the product was less than that of the preceding year by \$7,203,553, due to lower prices.

This decreased production of copper is the prominent feature of the year, and its cause has been noted previously in this Report and is further accounted for under the heading of "Copper."

TABLE IV. shows the proportions of the total mineral productions made in each of the various districts into which the Province is divided.

It will be noted that this year the Southern Coast District has again the honour of first place on the list, followed, in order of importance, by the East Kootenay, Cassiar, West Kootenay, and Boundary Districts. The Southern Coast and East Kootenay Districts owe a considerable proportion of their output to the coal-mines situated within their limits, whereas, in the other districts, the production is chiefly from metal-mining.

The Southern Coast District also derives a fair proportion of its production from "Miscellaneous products," such as building materials, etc., due to the larger cities therein; this year this amounted to \$952,579, as shown in Table V.

TABLE V. is an endeavour to show in some detail the production of those products, such as building materials, previously summarized under "Miscellaneous products," and which amounts this year to \$1,283,644. Much difficulty has been found in obtaining reliable figures regarding these products, and in many cases they have had to be estimated; but, while the figures are not as complete as desired, they are at least approximate, and show what an important branch of mineral production this has become, despite the falling-off due to the war and depressed financial conditions.

TABLE VI. shows the statistical record of the placer mines of the Province from 1858 to 1919, and shows a total production of \$75,722,603. The output for 1919 was \$286,500, a decrease, as compared with the previous year, of \$33,500.

TABLE VII. relates entirely to the lode mines of the Province, and shows the quantities and values of the various metals produced each year since the beginning, in 1887, of such mining in the Province. The gross value of the product of these mines to date is \$365,025,293; this figure includes the zinc production of 1909 and all subsequent years.

TABLE VIII. contains the statistics of production of the coal-mines of the Province. The total net amount of coal produced to the end of 1919 was 51,614,370 tons (of 2,240 lb.), worth

\$175,814,183. Of this, there was produced in 1919, 2,267,541 tons valued at \$11,337,705. In these figures of coal production the coal used in making coke is not included, as such coal is accounted for in the figures of output of coke. The amount of coal used in making coke in 1919 was 141,407 tons, from which was made 91,138 tons of coke, having a value of \$637,966, a decrease in amount from the preceding year of 97,829 tons. The total value of the output of the collieries of the Province in 1919 was \$11,975,671.

More detailed statistics as to the coal production of the Province and of the separate districts are given elsewhere in this Report.

TABLE IX. gives the details of production of metalliferous mines of the Province for the years 1916, 1917, 1918, and 1919, and the districts in which such productions were made, showing the tonnage of ore mined in each district, with its metallic contents and its market value.

The total tonnage of ore mined in the Province during the year 1919 was 2,112,975 tons, having a gross value of \$19,750,498, and, with the placer gold, a total value of \$20,036,998.

The following table shows the tonnage derived from the various districts of the Province:—

	Tons.
Cassiar and Omineca District .....	764,108
Southern Coast District .....	650,292
Boundary-Yale District .....	282,131
Slocan Mining Division .....	139,824
East Kootenay District .....	147,736
Trall Creek Mining Division .....	88,266
Ainsworth Mining Division .....	30,157
Nelson Mining Division .....	5,694
Other Mining Divisions .....	4,767
Total .....	2,112,975

In reports previous to 1910 there has been included in Table IX. the "Miscellaneous products," and in 1910 these were shown distributed to the various districts; the great increase of these products in the past few years has rendered it advisable that this table be reserved exclusively for metalliferous products, and so a new table (No. V.) was introduced in 1911, giving in some detail the output of these miscellaneous products.

In making comparisons of this table with similar tables in previous reports, the fact that "Miscellaneous" has been removed will have to be borne in mind.

TABLE X. presents in graphic form the facts shown in figures in the tables, and demonstrates to the eye the rapid growth of lode-mining in the Province, and also the fluctuations to which it has been subject.

It will be seen that, although coal-mining has been a constantly increasing industry during this whole period of twenty-six years, lode-mining did not begin, practically, until 1894, since when it has risen with remarkable rapidity, though not without interruption, until it reached, in 1906, the \$17,500,000 line. The total mineral production in 1910 reached the \$26,000,000 line, in 1912 it reached the \$32,000,000 line, in 1916 the \$42,000,000 line, while this year it is just a little above the \$33,000,000 line.

#### GOLD.

The recovery of placer gold for 1919 was \$286,500, of which practically all was **Placer Gold.** obtained in the Cariboo and Cassiar Districts, only about one-twentieth of the total coming from the other districts. An approximate apportionment is as follows: From Cariboo District, \$78,000; Atlin, Stikine, and Liard Divisions of Cassiar District, \$177,000; remaining parts of the Province, \$31,500. This production for 1919 shows a decrease from the preceding year of \$33,500, or about 11 per cent.

During the last four years the production of placer gold in the Province has steadily decreased. The chief reason is to be found in the economic conditions of high prices for labour and supplies, which made placer-mining less profitable than in former years. Shortage of labour also handicapped operations.

Information available regarding the Atlin Division shows that the production was considerably less than in 1918, and that some of the former operating companies were closed down during the year.

The value of lode gold produced in 1919 was \$3,150,645, as compared with \$3,403,812 in 1918, a decrease of \$253,167, or nearly 8 per cent. The decrease in 1919 is due to a big reduction in output from the Boundary-Yale District, a decline of approximately \$500,000 as compared with 1918. During the year the Granby Company closed its mines and smelter in this district and therefore only made a small production. The low-grade copper ore handled carries small gold and silver values, and in former years this gold production amounted to a considerable total. The *Nickel Plate* mine in this district also made a decreased production.

The Rossland mines, which prior to 1917 contributed annually about one-half of the output of lode gold, made about the same production in 1919 as in the preceding year; during these two years about one-quarter the normal output was made.

The following table shows the gold production of 1918 and 1919:—

	1918. Oz.	1919. Oz.
Cassiar District .....	48,016	60,076
Rossland .....	43,745	50,229
Boundary-Yale .....	56,169	33,526
Coast (Southern) .....	5,565	5,514
Lillooet .....	2,473	2,506
Nelson .....	7,155	297
All others .....	1,551	278
Totals .....	164,674	152,426

From the above table it will be seen that the only districts to show an increase are the Cassiar, Rossland, and Lillooet Districts. In the latter case the increase is small. The increase in Skeena is due to a larger output from the *Surf Inlet* mine, and the commencement of new shippers—namely, the *Premier* in the Salmon River section and the *Dolly Varden* mine in the Alice Arm section. The outlook for the future in this latter district is most promising and a largely increased production of gold and other metals may be expected.

The decrease in Nelson Division is large and is mainly due to the *Yankee Girl* mine being closed all year. Developments in this district at present under way may bring the production up again to that of former years.

The production of gold in British Columbia during each of the last three years has only been about one-half that of those years before the war, and shows that gold-mining in this Province has, as elsewhere in the world, been adversely affected by the conditions of high costs and a standard price for the product. Nevertheless, from the developments now in progress it would seem that in a short time the annual production of gold in British Columbia should increase considerably.

#### SILVER.

The quantity of silver produced was 3,403,119 oz., worth \$3,592,673, a decrease from the production of 1918 in quantity of 95,053 oz., but, owing to the higher market value of silver, an increase in value of \$376,803, or nearly 12 per cent.

The market price of silver gradually rose during the year, the average for January being 101.125 cents an ounce, while in December it was about 132 cents. The average for the year was 111.122 cents, the highest that silver has been for many years back. The prospect of silver maintaining its present price of well over \$1 an ounce is good, and in this respect the silver market is in marked contrast to the other metals, the future prices of which are uncertain.

The following table shows the silver production for 1918 and 1919:—

	1918. Oz.	1919. Oz.
Slocan and Slocan City .....	1,873,236	1,556,714
Skeena .....	416,616	920,413
Boundary-Yale .....	228,561	231,599
Fort Steele .....	261,497	205,500
Ainsworth .....	228,699	167,453
Coast (Southern) .....	116,425	104,806
Omineca .....	84,125	72,573
Windermere-Golden .....	91,784	68,634
Nelson .....	136,738	44,280
All others .....	60,491	31,147
Totals .....	3,498,172	3,403,119

The above table shows an increase in the silver production from the Skeena and Boundary-Yale Districts and decreases in all the others.

Two factors have affected silver production during the year, one favourably and the other adversely. In the first place, the high market price of silver has been a great incentive to the mining of silver-bearing ores. On the other hand, the lessened demand and lowered market price of all other metals has led to the curtailment of output in many mining camps where silver is produced merely as a by-product. British Columbia has practically no mines producing exclusively silver, but the silver-lead-zinc ores of the Slocan District have a high percentage of their values in silver. In this connection it may be noted that about 75 per cent. of the total Provincial output of silver comes from the treatment of silver-lead-zinc ores and the balance mainly from the smelting of copper-gold-silver ores.

A reference to the notes on copper will show that the production of that metal has decreased this year about 31 per cent. as compared with last year, and, as all our copper ores carry some silver, the lessened tonnage of copper ores smelted has reduced the silver production by the amount of the content of such ores. Considering these facts, the production of silver in 1919 as compared with 1918 is gratifying.

Increased production was made in the Skeena District and is accounted for by new shippers entering the lists. Two of these, the *Premier* and the *Dolly Varden* mines, give promise of swelling the silver production very materially during future years.

The Slocan District is again far in the lead of all other districts in silver production, 46 per cent. of the total being credited to the Slocan.

The largest producers in the Slocan were the *Queen Bess*, *Bosun*, *Surprise*, *Hewitt-Van Roi*, *Silversmith*, and *Standard*. There were nearly forty shipping mines in the district in 1919.

In the Boundary District the chief producers were the *Bell*, *Granby-Phoenix*, and *Providence*. Other mines contributing are the *Sally*, *Emma*, and *Waterloo*.

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

The Coast production of silver comes from the smelting of copper ores carrying low values in the precious metals.

#### LEAD.

The total amount of lead produced in 1919 was 29,475,968 lb., valued at \$1,526,855. This represents, as compared with the previous year, a decrease in quantity of 14,423,693 lb., and with the lower market price of lead a decrease in value of \$1,401,252, or about 48 per cent.

During the first half of 1919 the market for lead was in a dull and demoralized condition owing to conditions arising from the sudden stopping of the war. Large stocks of lead were on hand for war purposes when the Armistice was signed, and also all lead-producers were speeded up to a high capacity. When the abnormal war demand for lead ceased, the market price dropped and production was curtailed until the surplus stocks were consumed by normal demand.

The Consolidated Mining and Smelting Company, which treats at its smelter and refinery at Trail nearly all the lead produced in Canada, was heavily stocked with lead when the year opened, and as a result had to refuse to take lead ore for some time from the mines.

During the year the lead market gradually adjusted itself to normal demands and now seems to be in a fairly healthy condition.

The average price of lead in January in New York was 5.432 cents a pound, and although fluctuating somewhat it was not until August that any material advance was made. Slight advances continued until the average for December was about 7 cents a pound. The average price for the year was 5.759 cents, as compared with 7.413 cents in 1918.

The following table shows the production of lead, according to districts, for the years 1918 and 1919:—

	1918. Lb.	1919. Lb.
Fort Steele .....	18,695,565	10,729,483
Slocan .....	14,575,379	12,156,845
Ainsworth .....	6,106,262	4,336,602
Windermere-Golden .....	2,659,210	1,659,279
Nelson .....	1,611,166	292,010
All others .....	252,079	301,749
Totals .....	43,899,661	29,475,968

From the above table it will be seen that the decrease in output was general in all districts, and shows that the different mines throughout the Province were forced to curtail their outputs.

The Slocan District was the heaviest producer in 1919, chiefly contributed by the *Queen Bess*, followed by the *Silversmith*, *Surprise*, *Bosun*, and the *Hewitt-Van Roi*.

The next largest producer was the Fort Steele Division; the *Sullivan* mine contributes nearly all of this production as a rule, but this year over 1,700,000 lb. came from the *North Star*.

In the Ainsworth Division the largest producer was the *Florence*, with an output of about 2,000,000 lb., followed by the *Whitewater*, with approximately 520,000 lb., and about twenty smaller shippers.

The lead production of Nelson Division was mainly from the *Molly Gibson* and the *Emerald* mines, and these mines produced less than in the previous year.

The production from Windermere-Golden was chiefly from the *Paradise* mine, with a production of about 1,340,000 lb., and five small shippers.

## COPPER.

The amount of copper produced in 1919 shows, as compared with the previous year, a decrease in quantity, and, owing to the lower market selling-price, a larger proportionate decrease in value. The production was 42,459,339 lb., which is 19,024,415 lb. less than the 1918 output; the value for this year is \$7,939,896, which, compared with \$15,143,449 made in 1918, shows a decrease of \$7,203,553, or about 47 per cent.

The demoralized condition of the copper market during 1919 has been referred to somewhat fully in the opening pages of this report, so that it is not necessary to further discuss it here, but some figures regarding the market price of the metal are given.

The year commenced with practically no sales of copper in January; in February the average price, according to the *Engineering and Mining Journal*, was 16.763 cents a pound. By August the price rose to 22.319 cents a pound, but to some extent the market was artificial, as the demand was very considerably less than the supply. From August to the end of the year the price declined again, and the average for December was about 18.5 cents a pound. In the last two weeks of the year the market appeared to have a healthier tone, and the price advanced slightly. The average price for the year was 18.69 cents a pound, as compared with 24.63 cents in 1918.

The following table shows the production of copper, according to districts, in 1918 and in 1919:—

	1918. Lb.	1919. Lb.
Skeena .....	30,190,606	20,411,421
Coast (Southern) .....	18,475,013	17,062,100
Boundary-Yale .....	10,477,833	3,835,516
Trail Creek Division .....	1,654,356	1,112,133
All others .....	685,946	38,169
Totals .....	61,483,754	42,459,339

From the above table it will be seen that there was a decrease in output from every district. In the Coast (Southern) District, the main producer was the *Britannia*, and this property mined and milled a larger tonnage in 1919 than in any previous year. Considering the adverse market conditions, this increased production of the *Britannia* mine shows the satisfactory condition of the property.

Early in the year the Granby Company was forced to close down the low-grade mines at Phoenix and smelter at Grand Forks, resulting in a great decrease in the copper production of Boundary-Yale District.

The Granby Company also curtailed production at the mines and smelter at Anyox, with the result that the copper production was about two-thirds that of last year.

The *Marble Bay* mine at Vananda was operated during the year, but a smaller production was made than in 1918.

The *Rocher Déboulé* mine, in Omineca Division, was closed all year, with the result that practically no copper was produced in that district.

## ZINC.

The quantity of zinc produced in 1919 amounted to 56,737,651 lb., which, compared with 41,772,916 lb. produced in 1918, shows an increase of 14,964,735 lb. This production is valued at \$3,540,429, which shows an increase, as compared with the 1918 value, of \$641,389, or about 22 per cent.

The zinc market was not as much affected as the copper and lead markets by the transition period from war demands to peace conditions, with the result that the price of the metal did not fluctuate greatly and production continued uninterruptedly.

In January the average price of zinc in New York was 7.272 cents a pound; by May it had fallen to 6.429 cents, but thereafter gradually rose until the end of the year, the average for December being about 8.5 cents a pound. The average price of zinc for the year 1919 was 7.338 cents a pound, as compared with 8.159 cents for 1918.

It should be noted that the 1919 production of zinc is the highest, as to quantity, in the history of the Province.

The following table shows the production of zinc, according to districts, for 1918 and for 1919:—

	1918. Lb.	1919. Lb.
Fort Steele .....	26,704,806	46,460,703
Slocan .....	14,107,682	10,015,624
Omineca .....	313,112	224,539
Ainsworth .....	640,991	36,785
All others .....	6,325	.....
Totals .....	41,772,916	56,737,651

From the above table it is seen that the only district showing increased zinc production in 1919 was Fort Steele. The output in this district is made almost entirely by the *Sullivan* mine, and the increase was due to a larger tonnage being handled at the Consolidated Company's electrolytic zinc-refinery at Trail, where the ore is treated.

In the Slocan District the heaviest shipper was again the *Standard*, with a production of about 4,332,000 lb., which, however, is 2,000,000 lb. less than in 1918. The next largest shipper was the *Hewitt-Van Roi*, followed by the *Bosun*.

The Omineca production is mainly a silver-zinc concentrate from the *Silver Standard* mine at Hazelton.

#### OTHER MINERALS.

**Iron.** So far there has been no metallic iron produced in British Columbia, but it has been strongly advocated in many quarters that the conditions are favourable for the establishment of an iron-smelting plant somewhere on the British Columbia coast. So far nothing definite has materialized, although there is apparently a prospect of such a plant being established. As is well known, there is on the Coast, in the aggregate, an adequate supply of magnetite-iron ore, quite sufficiently free from impurities as to be within the "Bessemer limit" to supply ore for such a plant.

Important bodies of limonite ore have been discovered in the Chilcotin district, which were examined by Mr. Brewer, his notes on which are included in his report, published herein under heading of "District No. 6."

About 25 tons of magnetite was shipped by this Department from Texada island to Vancouver for an experiment in electric smelting by the Fleet process, from which process, however, no satisfactory results were obtained.

The Smelters Steel Company of Seattle, mined on the shore of Dean channel, in Bella Coola Mining Division, some 1,200 tons of magnetic-iron ore; most of this ore was transported by scows to Seattle, and assayed about 47 per cent. metallic iron. This company has erected near Seattle a portion of the first unit of a commercial-sized electro-thermic iron-smelting plant, in which there has been produced a few tons of exceedingly good metallic iron. This has demonstrated practically that iron and steel of excellent quality can be made direct from these ores.

**Platinum.** The well-known fact of the wide occurrence of platinum throughout the Province in connection with our placer-gold deposits gives reasonable hope that such may be found in payable quantities and justifies further investigations. As far as reports received indicate, the only output this year is about \$1,500 worth from the Similkameen District, in which district the Dominion Government was last year making a search for the metal for war purposes, but this work has now ceased.

**Molybdenite.** Since the Armistice the market is dormant, like other metal prices, but nominal quotations vary from 75 cents to \$1 a pound. No advice of any shipment this year has been received.

**Chromite.** In 1918 about 800 tons of chromite ore, carrying from 30 to 45 per cent. chromic oxide, was shipped from the *Mastodon* claim, Grand Forks Division; and a deposit on Scottie creek, near Clinton, was opened up, but no shipments were made. With the end of the war the market for chromite temporarily collapsed, as large stocks were available, with no purchasers in sight. It is believed that no ore was shipped in 1919.

**Manganese.** Nearly 600 tons of manganese ore, running over 50 per cent. manganese and less than 20 per cent. silica, was shipped from the *Hill 60* property on Cowichan lake before the roads became impassable through winter rains. The company is now arranging for the installation of an aerial tramway, which should prevent, in the future, interruption to sustained shipments. About 100 tons of high-grade manganese ore was also shipped from the Curle *Manganese* group near Kaslo. Both shipments went to the Blirowe Alloys Company, of Tacoma.

**Non-metallic Minerals.** About 5,000 tons of fluor spar was shipped from the *Rock Candy* group, in the Grand Forks Division. This property is owned by the Consolidated Mining and Smelting Company and is being equipped to make steady shipments in the future. The mineral is shipped to the Trail smelter and is used for making hydrofluoric acid, which is used in the lead-refinery, and to other points in Canada and to the United States.

Shipments of magnesium sulphate (Epsom salts) were made from Spotted lake, Osoyoos Division, amounting to about 120 tons. Seven hundred and fifty tons of magnesium sulphate was shipped from deposits of this mineral near Clinton, and 140 tons from near Basque.

Deposits of hydromagnesite in the Clinton Division, which are reported to be large and of great purity, have attracted considerable attention during the past year. No shipments have been recorded.

A production of arsenic valued at \$21,000 was made by the *Nickel Plate* mine in 1919.

### COAL.

The gross production of coal in 1919 was 2,408,948 long tons, of which 141,407 tons was made into coke, leaving the net production at 2,267,541 tons. These figures show a decrease, as compared with 1918, of 169,776 tons gross and of 34,704 tons net. The quantity of coke made was 91,138 tons, which is a decrease of 97,829 tons as compared with 1918. For purposes of comparison the following table is shown:—

	1914.	1915.	1916.	1917.	1918.	1919.
Coal, gross. . . . . tons, 2,240 lb.	2,166,428	1,972,580	2,485,580	2,398,715	2,578,724	2,408,948
Less made into coke " "	355,461	361,451	401,487	248,740	276,479	141,407
Coal, net. . . . . " "	1,810,967	1,611,129	2,084,093	2,149,975	2,302,245	2,267,541
Coke made. . . . . " "	234,577	245,871	267,725	159,905	188,967	91,138

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

	1916.	1917.	1918.	1919.
Vancouver Island mines . . . . . tons, 2,240 lb.	1,492,761	1,695,721	1,666,211	1,699,348
Nicola and Similkameen mines. . . . . " "	110,549	151,243	179,179	149,042
Crowsnest mines. . . . . " "	882,270	551,751	732,864	558,806
Omineca-Telkwa . . . . . " "	.....	.....	470	1,752
Total quantity of coal mined. . . . . " "	2,485,580	2,398,715	2,578,724	2,408,948
Less made into coke. . . . . " "	401,487	248,740	276,479	141,407
Net quantity of coal produced " "	2,084,093	2,149,975	2,302,245	2,267,541

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

	1916.	1917.	1918.	1919.
Vancouver Island collieries . . . . . tons, 2,240 lb.	27,604	30,406	24,887	34,071
Nicola and Similkameen collieries. . . . . " "	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>
Crowsnest District collieries. . . . . " "	240,121	129,499	164,080	57,067
Total coke production. . . . . " "	267,725	159,905	188,967	91,138

As will be seen from the above figures, the net coal production this year is 117,566 tons more than it was in 1917, and, with the exception of 1918, greater than it has been since 1912.

This output would have been considerably greater had not there been in the early part of the year labour troubles that interfered with production. All these contributed to occasion a shortage of both coal and coke when the demand was most keen.

The production of coke in 1919 was 91,138 tons (2,240 lb.), which is 97,829 tons less than the preceding year. Of this gross coke production, 57,067 tons was made by the Crow's Nest Pass Coal Company in East Kootenay, 14,865 tons by the Canadian Collieries at Comox, and 19,206 tons by the Granby Consolidated Mining, Smelting, and Power Company at Anyox.

The greater part of the gross Provincial coal production is still being mined by three companies—the Crow's Nest Pass Coal Company of East Kootenay, the Canadian Collieries (Dunsmuir), and the Canadian Western Fuel Company of Vancouver island, which mined, collectively, 82.2 per cent. of the gross output.

Of the other collieries: In the Coast District, on Vancouver island, the Pacific Coast Coal Mines, Limited, produced 65,843 tons; the British Columbia Coal Mining Company 36,995 tons; the Nanoose Collieries, Limited, 21,642 tons; and the Granby Company, from a new colliery near Cassidy, produced 72,885 tons. In the Nicola Valley section of the district, the Middlesboro Colliery Company mined 77,550 tons; the Fleming Coal Company 39,110 tons; the Princeton Coal and Land Company 22,193 tons; and the Coalmont Colliery some 10,189 tons of coal.

A new coalfield has been opened up in the Omineca District, where a small colliery is being developed on the Telkwa river that last year shipped 1,752 tons of coal. For convenience this has been included in the Coast District figures.

In the East Kootenay District, in addition to the Crow's Nest Pass Coal Company, which produced 479,059 tons, the Corbin Coal and Coke Company produced 79,747 tons.

The collieries of the Coast District, including the Nicola-Princeton fields, are to be credited this year with about 71 per cent. of the total coal-output.

The gross output of the collieries of the Province for the past year was, as already stated, 2,408,948 tons, of which 16,236 tons of coal was taken from stock.

Of this gross amount, there was sold for consumption in Canada, 1,057,404 tons; sold for consumption in the United States, 763,990 tons; sold in other countries, *nil*; making the total coal sales for the year 1,821,394 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 141,407 tons, and used under companies' boilers, etc., 210,003 tons; while 252,380 tons was lost in washing and screening.

The coke sales of the Province for the past year amounted to 92,765 tons, of which 1,703 tons was taken from stock.

The following table indicates the markets in which the coal and coke output of the Province was sold:—

COAL	Coast District.	Crowsnest Pass District.	Total for Province.
Sold for consumption in Canada . . . . . tons, 2,240 lb.	991,477	65,927	1,057,404
" export to United States . . . . . "	390,642	373,348	763,990
" export to other countries . . . . . "			
Total coal sales . . . . .	1,382,119	439,275	1,821,394
COKE.			
Sold for consumption in Canada . . . . . tons, 2,240 lb.	35,635	48,996	84,631
" export to United States . . . . . "		8,134	8,134
" export to other countries . . . . . "			
Total coke sales . . . . .	35,635	57,130	92,765

#### COLLIERIES OF COAST DISTRICT.

The Collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields, and a small colliery on Telkwa river mined 1,850,142 tons of coal in

1919, in addition to which 3,407 tons was taken from stock, making 1,853,549 tons distributed from these collieries in 1919. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada .....	991,477	
Sold as coal in United States .....	390,642	
Sold as coal in other countries .....		
<b>Total sold as coal .....</b>		<b>1,382,119</b>
Used under companies' boilers, etc. ....		163,378
Used in making coke .....		55,672
Lost in washing, etc. ....		252,380
		<u>1,853,549</u>
<i>Minus</i> coal taken from stock .....		<u>3,407</u>
Gross output .....		1,850,142

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, a decrease of 20,197 tons, equivalent to nearly 1.5 per cent.

The coal sold in Canada by the collieries of the Coast District this year shows an increase of 58,181 tons, or about 6.2 per cent. from the preceding year; the amount exported to the United States was 19,961 tons less than the preceding year, a decrease of about 4.8 per cent.

The coke produced in the Coast District in 1919 was 34,071 tons (2,240 lb.); the newly installed coke-ovens of the Granby Consolidated Mining, Smelting, and Power Company at Anyox producing 19,206 tons, and the Canadian Collieries (Dunsmuir), Limited, at Comox producing 14,865 tons. With the addition of 1,640 tons taken from stock, less 76 tons used under companies' boilers, the total sales of the Coast District for the year are shown at 35,635 tons—the highest on record.

On Vancouver island six companies produced coal this year—the Canadian Collieries, Limited, the Canadian Western Fuel Company, the Granby Consolidated Mining, Smelting, and Power Company, the Pacific Coast Coal Mines, the British Columbia Coal Mining Company, and the Nanoose Collieries, Limited; the majority of these companies each operate two, or more, collieries. The combined gross output of the Island collieries was 1,699,348 tons.

In the Nicola and Princeton coalfields of the Coast District, the Middlesboro Colliery Company produced 77,550 tons of coal; the Fleming Coal Company 39,110 tons; the Princeton Colliery, 22,193 tons; and the Coalmont Collieries, 10,189 tons.

The total output of this portion of the sub-district was 149,042 tons. The Telkwa Collieries produced 1,752 tons.

#### EAST KOOTENAY COALFIELD.

There were only two companies operating in this district this past year—the Crow's Nest Pass Coal Company, operating two separate collieries, the combined output of which was 479,059 tons; and the Corbin Coal and Coke Company, which made an output of 79,747 tons; making a gross output for the district for 1919 of 558,806 tons of coal.

To the coal mined was added 12,829 tons taken from stock, making the amount of coal distributed from the collieries 571,635 tons.

Of this gross tonnage, 85,735 tons was used in the manufacture of coke, of which there was produced 57,067 tons (2,240 lb.).

The coke sold this year amounted to 57,130 tons, of which 63 tons was taken from stock.

The following table shows the distribution made of the coal of this district:—

	Tons.	Tons.
Sold as coal in Canada .....	65,927	
Sold as coal in United States .....	373,348	
<b>Total sold as coal .....</b>		<b>439,275</b>
Used by the companies in making coke .....		85,735
Used by the companies under boilers, etc. ....		46,625
		<u>571,635</u>
<i>Minus</i> coal taken from stock .....		<u>12,829</u>
Gross output .....		558,806

## BUILDING MATERIALS.

The output during 1919 of structural materials, such as cement, lime, building-stone, sand and gravel, brick and other clay products, was considerably greater than in the preceding year, being \$1,148,485 as against \$940,891. The production of cement and brick individually is less than in 1918, but the greater increase in other materials, particularly in lime and limestone, brings the total production \$207,594 above that of last year. Since 1912, when a production, amounting to \$3,435,722 was recorded, the output of building materials steadily declined, due to the cessation of the building trade, brought about by the continued financial depression, and the war. It is probable that the figures of 1918 reached a minimum, and that an output amounting to about \$1,000,000 represents the steady yearly demand for these materials for use in repairs, renewals, and various small demands, with but little new construction-work. It may be expected, therefore, that the production will remain at about this figure until a period of active construction-work again commences in the Province.

Approximately 80 per cent. of the total production of building materials comes from the Coast District, and the larger part of this finds its markets in the Coast cities.

In Table V., where the production of building materials is given in detail by districts, the column previously headed "Clay, Gypsum, etc.," was changed in 1916 to "Miscellaneous Minerals," this column being used for listing the production of hydromagnesite from Atlin, molybdenite from Skeena, Lillooet, Nelson, arsenic from Osoyoos, and antimony ore from Slocan. The column previously headed "Crushed Rock" was changed in 1917 to "Crushed Rock and Flux"; in it is recorded, in addition to the crushed rock, the value of limestone and quartz which are quarried for use at the smelters as flux.

Excellent building-stone of various sorts is found in abundance in almost every part of the Province; the fact of its widespread distribution has, however, been somewhat against the establishment of large quarrying industries, as a sufficient local supply could always be obtained, and, except within reach of the larger cities, few regularly equipped quarries have been opened.

On the Coast, chiefly between Vancouver island and the Mainland, there are several well-equipped quarries taking out granite, sandstone, and andesite, all of excellent quality. These quarries supply the stone building material of the Coast cities, and have also exported to the United States.

A detailed description of the more important quarries was given in the Report of this Bureau for 1904.

**Red Brick.** The sale of red brick during the past year was about 5,100 M.; the price varies from \$12 to \$15 a thousand, according to quality and demand. This small output shows very clearly that but little construction-work has been carried on. It is probable, however, that a considerable quantity of brick is still imported into the Province.

**Firebrick.** The only company producing firebrick in the Province is the Clayburn Company, Limited, with a plant at Clayburn. The fireclay is found here as a bed occurring in bedded rocks of Eocene age. Shales, sandstones, and conglomerates, all but little consolidated, make up this sedimentary series. The shales are quarried or mined for brick-making and one bed is an excellent fireclay. Associated with these rocks is a bed of lignite which is sufficiently good to be used for firing the boilers of the plant. The production of this company was somewhat less than in 1918. Firebrick is the principal manufactured article produced by this company, but, in addition, considerable quantities of common brick, paving-brick, tiles, drain-pipes, and prepared fireclay are made.

**Lime.** The manufacture of lime is conducted in a small way at a large number of points in the Province, but only on the Coast has any attempt been made at more extensive operations. In the neighbourhood of Victoria, on Esquimalt harbour, three kilns are in operation, and there is a kiln on Saanich arm. On Texada island—in addition to the old plant at Marble bay—a new and extensive plant was erected at Blubber bay a few years ago. The limestone being used is of exceptional purity, but in some instances the limestone-beds are cut by igneous dykes which have to be rejected, and this somewhat increases the cost of quarrying.

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The production of lime and limestone for 1919 is valued at \$204,538, as compared with \$28,536 in 1918, and in addition about \$60,000 worth of limestone was quarried for use as smelter flux by the Granby and Consolidated Companies and a certain amount quarried by the paper and pulp mills for their own use.

There were two large and well-equipped cement plants in the Province, both **Portland Cement**, situated on Saanich inlet. These two concerns have recently been amalgamated under the name of the British Columbia Cement Company, with plant at Tod inlet, which made a production in 1919 of over \$260,000. Portland cement is thus the most important item in the production of building materials.

The returns for crushed rock and gravel indicate an increased demand for this material, although some of the plants have not been in operation for the **Crushed Rock and Gravel** past two or three years. During the boom years of 1911 and 1912 a number of well-equipped plants were put up near Vancouver and Victoria for supplying washed sand and gravel, properly screened to size. Some of these companies use a system of mining the gravel by hydraulic streams and carrying the product to the screens by the water used. Practically all of these plants are now idle, as there is but little demand for sand and gravel.

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## BUREAU OF MINES.

### WORK OF THE YEAR.

The work of the Bureau of Mines naturally increases year by year, this growing activity being due to the following causes: The extension of the mining area of the Province, with the proportional increase in the number of mines; the increasing desire of the outside public for the free information which the Bureau supplies with regard to the various mining districts and camps, and the appreciation by the prospector of the fact that he may obtain, gratis, a determination of any rock or mineral which he may send to the Bureau.

The routine work of the office, and the preparation and publication of the Report for the year just ended, followed by the examination in the field of as many of the mines and mining districts as the season would permit, together with the work of the Laboratory, fully occupied the staff for the year.

The permanent staff of the Bureau now consists of the Provincial Mineralogist and Assayer, Wm. Fleet Robertson; the Assistant Provincial Assayer and Provincial Analyst, D. E. Whittaker; and John Adams as Laboratory Assistant.

Major Nation, who went overseas in 1914, returned in September, 1917, and resumed his position as general office assistant.

Aside from his usual duties, the Provincial Mineralogist was occupied for three months, during the absence of the Deputy Minister on sick leave, as Acting Deputy Minister of Mines.

During the session of 1917 the Hon. the Minister of Mines brought in the "Mineral Survey and Development Act," which was passed on May 19th, 1917, and under the provisions of which the Province was divided into six Mineral Districts, to each of which there was appointed a Resident Engineer with headquarters at a centrally located point in such district.

In the district to which he was appointed the Resident Engineer is expected to devote his whole time to the performance of the duties of his office, and to carry on continuously a mineral survey of his district, keeping records of the same and of the mining and mineral developments taking place, and at the same time to assist prospectors and others with such advice as may be necessary and may come within the scope of a mining engineer's work.

Aside from special reports which may be called for by the Minister, the Resident Engineers are expected annually to make a comprehensive report covering all matters relating to mining, mine development, and prospecting that have occurred within the year in their respective districts.

These annual reports of the Resident Engineers are given later in this general Report, and form the basis of the information given in respect to the mineral industry and its development within the Province.

### MINERAL SURVEY DISTRICTS AND RESIDENT ENGINEERS THEREOF.

The following are the six Mineral Districts into which the Province is divided, with the Mining Divisions included in each and the location of the permanent office of the district, with the name of the Resident Engineer appointed to each district:—

*District No. 1.*—The North-western Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Atlin, Stikine, Liard, Skeena, Nass River, Portland Canal, Bella Coola, and Queen Charlotte; and shall have its permanent survey station and office at the City of Prince Rupert. Resident Engineer, Geo. A. Clothier, B.Sc.

*District No. 2.*—The North-eastern Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Omineca, Peace River, Cariboo, and Quesnel; and shall have its permanent survey station and office at Hazelton. Resident Engineer, John D. Galloway, M.Sc.

*District No. 3.*—The Central Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale; and shall have its permanent survey station and office at the City of Kamloops. Resident Engineer, R. W. Thomson.

*District No. 4.*—The Southern Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Similkameen, Greenwood, Grand Forks, and Osoyoos; and shall have its permanent survey station and office at the City of Grand Forks. Resident Engineer, Philip B. Freeland.

*District No. 5.*—The Eastern Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Golden, Windermere, Fort Steele, Ainsworth, Slocan, Slocan City, Trout Lake, Nelson, Arrow Lake, Revelstoke, Lardeau, and Trail Creek; and shall have its permanent survey station and office at the City of Revelstoke. Resident Engineer, A. G. Langley, B.Sc.

*District No. 6.*—The Western Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Nanamo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver, and New Westminster; and shall have its permanent survey station and office at the City of Nanaimo. Resident Engineer, W. M. Brewer.

#### ASSAY OFFICE.

The following is a summary of the work of the Assay Office of the Bureau of Mines for the year 1919 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1919 there were made by the staff in the Government Assay Office 2,986 assays or quantitative determinations; of these the majority were for the Bureau of Mines or for the other departments, for which no fees were received.

The fees collected by the office were as follows:—

Fees for analyses .....	\$ 763 20
Fees for assaying .....	188 70
Fees for assayers' examinations .....	270 00
Fees, gold bullion .....	74 04
<b>Total cash receipts .....</b>	<b>\$1,295 94</b>
Determinations and examinations made for other Government departments for which no fees were collected—	
Attorney-General's Department .....	\$ 669 00
Agricultural Department .....	435 00
Board of Health .....	140 00
Treasury Department .....	83 00
Other departments .....	320 00
	<b>\$1,647 00</b>

Value of work done outside of Mines Department work ..... \$2,942 94

The value of gold melted during the year 1919 was \$16,182 in 23 lots, as against \$4,276 in 33 lots in 1918.

**Free Determinations.** In addition to the above quantitative work, a large number of qualitative determinations, or tests, were made in connection with the identification and classification of rocks or minerals sent to the Bureau for a report; of these no count was kept, nor were any fees charged, as it is the established custom of the Bureau to examine and test qualitatively, without charge, samples of minerals sent in from any part of the Province, and to give a report on the same. This has been done for the purpose of encouraging the search for new or rare minerals and ores, and to assist prospectors and others in the discovery of new mining districts, by enabling them to have determined, free of cost, the nature and probable value of any rock they may find. In making these free determinations, the Bureau asks that the locality from which the sample was obtained be given by the sender.

## EXAMINATIONS FOR ASSAYERS.

REPORT OF D. E. WHITTAKER, SECRETARY OF BOARD OF EXAMINERS.

I have the honour, as Secretary, to submit the Annual Report for the year 1919 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act Amendment Act, 1899."

Examinations were held in Victoria, in the Government Laboratory, on May 16th, July 24th, and December 19th and the following days. Thirteen candidates came up for examination, and ten obtained the required number of marks; the Board recommended that a Certificate be granted to them. No candidates applied for exemption under section 2, subsection (2), of the Act.

In accordance with the recommendations of the Board, Certificates have been duly issued by the Honourable the Minister of Mines to the ten candidates.

## LIST OF ASSAYERS HOLDING PROVINCIAL CERTIFICATES OF EFFICIENCY UNDER THE "BUREAU OF MINES ACT AMENDMENT ACT, 1899."

*(Only the holders of such certificates may practise assaying in British Columbia.)  
Under section 2, subsection (1).*

Adams, J. B. ....	Victoria.	Longworth, F. J. ....	Boysds, Wash.
Archer, E. G. ....	Anyox.	Laucks, I. F. ....	Seattle.
Armstrong, N. ....	Vancouver.	Manning, S. M. ....	Trail.
Ayres, D. A. ....		Martin, S. J. ....	
Austin, John W. ....	Vancouver.	Marsh, Richard ....	Republic, Wash.
Backus, Geo. S. ....	Britannia Beach.	Marshall, H. Jukes ....	Vancouver.
Baker, C. S. H. ....		Marshall, William S. ....	Ladysmith.
Barke, A. C. ....		Meale, Eric A. ....	East Helena, Mont.
Bernard, Pierre ....	Monte Christo, Wash.	Merrifield, T. T. ....	Trail.
Bishop, Walter ....	Grand Forks.	Miles, Arthur D. ....	
Buchanan, James ....	Trail.	Milne, A. S. ....	Vancouver.
Buehman, A. S. ....	Trail.	Mitchell, Charles T. ....	Copper Cliff, Ont.
Campbell, Colin ....	New Denver.	McCormick, Alan F. ....	Ruth, Nevada.
Carmichael, Norman ....	Clifton, Arizona.	MacDonald, Alec C. ....	Vancouver.
Church, George B. ....		McLellan, R. D. ....	Vancouver.
Cobeldick, W. M. ....	Scotland.	Morgan, Richard ....	Trail.
Collison, H. ....	Cobham, England.	Nicholls, Frank ....	Norway.
Comrie, George H. ....	Vancouver.	Parker, Robt. H. ....	
Craufurd, A. J. F. ....	Rossland.	Parsenow, W. L. ....	
Crerar, George ....		Perkins, Walter G. ....	
Cruickshank, G. ....		Pickard, T. D. ....	Vancouver.
Davidson, J. R. ....	Vancouver.	Pirrie, Noble W. ....	Ottawa.
Day, Athelstan ....	Dawson.	Poole, H. W. ....	Vancouver.
Dedolph, Ed. ....		Prior, C. E. ....	Hedley.
Dockrill, Walter R. ....	Chemainus.	Richmond, Leigh ....	Duncan.
Dunn, G. W. ....	Rossland.	Robertson, T. R. ....	
Farquhar, J. B. ....	Vancouver.	Rodgers, Ch. B. ....	Vancouver.
Fingland, John J. ....	Kaslo.	Rombauer, A. B. ....	Butte, Mont.
Grosvenor, F. E. ....	Vancouver.	Schroeder, Curt. A. ....	
Hamilton, Wm. J. ....	Anyox.	Segsworth, Walter ....	Toronto, Ont.
Hannay, W. H. ....	Rossland.	Shepherd, G. H. ....	North Vancouver.
Harsant, R. C. C. ....	Port Essington.	Sharpe, Bert N. ....	
Hart, P. E. ....		Shore, J. T. ....	Vancouver.
Hawkins, Francis ....	Silverton.	Sim, Chas. John ....	Monte Carlo.
Hawes, F. B. ....	Vancouver.	Sloan, Wm. ....	Vancouver.
Hodgson, A. R. ....	Anyox.	Snyder, Blanchard M. ....	
Hook, A. Harry ....	Greenwood.	Steven, Wm. Gordon ....	
Hurter, C. S. ....	Prince Rupert.	Stimmel, B. A. ....	Trail.
Irwin, George E. ....	Vancouver.	Stockly, Galt ....	Princeton.
John, D. ....	Haileybury, Ont.	Sundberg, Gustave ....	Mexico City.
Kiddie, Geo. R. ....	California.	Tally, Robert E. ....	Spokane, Wash.
King, R. ....		Taylor, H. L. ....	Vancouver.
Kitto, Geoffrey B. ....	Victoria.	Thomas, Percival W. ....	Vancouver.
Langley, A. S. ....	Crofton.	Tretheway, John H. ....	
Lee, Fred E. ....	Trail.	Turner, H. A. ....	Vancouver.
Lee, Geo. M. ....	Grand Forks.	Vance, John F. C. B. ....	Vancouver.
Ley, Richard H. ....	Victoria.	Van Agnew, Frank ....	Siberia.
Levy, Frank ....		Vaughan-Williams, V. L. ....	California.
Lindsay, W. W. ....	Kimberley.	Wales, Roland T. ....	

Watson, Wm. J. ....	Ladysmith.	Widdowson, E. Walter ....	Nelson.
Watson, Thomas .....	Vancouver.	Williams, W. A. ....	Vancouver.
Welsh, J. Cuthbert .....	Butte, Mont.	Williams, Eliot H. ....	
Wells, Ben T. ....		Williams, J. R. ....	Vancouver.
West, Geo. G. ....	Vancouver.	Wimberley, S. H. ....	Nevada, U.S.A.
Whittaker, Delbert E. ....	Victoria.		

*Under section 2, subsection (2).*

Archer, Allan .....		McDiarmid, S. S. ....	
Baylock, Selwyn G. ....	Trail.	McGinnis, Wm. C. ....	Queen Charlotte Ids.
Bissett, D. G. ....	Trail.	McKay, Robt. B. ....	Vancouver.
Bolton, George E. ....	Silverton.	McLellan, John .....	Queen Charlotte Ids.
Brennan, Charles Victor ...	Victoria.	McMurtry, Gordon O. ....	
Browne, R. J. ....	Rossland.	McNab, J. A. ....	Thompson, Nevada.
Browne, P. J. ....	Nelson.	McPhee, W. B. ....	
Bryant, Cecil M. ....		McVicar, John .....	Edmonton, Alta.
Burwash, N. A. ....		MacIennan, F. W. ....	
Cavers, Thomas W. ....		Moran, P. J. ....	Vancouver.
Clothier, George A. ....	Prince Rupert.	Newton, W. E. ....	Sandon.
Cole, Arthur A. ....	Cobalt, Ont.	Oughtred, S. W. ....	Ainsworth.
Cole, G. E. ....	Rossland.	Outhett, Christopher .....	Kamloops.
Cole, L. Heber .....	Ottawa, Ont.	Pemberton, W. P. D. ....	Victoria.
Conway, E. J. ....	Vancouver.	Reid, J. A. ....	Cobalt, Ont.
Coulthard, R. W. ....		Ritchie, A. B. ....	Nelson.
Cowans, Frederick .....		Roaf, J. R. ....	
Dawson, V. E. ....	Trail.	Rose, J. H. ....	Thompson, Nevada.
Dempster, R. C. ....	Rossland.	Rutherford, R. C. ....	Trail.
Dempster, A. S. ....	Rossland.	Sampson, E. H. S. ....	Riondel.
Dixon, Howard A. ....	Toronto, Ont.	Scott, Oswald Norman ....	
Eardley-Wilmot, V. L. ....	Rossland.	Shannon, S. ....	
Eldridge, Gardner S. ....	Vancouver.	Sharpe, G. P. ....	Midland, Ont.
Galbraith, M. T. ....		Shorey, P. M. ....	Trail.
Gilman, Ellis P. ....	Vancouver.	Sloan, David .....	Three Forks.
Green, J. T. Raoul .....	Blairmore, Alta.	Stevens, F. G. ....	Mexico.
Guess, George A. ....	Toronto, Ont.	Stroud, J. E. C. ....	Anyox, B.C.
Gwillim, J. C. ....	Kingston, Ont.	Sullivan, Michael H. ....	Kellogg, Idaho.
Harding, Wilson M. ....		Sutherland, T. Fraser ....	
Heal, John H. ....		Sutherland, Wm. ....	Glasgow, Scotland.
Hearn, Roy D. ....	Trail.	Swinney, Leslie A. E. ....	
Hilliary, G. M. ....	Idaho, U.S.A.	Thompson, W. K. ....	Trail, B.C.
Johnston, William Steele ..	Lachine, Que.	Thomson, H. Nellis .....	Anaconda, Montana.
Kaye, Alexander .....	Vancouver.	Thomson, Robt. W. ....	
Kendall, George .....	Vancouver.	Watson, A. A. ....	
Kidd, G. L. ....	Edmonton, Alta.	Watson, Henry .....	
Kilburn, Geo. H. ....	Rossland.	Willis, F. S. ....	Trail.
Lathe, Frank E. ....	Grand Forks.	Winslow, R. H. ....	Vancouver.
Lay, Douglas .....		Wilson, Ridgeway R. ....	Fernie.
Lewis, Francis B. ....	South Africa.	Workman, Ch. W. ....	
Merrit, Charles P. ....		Wright, Richard .....	Rossland.
Murphy, C. J. ....	St. Catharines, Ont.	Wynne, Lewellyn C. ....	
Musgrave, W. N. ....	England.	Yuill, H. H. ....	
McArthur, Reginald E. ....			

*Under section 2, subsection (3).*

Carmichael, Herbert .....	Victoria.	Marshall, Dr. T. R. ....	London, England.
Galloway, J. D. ....	Victoria.	McKillop, Alexander .....	Vancouver.
(Resident Engineer.)		Pellew-Harvey, Wm. ....	London, England.
Harris, Henry .....	Tasmania.	Robertson, Wm. Fleet ....	Victoria.
Hedley, Robt. R. ....	Vancouver.	(Provincial Mineralogist.)	
Kiddie, Thos. ....	California.		

PREVIOUSLY ISSUED UNDER THE "BUREAU OF MINES ACT, 1897," SECTION 12.

Pinder, W. J. ....		Thompson, James B. ....	Vancouver.
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## NORTH-WESTERN DISTRICT (No. 1).

REPORT OF GEO. A. CLOTHIER, RESIDENT ENGINEER.

### INTRODUCTORY.

The North-western Mineral Survey District is comprised of eight of the Mining Divisions of the Province—namely, Skeena, Portland Canal, Nass River, Bella Coola, Queen Charlotte, Stikine, Liard, and Atlin. The first five include the northern coast portion of the Province, from Seymour inlet north to the Unuk river; and the last three, all the northern interior part of the Province to the Yukon-British Columbia boundary-line.

For the purposes of this report the district will be considered under the main headings of the Mining Divisions, subdivided into sections, as follows:—

Bella Coola Mining Division.

Queen Charlotte Mining Division.

Skeena Mining Division—Coast section; Grand Trunk Pacific section; Kitsumgallum Valley section; Lakelse Valley (Thornhill Mountain) section.

Portland Canal Mining Division—Portland Canal section; Marmot River section; Bear River section; Salmon River section.

Nass River Mining Division—Observatory Inlet section; Alice Arm section; Kitsault River section; Illiance River section; Unuk River section.

Stikine Mining Division—Stikine River section; Iskut River section.

Liard Mining Division—Dease Lake section.

Atlin Mining Division—Rainy Hollow section; Atlin section.

It has been pointed out in former reports that this district has many distinctive features, both geologic and geographic, that are exceptionally advantageous and desirable to the prospector and the mine operator.

The following brief outline of the general geological conditions show them to be very favourable for the occurrence of the economic minerals. The district may be divided into three, broad, parallel belts or zones, each with its own characteristic ore occurrences, as follows: (1) The Main Coast Range; (2) the Western Contact Belt; (3) the Eastern Contact Belt.

(1.) The Coast range, consisting of granodiorite, extends the full length of the Province, crossing the British Columbia boundary-line into the Yukon at the head of Lynn canal, and it is from thirty to one hundred miles in width.

This belt of massive granite has, as such, been rather shunned by prospectors, who, as a rule, consider this formation "no good," or at least unfavourable for mineral-deposits. The fallacy of this opinion has, however, been demonstrated by the number of meritorious prospects that have been discovered, one of which has developed into a valuable producing mine.

Its importance from a prospecting standpoint is exemplified in such showings as the magnetite veins on Seymour and other inlets in the Bella Coola Mining Division; the quartz veins of the Belmont-Surf Inlet Mines, Limited, on Princess Royal island, which occur in a shear-zone in the granite, the shearing action providing the channel through which the siliceous and mineral-bearing solutions have circulated and deposited their loads; the *Drum Lummon* property, on Douglas channel, representing replacement veins following along acidic dykes which have penetrated the granite; the immense pyrite-deposits, carrying chalcopyrite, on the *Ecstall* river, contained in a belt of schists enclosed in the granite; the *Hidden Creek* mines of the Granby Company at Anyox; the *Outsider* and *Maple Bay* groups at Maple bay, on Portland canal, in the same formation; the Georgia River Mining Company's showings, which are apparently filled fissures in the solid granite, each representing a different class of ore-deposit that may be found in the Coast range.

Of the enclosed sedimentaries within the granite, F. E. and C. W. Wright\* say: "Within the granite area itself are occasional belts of sedimentary rocks in a highly metamorphosed condition. They vary from argillites to mica, hornblende and calcareous schists of various types,

\* Bulletin No. 347, U.S. Geological Survey.

even marble, and occur in long bands intensely folded. These included schist-belts are usually not wide and more appear near the mountain-tops than at sea-level. They are usually intensely mineralized with sulphides, especially pyrite, and near the mountain-tops show abundant evidence of contact metamorphism. They were directly above the intrusive mass and were evidently in the most favourable position to be affected by magmatic waters and heat escaping from the intrusives, so that they are the most heavily mineralized bodies."

(2.) The Western Contact Belt borders the Coast range on its western side, and in this district extends from the head of Vancouver island north to the southern boundary of the Alaska strip. Portions of the Coast, the majority of the off-shore islands, and the Queen Charlotte group of islands, though the northern extension of the Vancouver range, will for the purposes of this report all be included in this belt.

The rock formation is essentially sedimentary, highly metamorphosed at and near the contact with the granite and intruded by many spurs and isolated masses from the main granite Coast range, as well as cut by many dykes of all kinds of igneous rocks; all tending to produce conditions exceptionally conducive to the circulation of mineral-bearing solutions and ore-deposition.

Excerpts from F. E. and C. W. Wright's report state: "It is probable that at many points along the western flanks of the batholiths (granites) the schists now visible were so deeply buried at the time of the intrusion that the invading granite did not alter them so materially as to produce wide contact change. Strata nearer the surface at the time of intrusion should show more pronounced alteration from the magmatic solutions and the heat. It is significant that in these deep-seated schists and gneisses near the granite-contact no ore-bodies of consequence have been found, while rocks farther away from the granite and nearer the surface during its invasion in many localities show traces of contact metamorphism, as in spotted schists, and contain valuable metalliferous deposits."

The Prince Rupert schists, so termed by McConnell,\* made up largely of crystallized mica and hornblende schists, passing in places into fine-grained gneisses and greyish and white crystalline limestone, extend south in a wide band from Prince Rupert to some distance below Klewnuggit, on the east shore of Grenville channel. The belt is about twelve miles wide at the mouth of the Skeena river and gradually narrows down Grenville channel.

A glance at the map will convince any one of the ideal natural prospecting conditions and transportation facilities furnished in this Western Contact Belt. Any point on the Coast or off-shore islands is easily reached from the many canneries and sawmilling camps scattered along the Coast, which are calling-ports for Coast-plying steamers. The Queen Charlottes have a weekly service from Vancouver and Prince Rupert.

(3.) The Eastern Contact Belt, as the name signifies, borders the Coast range on its eastern side, and extends in this district from the Lakelse valley, south of Terrace, on the Grand Trunk Pacific Railway, north to the northerly boundary of the Province, a distance of about 450 miles.

As on the Western Contact, the essential rock formation is sedimentary, but differing in that the alteration is markedly less. F. E. and C. W. Wright say: "The character of the invaded sedimentaries east of the inland border of the granite is noticeably different. The slates and sandstones are less altered and typical schists are rare. Folding and particularly faulting are common and characteristic of the whole complex. The intruded rocks are often indurated (hardened) and heavily mineralized with sulphides near the contact and show evidence of metamorphism by the intrusives. The geologic interpretation of these data indicates clearly that the rocks east of the massifs were less deeply buried at the time of intrusion than those on the coastal side. In other words, the inland rocks were then above the zone of deep-seated metamorphism or rock-flowage, and were therefore profoundly affected by the invading intrusions and accompanying pneumatolytic solutions. Furthermore, the mineral-bearing solutions emanating from the granite encountered new conditions of temperature and pressure on entering the adjacent sedimentary rocks, and deposited, as supersaturated solutions in their new environment, a portion of their dissolved contents, especially metallic sulphides and silicates."

Quoting from McConnell: "The batholith is bordered on the east in this latitude (Portland Canal area) by two series of sedimentary, predominatingly argillaceous, beds, separated by a

\* Summary Report, Dominion Department of Mines, 1912, page 63.

volcanic group made up of massive and fragmental greenstones. These formations are cut by numerous dykes and satellitic stocks belonging to the period of the Coast Range granitic invasion."

McConnell's observations with regard to the Portland Canal area apply equally as well to the Alice Arm, Kitsault River, and other sections of the Eastern Contact Belt and are probably typical throughout its whole length.

These dykes of igneous rocks, ranging from andesite to gabbro, are termed greenstones. They are both massive and schistose, highly altered, of a greenish colour, and generally impregnated with disseminated crystals of pyrite, weathering to a light yellowish colour. Silicified veins and shear-zones within these altered masses of greenstone are proving wonderfully rich carriers of native gold, native silver, and silver sulphides in the Kitsault River and Salmon River sections.

Geographically, the Eastern Contact Belt has not the natural advantage of accessibility such as the Coast and islands. Lying as it does east of the Alaska strip places it from fifty to one hundred miles from tide-water. The southern end is reached by the Grand Trunk Pacific at Terrace, ninety-five miles from Prince Rupert. North of this the Coast range is penetrated to the Eastern Contact Belt by the Nass river, Observatory inlet, and Portland canal, which are branches of Portland inlet, the Unuk river, Stikine river, and Taku inlet and river. The extreme northern portion of the belt is reached by way of Skagway; thence over the White Pass Railroad to Carcross, and from there by boat to Atlin.

#### PROSPECTING ON THE EASTERN CONTACT BELT.

Exploration and development work on this zone are at present being carried on mainly at the head of Alice arm, up the Kitsault river, Illiance river, and at the head of Portland canal, up the Salmon and Bear River valleys. The results in these separate areas, which are about fifty miles apart, fully justify the opinion that, should other portions turn out equally as well, this belt will become one of the greatest mineral-producers on the continent.

Some little prospecting has been done in the Lakelse and Kitsumgallum valleys, and there should be good country around Kitsumgallum lake and beyond to the Nass river above Ayansh. This section is very accessible from Terrace, on the Grand Trunk Pacific, by wagon-road to Kitsumgallum lake, and from the lake following the telegraph-trail through to Ayansh, on the Nass river, the head of Indian mail-launch service from Mill bay. From Ayansh to Alice arm is reached by following the telegraph-line trail. There is an old trail from Ayansh up the Nass river to the foot of Mezladin lake, from which point there is a Government trail along the west side of the lake to the Bear-Nass trail from Stewart over the Bear River divide.

That portion of the belt at the head of Salmon river is reached by going over the Salmon River glacier beyond the *Forty-nine* group of mineral claims, or over the Long Lake glacier. (See Morkill's map of the Salmon River valley accompanying this report.)

The next point of access from the Coast is up the Unuk river from the nearest port of call of the Canadian Pacific Railway Coast steamers at Ketchikan. Several groups of claims were staked at the head of this river several years ago, were Crown-granted, and are still held by the original companies or individual owners. Some very fine samples of high-grade silver-gold ores, similar to those of the Salmon River valley, have been brought out of that section from time to time. (See Unuk River section in this report.)

Farther north the Stikine river and its main tributary from the south, the Iskut river, traverse the Eastern Contact Belt. The Stikine is navigable to Telegraph Creek, and an excellent service of river-boats is now handled by the Barrington Transportation Company from Wrangell. Navigation opens about May 15th, and a weekly service, meeting the Canadian Pacific Railway boats at Wrangell, is maintained throughout the summer. All that section of country from about seven miles above the boundary at the mouth of the Iskut river to the Clearwater river, flowing into the Stikine from the north, a distance of about sixty miles, should be as good prospecting country as is in the Province. The Clearwater river is navigable for small boats, by poling and lining, for probably thirty miles from its confluence with the Stikine, giving an additional area of fairly accessible country for prospecting. Also from the mouth of the Iskut river south for thirty or forty miles its course runs through this mineral-belt. It also is navigable for that distance by gas-boat or small boat by poling and lining.

With the exception of a few claims staked along the Stikine river and a group of claims up the Iskut, about thirty-six miles from its mouth, this whole length of nearly a hundred miles within the Eastern Contact Belt has never been prospected. There is room in this one section for hundreds of prospectors, and I believe the possibilities are the best in the Province.

A prospector's trail from the mouth of the South fork of the Iskut, following this branch for ten miles south to the head of the Unuk river, and a similar trail from the Bear-Nass trail, or from the head of Salmon river, north to the head of the Unuk, and connecting with the above-mentioned trail, would be an excellent start and of inestimable aid to prospectors toward opening up that very promising section of country.

Still farther north the belt is again cut by the Taku river, which flows into Taku arm. The river is navigable from its mouth to the Inklin river, flowing in from the south, for gas-boats. There is a trail through to Ailln from the mouth of the Sloko river. I have no information as to any prospecting or mineral finds in that section, but the river undoubtedly cuts through the mineralized belt. There is gas-boat service from Juneau to the head of Taku arm, and no doubt through to the Inklin river if desired.

#### THE MINING SITUATION.

The year 1919 has, I think, been the decisive year for mining in the north-western portion of the Province. In 1910 and the two following years there was a considerable boom in the Bear River section, at the head of Portland canal. At that time it was an entirely new country, which probably accounts for the rush and excitement. The properties under exploration at that time failed to come up to expectations, and as a result the country was not only practically abandoned, but was "knocked" for several years by every one who had lost money in taking chances in schemes, mining and otherwise, that never had a chance of making good. It therefore augurs well for the future when this section has again claimed the attention of the mining world, strictly on the merits of the properties. These have been in the majority of cases thoroughly investigated by competent mining engineers.

The bonding of a number of properties in the Salmon River section early this spring, subsequent to the remarkable development of the Premier Gold Mining Company's property, resulted in a season of extraordinary activity and exploratory work. This work has shown satisfactory results, warranting further extensive development, and resulting in the bonding of many more meritorious prospects, on which work will be started as early in the spring as conditions will permit, indicating years of increasing activity and, no doubt, the development of not a few of these into shipping properties.

A parallel case is that of the Kitsault River section, where the phenomenal success of the Taylor Engineering Company, formerly the Dolly Varden Mines, has been the incentive for the exploration of many other favourable-looking showings in that section.

Undoubtedly this activity will gradually extend to other sections of the district as prospects of merit are developed to the stage where they can command the attention of the mining engineer.

The success of this year's hydraulic operations in the Dease Lake section has also attracted the attention of many, and I look for a keen interest being taken in that part of the district next season. (See Dease Lake section in this report.)

This revival of interest in mining has had a stimulating effect on prospecting, and the known mineral areas will gradually be extended as new prospects are discovered and explored. It should be the policy of the Government to liberally assist in every way the endeavours of the prospector to explore new country and to further any scheme whereby new men can be trained for such work.

The Government has built several miles of new trails throughout the district this year and repaired and improved many miles of old ones. The assistance rendered to prospectors for trails, etc., under the "Mineral Survey and Development Act," by the Mines Department is having a beneficial effect toward encouraging prospecting in outlying sections.

The following is a list of the shipping properties and their outputs for the year in this district:—

## PRODUCTION FOR 1919 FROM DISTRICT NO. 1.

Name of Property.	Location.	Ore Mined.	Gold.	Silver.	Copper.
		Tons.	Oz.	Oz.	Lb.
Atlin (placers).....	Atlin.....				
Stikine and Liard (placers).....	Telegraph Creek.....		9,700		
Shuttle island (placers).....	Lockeport.....				
Granby Consolidated Mining, Smelting, and Power Co.....	Anyox.....	647,466	4,864	348,408	19,544,588
Taylor Engineering Co. (Dolly Varden).....	Alice arm.....	6,709		423,952	
La Rose mine.....	Alice arm.....	22	3	6,157	
Premier Gold Mining Co., Ltd.....	Stewart.....	488	3,209	108,285	
Ikeda Mines, Ltd.....	Ikeda bay.....	151	51	722	38,990
Shuttle island.....	Lockeport.....	50	18		
Patterson group.....	Porcher island.....	10	87	18	
Alice Arm Silver Mining Co., Ltd.....	Alice arm.....	27		968	
Belmont-Surf Inlet Mines, Ltd.....	Surf Inlet.....	102,716	51,084	30,319	810,388
Drum Lummon Mines, Ltd.....	Hartley bay.....	18	19	353	17,455
Golkeish mine.....	Alice arm.....	1,200	200	1,231	
Totals.....		758,857	69,776	920,413	20,411,421

From the above it will be seen that the year's aggregate mineral production will fall short of last year's, due to the lessened output of the Granby Consolidated Mining, Smelting, and Power Company at Anyox. Their deficit was the direct result of a complete close-down for a couple of months early in the year and subsequent curtailed operations.

This reduction of total output cannot by any means be taken as an indication that the mining industry is depreciating. If the production of the Granby Company had been normal, the year's increase would have been the increase in output of the Belmont-Surf Inlet Mines and the outputs of the Premier Gold Mining Company and Taylor Engineering Company, amounting to approximately \$750,000. As it is, the gold and silver outputs show an increase over last year, the latter being more than doubled, due to the shipments from the *Dolly Varden* at Alice arm and the *Premier* at Stewart.

The development of two such bonanza properties to the shipping stage and the advancement of several others to the stage that their future is assured, and the general encouraging mining outlook, are of far more significance to the mining industry than the temporary deficit in production of one property.

## BELLA COOLA MINING DIVISION.

There have been a number of claims staked to the north of the Dean river at Tesla lake and assessment-work done on the older claims. These claims at Tesla lake are probably in the Omineca Mining Division.

Owing to lack of time I was unable to get over any portion of this Division this year, and have no information as to what work has been done during the year on the magnetite-iron showings on Seymour and other inlets and King Island.

The Coast portion of this Division is very accessible for prospecting and can be reached by small boat from Hardy Bay or Alert Bay, or from Bella Bella, Ocean Falls, and Bella Coola, ports of call for Coast boats.

## QUEEN CHARLOTTE MINING DIVISION.\*

I visited the islands early in the spring, and regret that I have not been able to get over again to check up the season's work; however, from authentic information I am able to report properties and conditions to date.

There has been an encouraging increase in mining activities during the past season and claim-owners are very optimistic for next year.

There is an immense tonnage of straight magnetite ores exposed on the different islands, and therefore ideally located for mining and transportation. These would become of importance should the iron-manufacturing industry ever develop beyond the newspaper stage.

Nothing has been done this year with the beach sands on the east and north coasts of Graham Island.

Some interest is again being taken in oil lands and about thirty locations have been made, extending from the north end of the Indian reserve, about a mile and a half above Skidegate, for twelve or thirteen miles up the east coast, about five miles north of Lawn Hill. All this

\* Minister of Mines' Report, 1918.

area has been staked and applied for by W. A. Lewthwaite and Andrew Wright, of Victoria, representing English capital. They have made a trip of investigation to their holdings, accompanied by their engineer, Henry Jory, and claim that arrangements are complete for the immediate boring of this ground and that at least \$150,000 will be expended in such work. This is a very praiseworthy enterprise and its success would be of inestimable benefit, not only to this district, but to the Province and Canada.

A few oil locations have also been made on the west coast, but no new developments with regard to further drilling.

Several mineral claims were staked around Kootenay harbour, on the west coast, and high-grade samples reported.

**South Easter Mining Co.** This is a subsidiary company of the Northern Customs Concentrators, Limited, of Cobalt, Ontario. The holdings, consisting of seven claims, are situated about a mile from the beach at Skidegate. Operations were closed down early in the year and as yet have not been resumed. I am informed that the company is being reorganized and will proceed with the further development of the property. The company has a very serviceable little plant and has done, during the past two years, considerable exploratory work in sinking and drifting on the vein. There is a good surface showing of milling-grade gold ore, but the work so far has shown that this ore-shoot only extends down about 50 feet below the surface. Below this the vein is badly shattered and displaced. Deeper development by diamond-drilling was under consideration before closing down. A description of the workings was given in the Minister of Mines' Report, 1918, and very little has been done since.

**Producer Group.** This property, formerly the *Lucky Seven*, is situated just outside of Jedway harbour and owned by Ike Thompson and Wilson McKinnon. It was bonded by Seattle interests more than a year ago and has been under development continuously since that time. A small water-driven compressor plant was installed for this preliminary work. Considerable development had been done by way of open-cutting and stripping, a shaft sunk 50 feet on the vein, and a drift on the vein for 60 feet south from the bottom of the shaft. This year's work consisted of driving a cross-cut tunnel from near the beach to cut the vein under the shaft. It was run about 375 feet and some difficulty was had in locating the vein. Crosscuts were therefore run both ways from the end of the tunnel and a raise finally put through to the old drift at the bottom of the shaft. Work has now been resumed in this shaft, drift following about 2 feet of ore on the hanging-wall. The vein shows about 12 feet more of fair-looking milling ore.

A tramway has been installed from the mine to the beach, with a bunker of 25 tons capacity at the mine and one of 350 tons capacity at the beach.

This gives promise of becoming a valuable property, and the bondors deserve credit for the perseverance they have shown under rather discouraging conditions.

**Ikeda Mines, Ltd.** Very little development-work has been done on this property since reported on last year. It has been operated in a small way all year under the management of A. Ikeda, and shipped 151 tons of copper ore to the Granby smelter at Anyox, yielding 51 oz. gold, 722 oz. silver, and 38,990 lb. copper. The gold and silver content is about the same as last year, but the copper has fallen off 20,000 lb.

Mr. Ikeda made a trip to Japan, returning with mining engineers, who made a thorough examination of the property and returned to Japan. The property has been a persistent shipper for a number of years, but it is evident that it now requires a concentrating plant and extensive development if its production is to be maintained. It is to be hoped that Mr. Ikeda will be successful in his efforts to secure the necessary capital to develop and equip the property, which the exposed milling-ore in the present workings and the numerous surface showings would seem to justify.

**Copper Island.** This is situated just at the entrance to Jedway harbour and contains three claims—*Golden Gate, Trust, and Skincuttle Entrance*—belonging to A. Helno. The owner has done a lot of work on his claims and for several years has shipped a few tons of good-grade copper ore each year.

There is a broad belt of hornblende, about 1,400 feet long, that shows, wherever broken into, chalcopryrite in disseminated grains and bunches across a width of from 20 to 30 feet. A tunnel has been driven about 150 feet in a silicified limestone that appears to lie on the foot-wall of

the hornblende-belt and which is also mineralized with chalcopyrite. It is reported that the whole face of this tunnel is now in good ore.

The island is low, about 200 feet being the greatest depth obtainable without sinking, well timbered, and probably sufficient water could be developed for milling purposes. This is a rather promising-looking property.

The two claims, *Mother Lode* and the *Bank of Commerce*, are owned by **Burnaby Island.** Campbell & Wilds. I did not examine the property this year, but I am informed that a shaft has been sunk to a depth of 35 feet and some good chalcopyrite ore exposed.

This group, owned by J. S. McMillan, is situated above Jedway harbour. The **Copper Queen** last work done on the property was in 1908, when a tunnel some 220 feet in **Group.** length was driven and a few hundred feet of diamond-drilling done. One man has been employed during this summer prospecting the surface. The ore is magnetite carrying pyrite and chalcopyrite.

The numerous iron-deposits, of magnetite, in this Division were investigated to some extent during the summer.

This is a small island situated about seven miles below Lockeport. On the **Shuttle Island.** *Ellen* claim the owners have been working all summer. A crosscut tunnel had been run 65 feet to cut a quartz vein showing on the surface, in which native gold was found in spots. The vein was encountered showing a width of about 8 inches. The greatest depth obtainable without sinking would only be about 25 or 30 feet. They took out \$350 in gold by mortaring and panning. There are small irregular quartz veins occurring in sedimentary formation and these may prove profitable in a small way.

The placer claim *Ticksey* takes in all the gravel beach exposed. This also has been worked this summer by the owner, J. Hendricks. The beach-gravel was shovelled on a scow and hauled to the main island, about half a mile away, where a small creek was utilized for washing it to obtain the gold. About 54 oz. of placer gold was sent to the Dominion Government Assay Office, Vancouver, and the owner has also probably \$300 or \$400 in nuggets.

The gold is the result of the disintegration of the small quartz-seams, but the length of beach and the limited amount of gravel precludes the possibility of the diggings becoming of any great importance.

#### SKEENA MINING DIVISION.

This Division takes in about 200 miles in length of the Coast range and coast-line to the mouth of Portland Inlet, and includes a small strip of the Eastern Contact Belt from the Grand Trunk Pacific north to the southern boundary of the Nass River Division. The outer islands are in the Western Contact Belt. The main area is the granite Coast range, which is traversed by many waterways, of which the most extensive is Douglas channel, with its arms—Gardner canal, Kildala arm, and Kitimat arm—which penetrate almost to the Eastern Contact Belt. The head of Gardner canal is within thirty or forty miles of the mineral area of the Sibola section of the Omineca Mining Division, on the eastern side of the range, and may possibly eventually become the main outlet for that interior country.

There are many ports of call south of Prince Rupert from which any part of the Coast or Coast islands can be reached for prospecting. Prince Rupert, the western terminus of the Grand Trunk Pacific, is the main distributing centre for the Queen Charlotte islands, the interior, and up and down the Coast.

For convenience the Skeena Mining Division will be subdivided as follows: Coast section; Grand Trunk Pacific Railroad section; Kitsumgallum Valley section; Lakelse Valley (Thornhill Mountain) section.

#### COAST SECTION.

This includes all the Coast islands and any part of the mainland reached from tide-water.

This is a subsidiary company of the Tonopah Belmont Development Company. **Belmont-Surf** The holdings, consisting of nine mineral claims, were originally the *D.L.S. Inlet Mines, Ltd.\** group, owned by the Surf Inlet Mines, Limited, who optioned them to the Belmont Canadian Mines, Limited, retaining 20 per cent. The Belmont Canadian Mines, Limited, developed the property, bought the 80-per-cent. interest, and reorganized

\* See Minister of Mines' Report, 1917, 1918.

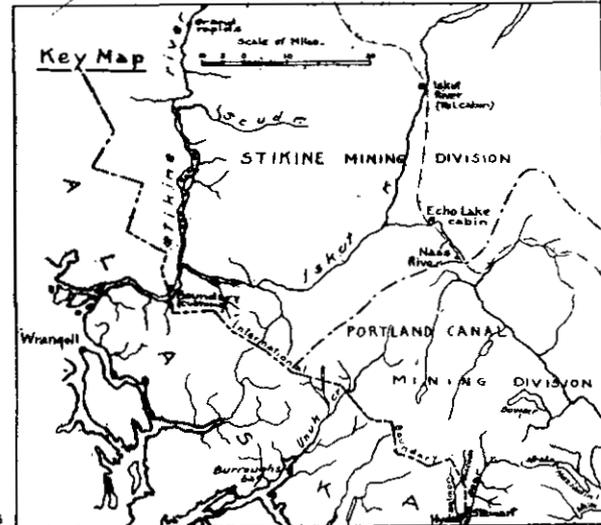
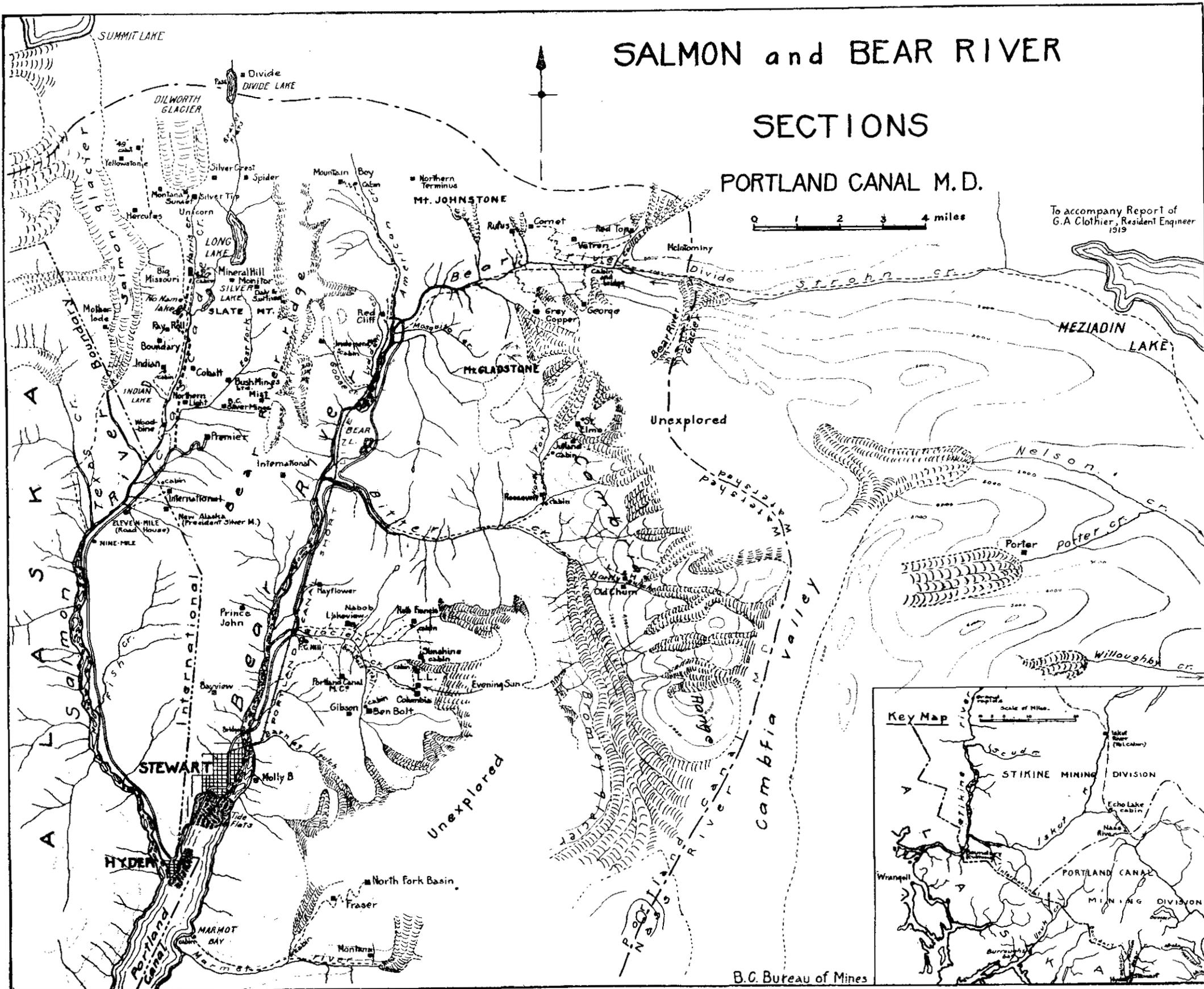
# SALMON and BEAR RIVER

## SECTIONS

### PORTLAND CANAL M.D.

0 1 2 3 4 miles

To accompany Report of  
G.A. Clothier, Resident Engineer  
1919



into the present company. The mine and plant were fully described in the Minister of Mines' Report, 1917, since which time the mine has been steadily developed and ore-exposures kept well ahead of production.

During 1919, 5,544 feet of underground development-work was done, consisting of 2,147 feet of raising, 2,250 feet of drifting, 1,017 feet of crosscut, and 121.5 feet of shaft-sinking, distributed over all the mine levels. The above work includes the new 800-foot level which has been opened up from the shaft by drifting north and south on the west vein, and which has opened up an appreciable tonnage of ore. The vein below the 700-foot level has straightened up considerably.

Both mine and mill operated continuously throughout the year, with the exception of about thirty days, when labour was extremely scarce. There were milled 103,927 dry tons of ore, of which 102,716 was stoped and 1,211 tons reclaimed from the dumps. From this, 9,515 tons of concentrates was produced, yielding a gross value of \$1,183,012.87 in metal content, as follows: 51,684 oz. gold, 30,319 oz. silver, and 810,388 lb. copper, an increase over last year's production of 10,066 oz. gold, 2,983 oz. silver, and 378,075 lb. copper. These returns indicate an increase of over \$1 a ton in average gold values and an increase of about 0.12 per cent. in average copper content of the mine-run ore. The silver remained about the same as last year. The concentrates were shipped to Tacoma, Wash., for treatment.

The *Pugsley* mine, adjoining the claims of the Belmont-Surf Inlet Mines, Limited, is owned by that company. Development-work has been continued throughout the year with a small crew in the lower tunnel. Additional ore was exposed in both the east and west veins.

The staff at the mine consists of F. W. Holler, superintendent; E. W. Hawkins, auditor; F. H. Penn, mill superintendent; and C. P. Seale, mine superintendent.

This company is being incorporated, with head office in Vancouver, for \$200,000 **Whale Channel** in 200,000 shares, to take over the *Moose* group, consisting of the *Moose*, **Mines, Ltd.** *Moose 2*, and *Moose 3* mineral claims, situated four miles south of River bight, on Princess Royal island. This group was located this summer. I have no information with regard to the mineral-showings, etc., on it.

This company has its registered office at 1115 Dominion Building, Vancouver. **Drum Lummon** W. Porteous Sloan is manager of the company. The property is situated on **Mines, Ltd.** Drum Lummon bay (Miskatlah bay), on the north shore of Douglas channel, about twenty-five miles from Hartley Bay, the nearest port of call for Coast-plying steamers, from which it is reached by launch. There is a good floating dock at the property used by Coast freight-boats. The company's holdings consist of fifteen Crown-granted claims.

The year's work consists of the continuation of the main drift for about 50 feet, making a total of nearly 400 feet, and drifting on a cross-vein for 25 feet. Also some stoping was done in two places, supplying feed for the mill, which produced 18 tons of high-grade copper ore. The concentrates were shipped to Tacoma and yielded 10 oz. gold, 353 oz. silver, and 17,455 lb. copper. A rough estimate of the amount of feed, compared with the concentrates produced, gives an approximate ratio of concentration of 20 into 1. It is probably possible to stope-sort the ore to a better feed grade than this.

The ore occurs as bornite, chalcocite, and chalcopyrite in biotite, quartz, or feldspar replacement products following a light-grey acidic dyke. The vein-filling appears to be a segregation of the granite constituents into separate masses, as there are big bodies of pure quartz, orthoclase feldspar, and, bordering either of the above, biotite, the whole suggesting a very coarse pegmatite. The metallic minerals may occur as disseminated grains around the borders of and in the quartz and feldspar, or bunches enclosed in either, but the main mineralization appears to be associated with the biotite, lying in small bunches or interlaminated in it. This mineralized border varies in width from an inch to 2 feet, and under present milling conditions is mined as clean as possible for mill-feed.

The ore is so erratic in occurrence that it is impossible to make any estimate of probable tonnage, and a great amount of development-work will therefore be necessary to put any definite amount of ore in sight. However, with a small, well-located, and suitably designed mill on the property, it would go far toward paying for the extensive development required to prove the worth of the property.

The present mill has been remodelled from the one built last year, the Gibson-type table having been replaced by three small jigs—a bull-jig and two finer ones—and a K. & K. flotation-

machine added. The two fine jigs make a clean, high-grade concentrate and an appreciable amount of gold is found on the screens, for the recovery of which provision will have to be made. Grinding is done with two Gibson mills, taking their feed direct from the crusher, but their capacity is inadequate and product unsuited for the present milling process.

A new camp has been built at the mine, consisting of a 16- x 24-foot bunk-house and a 16- x 18-foot cook-house under one roof with a shed between. This will eliminate the mile walk from the beach for the men. Mr. Copp is in charge of the work at the property.

**Ecstall River.** The pyrite-showings twenty-five miles up the Ecstall from its mouth are yet under option to the Granby Consolidated Company, of Anyox. Diamond-drilling was continued all summer, but no information is at hand as to the results obtained.

*Porcher Island.*

**McTavish Claims.** These are the *Mayday*, *Billie*, *Ida*, and *Jessie*, belonging to Neil McTavish and partners, Prince Rupert. The claims are situated on the North arm of Kitkatla inlet. The mineralization on the claims is pyrite contained in what appears to be a contact-belt of gneissoid granite, hornblende, and mica-schists. No work has been done yet, but the claims deserve a little exploration for copper values. They were staked last year.

**Patterson Group.** This group consists of the *Trivie*, *Jeanie*, and *Western Hope*, situated about three-quarters of a mile from the beach at Surf point, where there is a good harbour. The claims are owned by Frank Patterson, who this year mined, sorted, and shipped 10 tons of ore to Trail that gave returns of 3.76 oz. gold and 1.8 oz. silver to the ton, or a total of \$770.

The ore is a pyritized quartz, occurring in the solid granite country-rock, carrying nothing but pyrites, which contains the gold and silver values and is therefore an ideal concentrating-ore. The shipped ore assayed 40 per cent. insoluble or a concentrating ratio of nearly 2 into 1, so that the ore as broken would probably concentrate from 10 to 15 into 1.

On the *Trivie* claim a tunnel at an elevation of 400 feet has been driven 60 feet on a quartz vein, striking N. 70° E. and dipping slightly north, that widens in places to 3 feet. It was from this tunnel that the shipped ore was sorted. The pyrite apparently carries all the values, and as it occurs more or less in bunches it is difficult to estimate tonnage or average values. Higher up on the same claim, at an elevation of 450 feet, an open-cut about 20 feet high at the face has been driven across to another parallel vein that shows a width of 3 feet in places and pinches to a few inches. This is the highest showing exposed. A little lower than this cut considerable stripping has been done on a parallel vein, exposing it for a length of 300 feet and showing it to vary from a foot to 2 feet in width. The quartz in this vein is well and evenly pyritized and is the best showing on the property. Farther east, on the *Western Hope* claim, a crosscut tunnel was driven to undercut this surface showing. The tunnel is in 60 feet and at 42 feet from the portal encountered a barren quartz vein which was drifted on for 45 feet. This vein appears on the surface about 15 feet from the vein mentioned as being exposed for 300 feet. The face of the tunnel now shows bunches of pyritized quartz and should be extended a short distance farther to make sure that the vein has been crossed. Further development might expose sufficient ore to warrant a small mill. A crusher, ball-mill, and a flotation unit would be about all the plant required to make a perfect recovery of the iron sulphide.

**Eagle.** This claim, belonging to Joe Dawson, lies west of and adjoining the *Trivie* claim of the *Patterson* group. At an elevation of 125 feet a tunnel has been driven for 12 feet from the end of an open-cut about 12 feet long on a scattered mineralization of pyritized quartz lying in a diorite-belt. The vein or mineralization strikes N. 70° E., the same as the showings on the *Trivie* claim. There are about 50 tons on the dump from this work, a grab sample of which gave returns of 1.88 oz. gold and 3 oz. silver to the ton, with a trace of copper. At the face of the tunnel the ore is cut off by a cross-fracture which was followed for 24 feet without picking up the continuation of the ore. Bunches of good-looking ore up to 2 feet in width make this a fair showing, and it is well worth further work to try to locate the continuation of the ore beyond the fault-fracture.

With sufficient ore to justify a small mill, the location of this property, practically on tide-water, would make it an ideal little proposition.

A full report of this property was given by the Gold Commissioner in the **International** Minister of Mines' Report, 1916, page 50, under the name of *Bald Mountain* **Copper Co.** group. At the time of my trip this summer some surface work was being done and a short tunnel was being continued for the yearly assessment-work.

Nothing new has been reported.

*Mammoth Group.*—This group is owned by Martin O'Reilly, of Prince Rupert, and associates, and described in the Minister of Mines' Report, 1917. Assessment-work has been recorded to 1921. No work was done this year.

#### *Gibson Island.*

*Standard Group.*—This group is owned by Frank St. Amour, of Prince Rupert, and partners. Only the yearly assessment-work has been done.

Some small showings of high-grade chalcopryrite have been reported on Banks, Kennedy, Henry, and other islands, but nothing of importance has as yet been uncovered.

#### GRAND TRUNK PACIFIC RAILWAY SECTION.

There has been practically no activity in mining, other than yearly assessments, along the railroad this year.

#### KITSUMGALLUM VALLEY SECTION.

This valley probably marks the immediate eastern contact of the Coast range with the interior sedimentaries, and as such presents a good field for prospecting. Its accessibility is a favourable feature for the mine operator. There is a wagon-road extending the length of the valley for 16½ miles from Terrace, on the Grand Trunk Pacific, to the foot of Kitsumgallum lake. Portions of the road, especially the two or three miles next to the lake, are not in very good repair, but in the event of mining activity it could be readily made into a first-class road suitable for motor-haulage.

The hills on either side of the valley have not been prospected to any extent. The telegraph-trail extends from the end of the wagon-road, following the east side of the lake to its head, a distance of six miles, and from there up the valley for another ten miles to the Cedar River Crossing. From the crossing it continues through to Ayansh, on the Nass river, a further distance of twenty miles; thence by way of Alice Arm to Anyox. This trail follows the Eastern Contact Belt all the way through and affords an excellent means of getting into the country to prospect. Pack-horses can be taken all the way from Terrace to Ayansh, which point may also be reached by boat from the Coast up the Nass river. There is an excellent prospecting country from Terrace to the lake and surrounding the lake, the latter accessible by way of numerous creeks and rivers flowing into it.

A number of claims have been staked on the surrounding hills and considerable work done in assessments. I was unable to get into this section this year, but examined several properties the year before, described in Minister of Mines' Report, 1918. The rock formation is sedimentary, altered and intruded by many dykes and granite-masses, and should be exceptionally favourable for the occurrence of minerals. Yearly assessment-work has been done on all the old prospects and several new locations have been made on Beaver river and the east side of the lake.

The owners of the *Blue Grouse* and *Hunter* groups, about six miles up the Cedar river from the crossing, have built a good trail about half-way to their property, up the east side of the river. They will be assisted by the Mines Department, for this trail will be of great benefit to that upper section of the valley. I have not seen the coal croppings on the west side of Cedar river, but judging from authentic reports, I believe them worth investigating. The owners of the *Bear* group and surrounding claims, at the head of Falls creek, at the north-east corner of the lake, are said to have exposed some good showings of high-grade silver ore. This is probably the extension of the Fiddler Creek veins.

On Maroon creek, flowing in about the centre of the lake on the east side, the owners of the *Copper* group did the assessment-work on their claims and built about a mile of trail from the lake up the creek.

Several claims near Terrace, along the railroad, are said to have favourable-looking showings.

## LAKELSE VALLEY (THORNHILL MOUNTAIN) SECTION.

Only the yearly assessments have been done on claims in this section. There are no further developments with regard to the extensive limonite-deposits up the Zymoetz river. This section was reported on in Minister of Mines' Report, 1918.

## NASS RIVER MINING DIVISION.

This Division was created in 1918, and includes the whole valley and drainage-basin of the Nass river to the headwaters of the Unuk, and Observatory inlet with its branches, Hastings arm and Alice arm. It therefore contains all that portion of the Eastern Contact Belt from the summit of the range between the Skeena and Nass rivers north, crossing at the head of Alice arm to the Unuk river, with the exception of a small area at the head of Portland canal.

*Note by Provincial Mineralogist.*—Since this report was written there has been a change in the boundaries of the Nass River Mining Division, to take effect on and after the 2nd day of July, 1920. The boundaries as now defined are as follows:—

"Commencing at Ramsden point separating the entrance to Portland canal from the entrance to Observatory inlet; thence northerly along the divide separating the drainage area of the said canal from the drainage area of the said inlet to Mount Brown; thence easterly along the divide separating the drainage area of the Kshwan, Kitzaut, and Kinskuch rivers on the south from the drainage area of White river and Paw creek on the north to a crossing of the Nass river north of Cottonwood creek at the north-west corner of Lot 3402, Cassiar District; thence north-easterly along the divide separating the drainage area of Cottonwood creek on the south from the drainage area of Wolverine creek on the north to a point on the western boundary of Omineca Mining Division, east of the south end of Meziadin lake, approximately where the said western boundary of Omineca Mining Division is intersected by the 56th parallel; thence southerly and westerly along the divide separating the drainage area of the Skeena river on the east and south from the drainage area of the Nass river on the west and north; thence along the divide separating the drainage area of Kwinamass river on the north from the drainage area of the Khutzeymateen river on the south to a point on the Khutzeymateen inlet immediately south of Somerville island; thence across said inlet and westerly along the channel south of Somerville and Wales islands to the International Boundary; thence northerly following the said boundary to a point north of Pearse island, and thence south-easterly to the point of commencement at Ramsden point."

The Division is accessible by way of Portland inlet for Coast-plying boats, providing a bi-weekly service from Prince Rupert to Anyox and Alice Arm, and from Mill bay up the Nass river by gas-boat to Ayansh; also by way of Stewart, at the head of Portland canal, over the Bear River divide, Salmon River glacier, and Long Lake glacier. (See Portland Canal Mining Division.) From Alice Arm the Dolly Varden Railroad extends up the Kitsault River valley for eighteen miles, from which point there is a first-class pack-trail to the head of the river, a further distance of about eight miles. There are branch trails up the principal tributaries flowing into the Kitsault. There is also a good trail up the Illiance river for sixteen miles from Alice Arm.

From Ayansh (Indian village), on the Nass river, there is an old trail following the river through to Meziadin lake. There is also a trail from Kitwanga, on the Grand Trunk Pacific, up the Kitwanga river and down Cranberry creek, that hits the Nass river about sixty miles up from Ayansh.

The Division is subdivided as follows: Observatory Inlet section; Alice Arm section; Kitsault River section; Illiance River section; Unuk River section.

## OBSERVATORY INLET SECTION.

This takes in the area from the mouth of Portland inlet to the head of Observatory inlet at Anyox, and is practically all in the Coast Range granite. The only property in this section is that of the Granby Consolidated Mining, Smelting, and Power Company. The company's smelting plant and mine at Anyox were unfortunately closed down for a couple of months early in the year for a readjustment of conditions subsequent to the signing of the Armistice. This close-down and the curtailed operations following it were a serious detriment to the year's output. There was smelted from the company's *Hidden Creek* mines 647,466 tons of ore, using 41,000 tons of limestone from Swamp point and 36,000 tons of quartz for fluxing, and 56,500 tons

of coke. The metallic output from the above tonnage mined was 4,864 oz. gold, 348,408 oz. silver, and 19,544,588 lb. copper, showing an increase in gold and silver due probably to values in the fluxing-quartz, but a deficit of about 9,700,000 lb. copper.

The company has employed an average of 1,350 men throughout the year and has expended about \$2,350,000 in wages.

The most important feature of the year's operations was the completion of the by-product coke-ovens at the smelter. The following short sketch of that branch of the Anyox plant has been kindly furnished me by W. A. Williams, resident manager:—

"The Granby Consolidated Mining, Smelting, and Power Company, the largest producer of copper in British Columbia, consumes an average of 250 tons of coke a day. Bee-hive coke was formerly shipped in and these shipments were often considerably delayed, causing great inconvenience in operation of the smelter. To secure a more reliable supply the company decided to produce its own coke. A modern coal-mine was put in operation at Cassidy, a few miles from Nanaimo, on Vancouver island, and a coke plant was built at the smelter. The coal is screened at the mine, the marketable sizes sold, and the slack washed and shipped to coke plant.

"*Coal-handling.*—Barges holding about 2,000 tons, carry the washed slack to the coke plant, where it is unloaded by a steam-hoist operating a 1-ton hoisting-bucket and having an unloading capacity of 120 tons an hour. The hoisting-bucket empties the coal into a hopper, from which it is carried by a 30-inch belt to the top of the 12,000-ton storage-bin, where it is distributed by another belt running along the top of the bin. The storage-bin, built entirely of wood, is 300 feet long and 51 feet wide, with a V-shaped bottom. From the storage-bin the coal is taken by conveyor-belt and elevator to the crusher, which is of the swing-hammer type and has a rated capacity of 50 tons an hour. The coal is crushed so that at least 90 per cent. will go through a  $\frac{1}{4}$ -inch screen and 80 per cent. through a  $\frac{1}{8}$ -inch. A bucket-conveyor takes the coal from the crusher to the 500-ton bunkers over the ovens. The coal is drawn from the bunkers into a lorry equipped with four cone-shaped hoppers, the combined capacity of which is 130 tons, just sufficient to charge one oven.

"*Ovens.*—The battery consists of thirty ovens (capacity of 24-hour coke is 270 tons) and was designed by the Gas and Coke Oven Corporation of America; the special feature being vertical flues instead of horizontal flues. The dimensions of the coking-chambers are 37 feet 4 inches long, 9 feet 10 inches high, 18 inches wide at the pusher side, and 21 inches wide at the coke side, with a capacity of approximately 13 tons. A regenerator is situated directly under each oven and is separated from the adjacent regenerators by a heavy wall, upon which the heating-wall rests. The heating-wall is made up of thirty vertical flues, each two adjacent flues forming a complete heating unit. Situated beneath these vertical flues are two gas-ducts which feed the gas to them through removable nozzles. These horizontal gas-ducts are so divided that fourteen of the vertical flues receive their gas from the coke side and sixteen from the pusher side. The regenerators are connected to waste-heat flues paralleling each side of the battery, and are so divided as to furnish air to and to receive the products of combustion from those flues, receiving gas from the same side.

"The regenerators are divided into an upper and lower section by means of a horizontal partition extending from the front of the regenerator-chamber to within 18 inches of the back wall. Thus any tendency of the combustion-air and products of combustion to short-circuit is avoided and their travel increased. The efficiency of the regenerator system is greatly augmented by having that regenerator-chamber, through which combustion-air is being drawn, sandwiched between two regenerators through which products of combustion are escaping, thus effecting what might be called a combined regenerative and recuperative system.

"*Battery Equipment.*—The pusher was built by the Atlas Industrial Car Company, of Cleveland, Ohio, and comprises door-extractor, pushing-ram, and levelling-bar. The coke-guide and door-extractor on the coke side are hung from an overhead track. The quencher-car, also built by the Atlas Company, is provided with air-operated side-dumping doors. When the quencher-car with its load of red-hot coke reaches the quenching-station the water is automatically turned on, and is likewise automatically turned off when the car leaves the station. After quenching, the coke is taken directly to the screening-station, where it is separated into furnace and breeze coke and loaded directly into cars. The coke-handling is greatly facilitated by the fact that owing to difference in elevation of quencher and loading tracks the cars are loaded by gravity.

"The gas is reversed each half-hour, burning in one flue of each unit for one half-hour and in the other flue the next half-hour. Thus we have combustion taking place in every alternate flue the whole length of the oven-wall. The size of the opening connecting the two flues comprising a unit is regulated by a slide-brick, thus controlling the air-supply to that particular unit. Above each flue is an inspection-hole, through which the condition and temperature of the wall may be determined. The openings leading from the regenerator to the stack-flues are provided with dampers, so that the draught to each regenerator may be regulated. The incoming combustion-air is regulated by the use of finger-bars. There is a damper in each stack-flue just before they unite into a single flue at the stack end of the battery. This single flue, which leads to the stack, also contains a damper. The stack is built of radial brick, is 177 feet high, and 9 feet 8 inches in diameter at bottom and 7 feet at the top.

"The gas is conducted from the oven-chamber through 14-inch cast-iron ascension pipes to the collecting-main, which is 4 feet 4 inches wide and 4 feet 9 inches deep at one end and 5 feet 8 inches deep at the other, with a semicircular bottom. The offtake-main is 28 inches in diameter and continues to just beyond the bunkers, where it enters the downtake, which is 24 inches in diameter, and thence along the ground to the by-product building. A hand-valve to control pressure in the collecting-main is located just before the downtake. The temperature of the gas is considerably reduced in the collecting-main and the heavier particles of tar and liquor condense and escape as a liquid. To keep the main free from thick tar and pitch, fresh tar is continuously circulated through it. This flushing-tar drains off through a sealed overflow so arranged that any solid deposited may be raked out and removed.

"On reaching the by-products building the gas enters the primary coolers, of which there are three, each containing 504 3-inch outside diameter, lap-welded steel tubes 17 feet long. The water flows through the tubes and the gas around them. The temperature of the gas is here reduced to 32° C. and most of the tar and liquor is deposited. The gas now enters the exhauster, whose function it is to maintain an even pressure in the collecting-main and to force the gas through the remaining apparatus.

"The exhausters, three in number, were built by the Connersville Blower Company, and are driven by 10- x 10-inch vertical self-oiling Troy steam-engines, and are equipped with Huntoon float-governors, arranged so as to maintain a pressure of 1.2 mm. in the collecting-main. The exhausters have a displacement of 17 cubic feet a revolution and are designed to operate at 250 r.p.m. against a total plus and minus pressure of 2½ lb. a square inch.

"After leaving the primary coolers the gas still holds tar in suspension in the form of minute globules called 'tar-fog.' The removal of these last traces is accomplished by means of a P. & A. tar-extractor, which consists of a series of perforated steel plates so arranged that the gas passing through the first plate will impinge upon the unperforated part of the second plate. The impact causes the very fine particles to coalesce and run down the plate.

"*Sulphate-recovery.*—From the extractors the tar-free gas goes to the saturators, which are large lead-lined cast-iron containers, where it is caused to pass through a bath containing 5 to 7 per cent. of sulphuric acid. The ammonia in the gas reacts with the acid to form a white crystalline salt, ammonium sulphate, which settles to the bottom of the saturator and is removed to the drain-table by means of an air-ejector. From the drain-table the salt is conducted to a centrifugal dryer, where it is washed with water, to remove the free acid, and dried.

"The liquor and tar which have condensed out in the various parts of the process are pumped to a separating-tank of 45,000 gallons capacity, where the tar and liquor separate, due to their difference in specific gravity. The liquor overflows into a 50,000-gallon liquor-storage tank and the tar is drawn off from the bottom to the 200,000-gallon tar-storage tank. The tar produced averages eight imperial gallons to the ton of coal. The liquor, which contains one-fifth of the total ammonia produced, is treated in a continuous still, where the ammonia vapours are liberated. These vapours are also passed through the saturator, which is so constructed that the waste gases which accompany the ammonia vapours from the still may pass into the main gas-stream leaving the saturator, or be conducted to the atmosphere.

"The free leg of the ammonia-still is made up of three 21-inch cast-iron sections and one 15-inch section, all resting upon the liming-chamber, which is 6 feet high. The internal diameter of all sections is 4 feet 3 inches and the total height of the free leg is 15 feet. The fixed leg is made up of two 21-inch sections and one 15-inch section of the same diameter as those comprising the free leg. Each section is provided with a vapour-passage through the bottom covered with

a hood with serrated edges and an internal overflow for liquor passing to the next lower section. Each section is provided with hand-holes by means of which access can be had to every part of the interior, so that the apparatus may be readily inspected and cleaned. The liquor enters the top of the still and drops from section to section; the steam which enters at the bottom, as well as any liberated vapours, pass up through the vapour-passages and bubble through the liquor at the edge of the hood. The boiling liquor from which the free ammonia has been expelled is mixed with milk of lime in the liming-chamber and caused to flow into the fixed leg, where the remaining ammonia is liberated. The escaping liquor contains 0.003 to 0.007 per cent. ammonia.

"The saturator is provided with a mother liquor-heater which may be used to maintain the temperature of the bath in case the still is not running, or to heat up the bath when starting a saturator. Under normal working conditions the heat from the ammonia vapours from the still and the heat of dilution of the sulphuric acid are sufficient to maintain a temperature of 45 to 50° C. The salt produced averages more than 20 lb. a ton and contains at least 25 per cent. ammonia and less than 0.2 free acid.

"*Final Coolers.*—From the saturators the gas passes into the final coolers, which are 40 feet high and 10 feet in diameter and are of the direct-contact type. The water not only cools the gas, but mechanically washes out a large portion of the naphthalene.

"*Light-oil Scrubber.*—To recover the light oils the gas is scrubbed with straw-oil, a petroleum product, in a hurdle washer 75 feet high and 14 feet in diameter. The slats composing the hurdles are 5 inches wide,  $\frac{3}{4}$  inch thick, and spaced  $\frac{3}{4}$  inch apart; thus the gas in passing through the scrubber flows in thin streams over surfaces which are continually wet with the absorbent. The travel of the gas and oil is counter-current. The oil is pumped to the top of the scrubber and flows zigzag down over the hurdles, while the gas enters at the bottom and leaves at the top; thus the partially debenzolized oil is brought in contact with the fresh wash-oil, which is able to more efficiently remove the small amount of light oil yet remaining, and likewise the partially benzolized oil is brought in contact with the rich gas and its light contact oil increased. The amount of wash-oil circulated depends upon the number of cubic feet of gas produced and its light-oil content, and is of such an amount as to keep the light-oil content of the benzolized wash-oil between 2 and 3 per cent. The benzolized oil is stored in a 3,000-gallon tank, from which it is pumped to the stripping-still.

"*Heat Exchangers.*—The debenzolized oil leaves the still at about 130° C., and before it is recirculated its temperature is reduced by a system of heat exchangers and coolers to about 20° C. The debenzolized wash-oil leaving the bottom of the still and the light-oil vapours leaving the top of the still contain considerable amounts of heat which is transferred to the incoming benzolized oil. The benzolized wash-oil is pumped from the storage-tank to the vapour-oil heat exchanger, which consists of a cylindrical steel shell containing a number of tubes. The cold debenzolized wash-oil flows through the tubes, while the hot light-oil vapours from the top of the still pass around the tube. There are two vapour-oil heat exchangers so connected that one can be by-passed without interfering with the operation of the other.

"From the vapour-oil exchanger the partially heated benzolized oil enters the oil to oil heat exchanger, where its temperature is increased by the debenzolized oil leaving the still. After leaving the oil to oil heat exchanger the benzolized wash-oil enters a superheater, where its temperature is raised to 140-150° C. This superheater was furnished by the Alberger Heater Company, of Buffalo, New York, and is 8 feet long and about 20 inches diameter.

"*Stripping-still.*—The hot benzolized oil now enters a stripping-still which is continuous in its operation. The still is made up of seventeen sections, each section being 12 feet  $\frac{3}{8}$  inch in height and 4 feet 4 inches inside diameter. The hot oil enters the eighth section from the bottom and passes down the still rapidly, giving up the light oil it contains. Steam is admitted in the bottom section and passes up through the still, bubbling under the sealing-bells of each tray and carrying upward the light oil in the form of vapour.

"As noted before, the debenzolized oil, on leaving the still, passes through the oil to oil exchanger, where it gives up some of its heat to the incoming benzolized oil, then to the wash-oil coolers. There are two wash-oil coolers, a tank cooler containing eighteen 2½-inch steel pipes 22 feet long and a spray cooler consisting of sixty 2-inch steel pipes 19 feet long. From the cooler the oil goes to the debenzolized-oil tank and is ready for recirculation.

"*Fractionating and Purifying Stills.*—From the 23,000-gallon light-oil storage-tank the light oil is pumped into the crude-still, which consists of a horizontal cylindrical kettle holding 3,800

gallons and a fractionating column of fourteen sections resting on a separate foundation. Heat is supplied by means of indirect steam through sixteen 1½-inch extra-heavy pipes 13 feet 10 inches long placed in the bottom of the kettle so that direct steam may be used when desired. The presence of live steam lowers the boiling-point and is necessary when the toluol and solvent fractions are reached.

The operation of the raw-still depends upon whether motor-fuel or pure products are to be produced. The first portion to distill over is often discarded because of the carbon bisulphide it contains. When making pure products the crude distillate is divided into 90 benzol, 90 toluol, and solvent naphtha. There will always be a residue left in the kettle consisting of wash-oil, naphthalene, etc.

"These crude products are then transferred to a lead-lined agitator, where they are washed with sulphuric acid for about thirty minutes, after which another thirty minutes is allowed for the used acid to settle. The acid is used to separate the unsaturated hydrocarbons, principally olefines. After the sludge is run off the benzol or toluol is washed with water and any acid remaining neutralized with caustic soda.

"The washed products are now ready for rectification in the pure-still. The pure-still is similar to the crude-still in construction, but greater care and skill is required in its operation. Each 1,000 gallons of light oil will produce about 500 gallons C.P. benzol, 100 gallons C.P. toluol, and 100 gallons refined solvent naphtha.

"When making motor-fuel, the benzol, toluol, and such higher portions as will give a finished product which will distill to complete dryness at not over 135° C. are caught in the same receiver. After the crude motor-fuel has been run off, there still remains a solvent naphtha fraction boiling from 130° to 160° or 170° C.

"The crude motor-fuel is also washed with sulphuric acid, but not so thoroughly as in the case of pure product. This washed motor-fuel is then run through the pure-still in order to remove the last traces of water and any foreign substances which do not settle after washing.

"Products made are coke, gas, tar, ammonium sulphate, benzol, toluol, solvent naphtha, and naphthalene.

"The plant has a boiler-house containing two 350-horse-power boilers which operate the by-product and benzol plants as well as unloading apparatus on coal-docks. There is also a well-equipped office and laboratory. All buildings are of steel and concrete and the plant well constructed."

#### ALICE ARM SECTION.

This section will include for the purposes of this report that portion of the Mining Division bordering Alice arm from Observatory inlet to the head, at the town of Alice Arm. The general term of Alice arm, as applied by the public, I have subdivided into the Kitsault River section and Illiance River section. The accompanying sketch-map gives a general outline of these three sections.

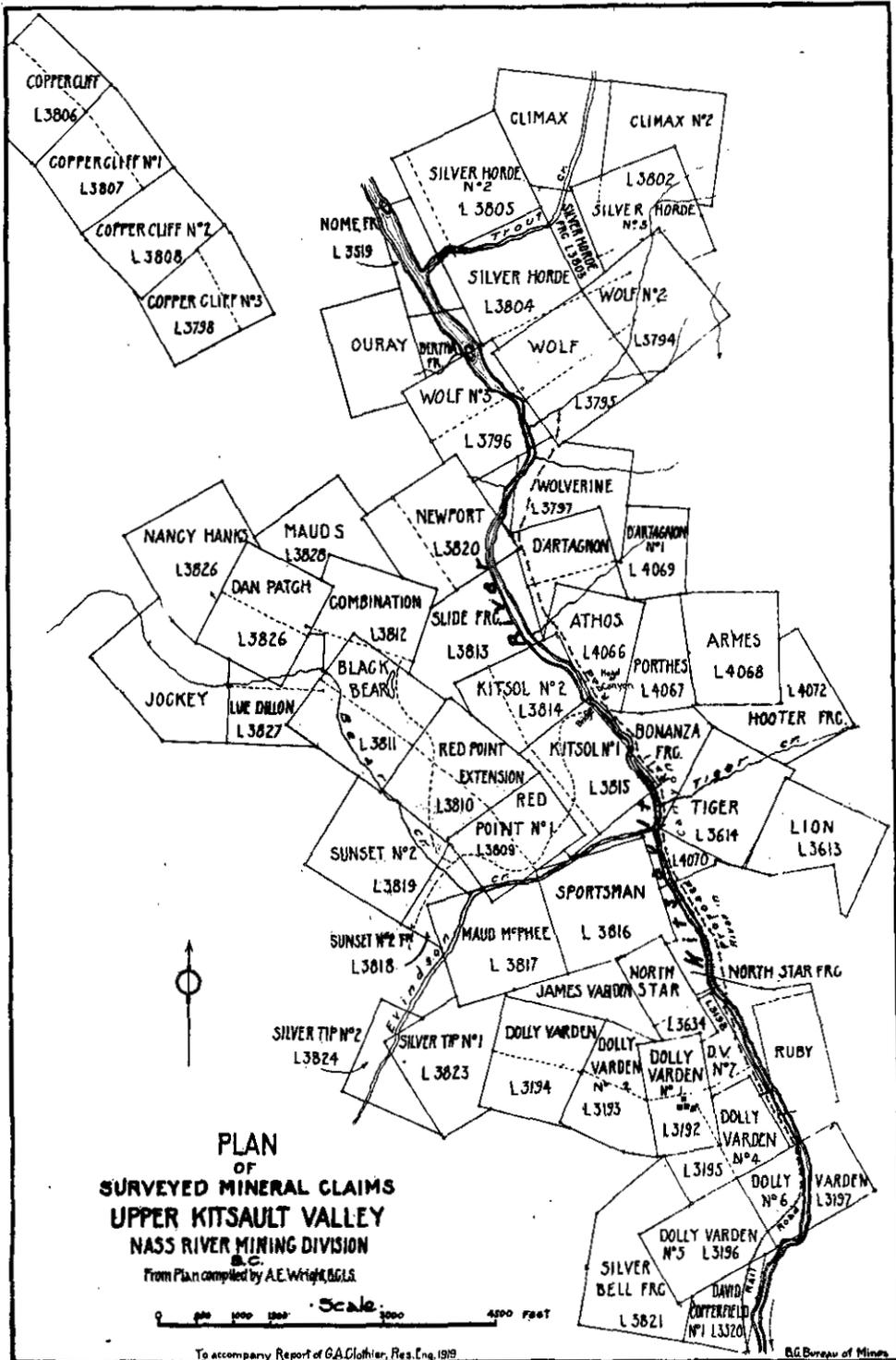
There has been very little mining done in this section other than the necessary yearly assessment. The property of the Molybdenum Mining and Reduction Company on the north side of the arm has been idle all year. On the south side of the arm there are a number of locations on Roundy and Lime creeks, but owing to lack of time I had not the opportunity of visiting them this year.

Acknowledgment is due A. E. Wright, B.C.L.S., of Prince Rupert, for his recent map of surveyed claims of the upper portion of the Kitsault river. This gives definite information, enabling one to accurately locate claims that have not been surveyed.

#### KITSAULT RIVER SECTION.

This embraces the Kitsault River valley and smaller tributary valleys from the town of Alice Arm north to the head of the river, about twenty-six miles. It is reached by Grand Trunk Pacific Coast steamers from Vancouver or Prince Rupert to Anyox, from which point there is a launch running to Alice Arm, also by Union Steamship Coast steamers, giving weekly service from Vancouver and Prince Rupert direct to Alice Arm; from Prince Rupert to Anyox about ninety-five miles and to Alice Arm about 107 miles.

Since the completion of the Dolly Varden Railroad this year, a distance of eighteen miles up, the Kitsault valley has been practically placed on tide-water. From the end of steel a first-class pack-trail is being built by the Government to the head of the river, a further distance of about eight miles; consequently transportation in this section is excellent.



There has been extraordinary activity throughout the summer, especially in the last three or four months. In the early spring this part of the district suffered a rather serious attack of "promoter's blight," several properties being bonded without any provision being made in the agreements for work to be performed. Later on, however, this was remedied and considerable development is now under way; five or six properties are being developed through the winter.

In addition to the main trail up the river, the Government has also started a trail up Trout creek, about a mile of which was built this summer and it will be completed next season. The Mines Department has given assistance, on a fifty-fifty basis, to several prospectors for trail-building.

The Taylor Engineering Company's property, formerly the Dolly Varden Mines Company, has at last been added to the shipping-list and has made a most enviable record for the short time it has been producing. This has established the needed confidence in the section and has resulted in a wonderful impetus to mining activity. At present there are few of the more promising properties that are not being developed or under option for next year. With railroad transportation assured, encouraging results from development-work to date, many properties under bond for next year, and the vigorous operation of the *Dolly Varden*, Alice Arm gives promise of being one of the most energetic camps in the north next year and of developing into a permanent mining town.

This section represents another small area on the Eastern Contact Belt containing, so far as yet known, bonanza deposits of high-grade silver ores in the *Dolly Varden* and many other extraordinary surface showings of silver ores lying in greenstone or andesite or its altered form, locally termed the "silver-belt." There are hundreds of miles of the Eastern Contact Belt in this district entirely unexplored, some of it more difficult of access, but probably equally as rich.

**Independent Group.** This group consists of three claims, and is owned by Archie McPhail, of Alice Arm. It is situated just above the town of Alice Arm and about half a mile from tide-water. The property was under bond this year to D. J. Hancock, who did a lot of work on it, but without satisfactory results. The tunnel was

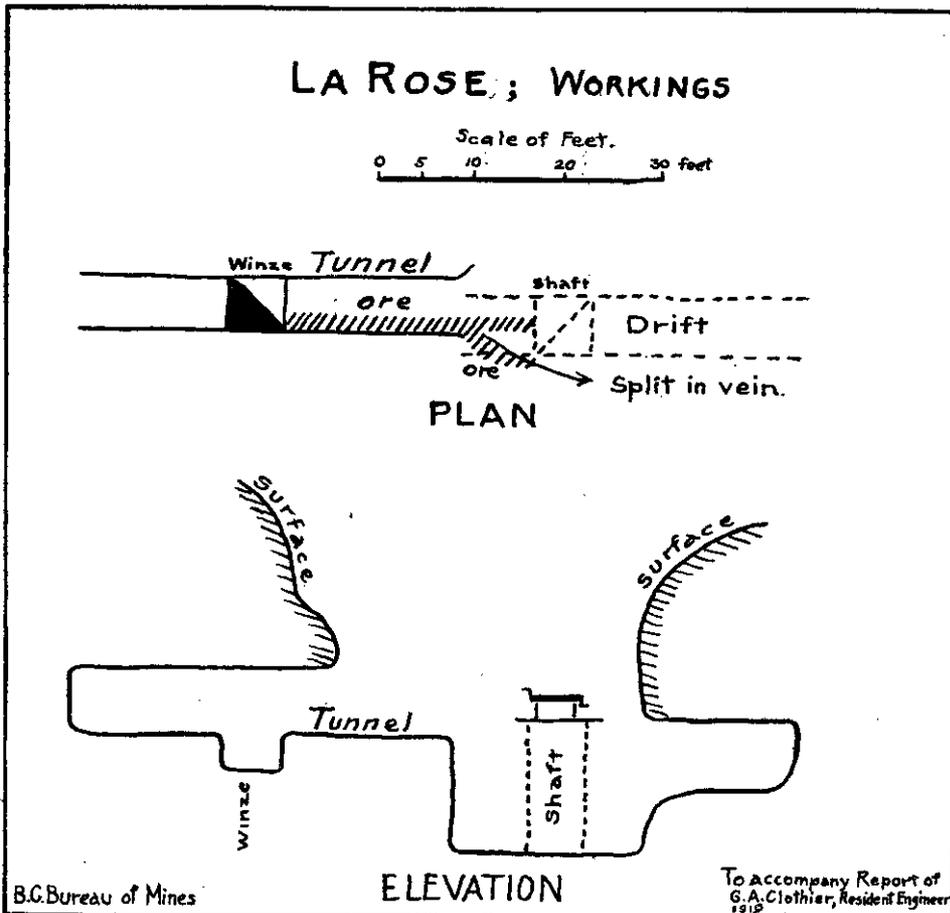
extended to 240 feet, following the vein all the way, except for the last 10 feet, where it seems to split up and disappear. The dyke which has persistently accompanied the vein has changed to a soft seam, possibly accounting for the expiration of the vein. A shaft has been sunk from the surface to a depth of 14 feet, showing well-defined slate walls about 6 feet apart. The vein-filling is about 5 feet wide in the bottom of the shaft, of nearly pure quartz. The quartz is evidently of low value, and since the tunnel driven under it at a vertical depth of 65 feet did not show any improvement in the vein or values, the showing may be considered as unimportant.

**Black Bear Group.** This group consists of three claims—*I Chance It*, *Aldebaran*, and *Black Bear* (formerly the Roundy property)—and is now owned by Salinas Bros., W. J. Vaughan, and A. J. Luffgren. This is one of the oldest properties in the section, and has had extensive work done on it and produced a considerable

tonnage of high-grade silver-sulphide ore. The vein is quartz, carrying in places high values in ruby and native silver, argentite, and grey-copper, with a little zinc and galena. It lies in the slate formation conforming with the bedding-planes of the country-rock. The ore appears to follow a monoclinical fold in the slates, the values in the lower levels occurring in the trough of the fold, while in the upper workings I believe the best values were found on the side of the fold. Numerous dykes can be seen, and it looks as if a fault on one of the upper dykes had thrown the upper portion of the vein to the west. The property has not produced any ore of importance for some time, for the reason that all the available ore had been extracted and differences amongst the partners prevented further exploration. This year, however, one of the Salinas Bros. (Baldy) drove a crosscut tunnel at an elevation of 460 feet, or below the older workings, and at the time of my visit had just struck 18 inches of fine-looking ore at a distance of 60 feet in the tunnel. This will be mined and shipped by the owners this winter.

**La Rose Group.** This group consists of two claims—*La Rose* and *La Rose No. 1*—owned by Miles Donald and partners, of Alice Arm, and situated on Paul Klayduc creek, two miles from the Dolly Varden Railroad, from which there is a good pack-trail to the mine. The general formation is a fine-grained greyish rock. The vein is quartz carrying blende, galena, pyrite, grey-copper, argentite, and native silver.

Considerable work has been done by the owners each year, from which about 50 tons of ore has been extracted and shipped, giving average returns of over 250 oz. silver to the ton. Early



this year the owners shipped 22 tons to the Trail smelter, which yielded 3 oz. gold and 6,157 oz. silver. A tunnel has been driven, following the vein from the surface for about 125 feet. This was started on ore which continued for about 40 feet from the portal, where a short winze was sunk on it. It was decided, however, to sink a shaft at the mouth of the tunnel in order to be in the best part of the ore-shoot and at the same time provide for ore-sorting facilities in daylight. The shaft was sunk 14 feet, drifted on both ways from the bottom, and some very fine ore stopped out. There is about a foot of good ore in the bottom. Further sinking would be required to take out more ore.

To the north of this showing the hill falls rapidly along the strike of the vein, and it would be good development-work to try to pick up the vein at some depth to drift on it. On account of a slide that would be dangerous in winter, it would require a crosscut tunnel possibly 450 feet long to get to the vein, which would give a depth on it of about 200 feet below the present workings. There is every reason to suppose that there are other ore-shoots in the vein similar to the one now being worked, and if these could be opened up at a depth of 200 feet it would put the property on a profitable basis.

Judging from the persistence of the vein so far, the extent and value of the ore-shoot already opened up, and taking into consideration the location of the property for shipping, I would have no hesitation in recommending the undertaking of the development-work mentioned.

There is also a big quartz vein on the property that has had no exploration and which would be well worth considerable development.

These three claims—*Nome*, *Rambler*, and *Eldorado*—are being opened up by the owner, Sid Miller, of Alice Arm. He is driving on a well-defined vein of banded slate and pyritized quartz lying in a slate country-rock. The mineralization and appearance of the vein improves as drifted on and the owner reports good gold values in picked samples. The property has the advantage of an ideal location, the tunnel being a few hundred feet from and on the same level as the railroad.

**Cape Nome Group.** This group is composed of three claims—*Homeguard*, *Traveller*, and *Central*—owned by William McFarlane and Dan Kennedy, of Alice Arm. The claims are located on the east side of the Kitsault river, extending from the river up the hill, about fourteen miles from tide-water and just across the river from the Dolly Varden Railroad. The river is crossed at the camp by a cage suspended on a cable. The property is therefore ideally located for operating and shipping facilities. The river at this point is at 600 feet elevation above the sea.

The first showing is at an elevation of 1,000 feet, or about 350 feet above the railroad, and consists of an open-cut along the side of the hill, exposing a width of about 20 feet of brecciated country-rock of greenstone cemented together with calcite. The calcite is heavily mineralized with pyrite and chalcopyrite. A 12-foot 6-inch portion across the face of this exposure assayed as follows: 4 feet 6 inches in width, \$2.40 in gold and 6 oz. in silver to the ton and 3.9 per cent. copper; 8 feet in width, 60 cents in gold and 2.4 oz. in silver to the ton and 3.5 per cent. copper.

The property was at one time under option to the Granby Consolidated Mining, Smelting, and Power Company, which did some prospecting by diamond-drilling. Four or five holes were put in from the face of the showing, proving it to be an immense boulder of ore, the drills going through it and into loose slide-rock on the other side. About 50 feet above this and diagonally up the hill is another huge boulder of the same kind of ore. At a further distance of 75 feet up the hill a tunnel has been driven along the side of another boulder of ore for 30 feet, getting into big boulders of country-rock at the face. Some distance up the hill, at an elevation of 1,275 feet, a tunnel has been driven by the owners a distance of 130 feet. The first 20 feet from the portal is through a boulder of ore; from there to a point 118 feet from the collar was driven through coarse boulders of country-rock, encountering no more boulders of ore; the balance of the tunnel, 12 feet, is in the solid andesite country-rock. From the fact that no more boulders of ore were found in driving through the slide-rock it would appear that the ore boulders were the last to come down, or nearly so. Just on the edge of the hill above, a wide dyke crosses the country, and it may be possible that in the intrusion of the formation so close to the edge of the hill the outer, weaker portion has been shattered and disintegrated into the huge boulders found in the rock-slide below. The location of the ore-masses, diagonally up the hill, would suggest the same strike for the vein in-place; therefore by turning the tunnel to the right would be driving toward the vein at right angles to it. Judging from the size of the float-boulders, the ore in-place must be 20 feet or more in width.

The average value of 12 feet across the ore is about \$20 a ton, and with its excess of lime should make a very desirable smelting-ore. I should judge that it would concentrate from 5 to 8 into 1 and make a better than 10 per cent. copper product. If the ore could be found in-place and the vein and metallic content correspond with the ore boulders found, it would make a valuable property. I consider it well worthy of exploration.

**Henderson's Claims.** These two claims are located along the Dolly Varden Railroad just below Spring camp, or Mile 9. Some good-grade silver ore was reported found on these claims. I found a small vein of slate and quartz about a foot wide lying beside a dioritic dyke that cuts across the slate formation. No values were obtained in a sample taken from this vein. Farther south is a broad belt, 50 feet wide, of slaty rock, in which are small veinlets of pyritized quartz and calcite which I did not consider of importance.

**David Copperfield Group.** There are two claims in this group—*David Copperfield No. 1* and *Silver Bell Fraction*—situated adjoining the *Dolly Varden* group on the south. The property is owned by W. McLean, R. McGinnis, of Alice Arm, and A. E. Wright, B.C.L.S., of Prince Rupert. Some surface work has been done in open-cutting and stripping, and a 10-foot tunnel, about 25 feet above the river, driven on a vein of quartz and barite carrying a little galena and assaying a few ounces in silver. Above this an open-cut 5 feet wide shows a similar vein, evidently low grade. Above the old *Dolly Varden* trail two

open-cuts also expose the same vein material. At 1,855 feet elevation a cut 16 feet wide shows that width of vein, and another cut at 1,915 feet elevation exposes the same width. These exposures of quartz and barite carry varying amounts of galena and better values in silver are found wherever silicification is strongest.

I have been reliably informed that the property has been recently bonded to Toronto interests by Mr. Wright.

The Taylor Engineering Company has been operating what was formerly the property of the Dolly Varden Mines, Limited. The holdings are situated on the west side of the Kitsault river, about eighteen miles from tide-water at Alice Arm. At the time the property was taken over by the Taylor Engineering Company there had been completed between fifteen and sixteen miles of the railroad from the beach to the mine, the claims had been thoroughly tested, ore-bodies located by thousands of feet of diamond-drilling, and extensive underground development-work done. Also the *Wolf* group, owned by the same company, and situated about two miles and a half farther up the valley on the east side of the river, had been satisfactorily tested by diamond-drilling and about 90 feet of tunnelling and crosscutting done to demonstrate the size and contents of the vein. The present company commenced operations in July of this year under the superintendency of A. W. Davis, to whom much credit is due for the results obtained.

The remaining two miles of the railroad were built to the mine and about half the total road was ballasted. It is a narrow-gauge road, equipped with light rolling-stock consisting of two 20-ton Porter locomotives, one 32-ton Climax-g geared engine purchased this year, twelve ore-cars, side-door dump of 10 tons each capacity, and fifteen 5-ton ballast flats. The grading has partly been done for the two miles and a half to the *Wolf* group. This portion of the road, I believe, will be finished next year to comply with the terms of the charter.

A small compressor was in operation at the mine, but was inadequate for the proposed work; consequently a steam-driven power plant was installed at the end of steel. There is a 40- x 60-foot compressor-building housing a 400-cubic-foot-a-minute machine driven by two 60-horse-power boilers (oil-burning), with an electric-lighting plant. A 4-inch air-line 2,500 feet long was laid to the mine. The equipment for the mine consists of new ore-cars, Waugh drills, pluggers, etc., a Canadian Rock Drill Company steel-sharpener, and an ample supply of rails, pipe, steel, etc.

A 2-bucket tramway, with upper terminal bunkers of 100 tons capacity and lower terminal bunkers of 150 tons capacity, was built. The tram is 1,900 feet long, supported by four towers, and equipped with 1¼-ton buckets giving a capacity of 12 tons an hour.

At the mine a combined bunk-house and cook-house, 20 x 120 feet, was built, with separate small buildings for root-house and storehouse. At the end of steel construction consisted of a storehouse, 20 x 50 feet; a two-story bunk-house and cook-house combined, 20 x 50 feet; several cottages for employees; and a water-tank. A two-story bunk and cook-house, 20 x 50 feet, was built along the railroad at 9-Mile. The old bunk-house at Alice Arm was repaired and a workshop, 20 x 40 feet, built at the dock. To facilitate the unloading of the cars into scows a temporary scheme was installed on the dock, which consisted of elevating the outer rail and tilting the cars to a 33-degrees angle.

Considerable underground work was necessary to get the mine into shape for stoping and shipping, but the first car of ore was brought down over the railroad to the beach on August 28th. Continuous shipments, of approximately 100 tons a day, were maintained until the snow-fall stopped the operating of the railroad. A total of 6,709 tons was shipped for the year to the Granby smelter at Anyox, yielding 423,952 oz. silver, or an average of about 63 oz. to the ton. The above includes a shipment of 42 tons which averaged about 1,280 oz. silver to the ton.

New work this year, other than stoping, consists of some diamond-drilling done with the object of locating the extension of the *North Star* vein, and a new tunnel started about 230 feet below the lowest tunnel for the purpose of opening up the ore-bodies at that depth. Small shoots of bonanza native-silver ore have been encountered in stoping, and I understand that this ore is being sacked and hauled to the beach this winter. Underground development is being continued throughout the winter under the superintendency of Cy. North.

The property has made a phenomenal record for the short time it has been shipping, and, like the remarkably parallel case of the *Premier* mine in the Salmon River section, is compelling the attention of the mining world to the Kitsault River section. The development of the *Dolly Varden* and the showings exposed and proven by diamond-drilling on the *Wolf* give every reason



and therefore toward the main vein. A tunnel is being driven on this showing this winter, with, I hear, very satisfactory results. The continuation of this tunnel to the main vein will give about 150 feet depth on it. The exceptionally favourable location of this property, along the railroad when it is completed through to the *Wolf*, will admit of the shipping or treatment of a low-grade ore.

**Musketeer Group.**

This property is owned by Miles Donald, Al. Miner, *et al.*, of Alice Arm, and is now under option to A. D. Meenach, of Seattle, Wash. There are five claims in the group—*Athos*, *Porthos*, *D'Artagnan*, *D'Artagnan No. 1*, and *Armes*—situated on the east side of the Kitsault, north of the *Tiger* group. (*See Wright's map.*) They were taken over by Mr. Meenach early in the spring and considerable work has been done on them since that time, though the work was closed down for a time through threatened litigation. The new work consists of an open-cut about 50 feet from the railroad-grade, 40 feet long, and from 12 to 15 feet deep in the solid rock. On the north end of this cut it is well mineralized for a width of 7 or 8 feet, but for some reason the cut was partially refilled, making a close examination impossible. The next 20 feet in the centre of the cut is barren andesite country-rock; the remaining 7 or 8 feet on the south end is pyritized quartz carrying some galena. About 40 feet beyond and above this another cut has been driven in from the creek-bank about 20 feet, exposing 8 feet of heavily pyritized quartz carrying a little galena and showing scales of native silver on the seams. This cut is about 12 feet deep, showing that depth of andesite overlying the ore, with no sign of its cropping through to the surface, exemplifying the difficulties of prospecting for these veins. The owners claim values of 32 oz. silver to the ton across 7½ feet in this cut. The vein appears to strike about N. 60° E. into the hill. Later work now under way consists of a tunnel which has been driven about 100 feet on the level of the upper cut, following along one wall of the vein without breaking into the vein. Very little information has therefore been gained so far, but I believe it is the intention to crosscut the vein at regular intervals later.

**Wolf Group.**

This group is situated north of and adjoining the *Musketeer* group and is a portion of the holdings of the Dolly Varden Mines. It is the proposed terminus of the Dolly Varden Railroad. There has been a tunnel driven on the ore for 35 feet and crosscuts for 60 feet across the vein. About 5,000 feet of diamond-drilling was done on it, proving the existence of an immense body of milling-grade ore.

*Silver Horde Group.*—This group consists of three claims and a fraction and belongs to Davidson & Miner, of Alice Arm. Very little work has been done this year, but the owners plan starting early in the spring to thoroughly prospect the ground.

**Climax Group.**

This group is composed of two claims—*Climax* and *Climax No. 2*—owned equally by M. P. Olson, of Alice Arm, and O. Besner, of Prince Rupert. The claims are located on the north side of Trout creek and adjoining the *Silver Horde* group on the north. A trail was started by the Government last year from the main trail up Trout creek, which will serve several groups of claims and a very promising country beyond. It will doubtless be completed next year.

A great deal of work has been done on the claims this summer, proving the continuation of the *Moose* veins through them. The work consists of a number of trenches and open-cuts along the side-hill, each about 150 feet long, at intervals up the hill. They expose a shattered zone in the andesite country-rock for a width of from 30 to 50 feet, filled with pyritized quartz and calcite, mineralized with varying amounts of galena. Near the surface these quartz-seams are decomposed, making the rock very easily worked. The mineralization exposed in nearly all the cuts is very meagre, but, judging from the capping over other veins in this section, it is reasonable to expect an improvement with depth. At an elevation of 2,250 feet a cut exposes a very good-looking showing, between 40 and 50 feet wide, of a more altered, more silicified, and consequently better mineralized rock. This exposure should be drifted on. At 2,350 feet elevation a cut 75 feet long has disclosed a width of about 20 feet of quartz well mineralized with pyrite and galena, but low in values. This is a fine showing and lines up with the exposures on the *Moose* group, whose side-line is about 100 feet above. Taking everything into consideration, this is a very promising-looking prospect.

**Moose Group.**

This group consists of four claims adjoining the *Silver Horde*, *Climax*, and *Last Chance* groups. It is owned by Don Cameron, of Alice Arm, and associates. The property was under bond early in the year, but reverted

to the owners later on. No work was done during the summer, but Cameron is driving a crosscut tunnel this winter to get under the best showing on the surface. There is a good showing on this group, a vein about 14 feet wide, with 2 feet on one wall of high-grade shipping-ore. The results of the tunnel when under this showing will be of interest to all the properties in that particular area.

**Last Chance Group.** There are four claims in this group—*Last Chance No. 1, Last Chance No. 2, Last Chance No. 3, and Last Chance No. 4*—owned by Archie McPhail, George Kolbeck, and Pat Morley, of Alice Arm. The claims lie east of and adjoining the *Moose* group and are about three-quarters of a mile up Trout creek from

the main Kitsault trail. The showing is exposed along the side of the hill for 300 feet and is composed of a matrix of barite, quartz, and calcite, in which are bedded boulders of all sizes of country-rock. The mineralization consists of pyrite, chalcopyrite, galena, a little blende, and argentite. The main values are in silver. The property has been under bond since early spring to H. B. Price, who also has the *Tiger* group, and is now being prospected by diamond-drilling. No definite or authentic information is available at present of the results obtained. It has a very promising surface exposure and it is to be hoped that diamond-drilling will prove it worth developing on a large scale.

There are a number of claims farther up Trout creek and across from Trout creek to the head of Clearwater creek, from which very fine specimens of ore have been shown, but as yet no work has been done.

**Columbia Group.** This group consists of three claims owned by Pete Anderson on the north bank of Clearwater creek, about a mile and a half from the Kitsault river.

There is a strong vein on this property, but the values have been low where any work has been done. The yearly assessment was the only work done this summer.

**Black Diamond Group.**—This group is owned by J. Hauber and is located on the extension of the vein through the *Columbia* group.

(See last year's Report.) This group is comprised of four claims owned by **Homestake Group.** A. Davidson and partners, of Alice Arm. The only work done on the claims this year was the surveying of them for Crown grant. It was bonded early

in the year to W. A. Somerville and associates, who have incorporated a company called Mineral Claims Development Company. The second payment has been made to the owners and work will be started on the property in the spring.

The same company has taken over at least one other property, the *Tip Top*, owned by H. Mann, above the *Homestake* claims, and, I believe, two other properties are being negotiated for.

The main Government trail, built this year as far as Clearwater creek, will be finished through to this property next summer and will provide good packing facilities from the end of the Dolly Varden Railroad, about eight miles.

**Vanguard Group.** This group is owned by Morris Peterson and the Strombeck Bros. The property was described in last year's Report, since which time considerable work has been done on it. The owners built some new trail and improved the old one from the main trail up to the property, with the assistance of the Mines Department. A little work was done in the tunnel driven to get under the big surface showing of chalcopyrite, but this work was not very encouraging.

On the lower showing a crosscut tunnel was driven under 2 feet of solid chalcopyrite exposed on the surface, proving it to have cut off a few feet below the surface. A pyritized, siliceous greenstone is exposed in the tunnel. Below this, on the surface, the vein has been faced up, showing considerable solid chalcopyrite in the seams and decomposed places.

**Wildcat Group.**—This group is owned by Davidson & Macey and has a little work done this year, but nothing new of importance was found. The other claims in this vicinity have had only the yearly assessments done.

**War Dance Group.** This property, consisting of six claims—*War Dance, Grouse No. 3, Betsy, Bute, Whistler, and Badger*—is owned by A. McGuire. These claims are situated on the west bank of the North-east fork of the Kitsault, which joins the main

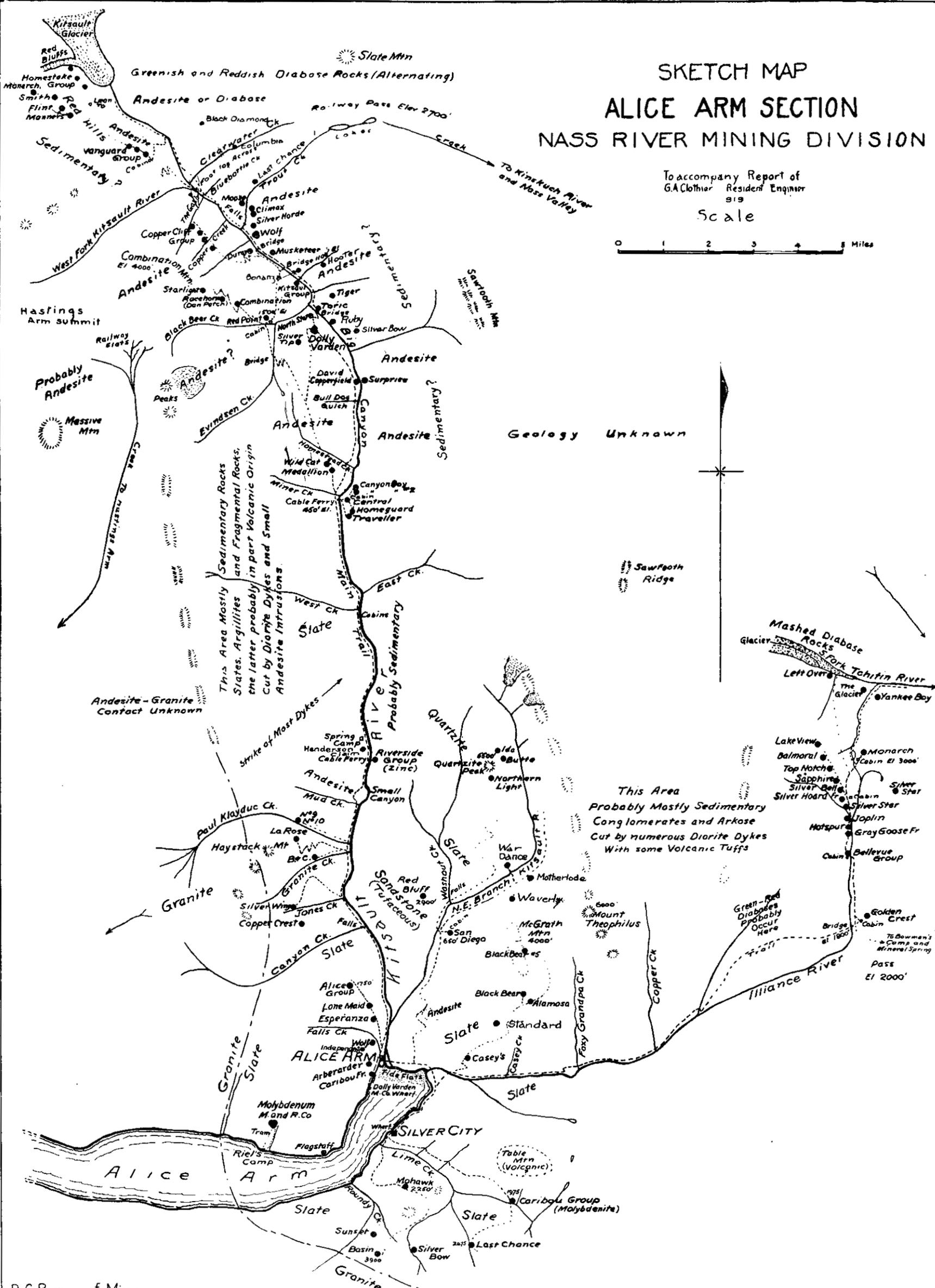
Kitsault just above the town of Alice Arm. It is about three miles from Alice Arm, across the Kitsault flats to the mouth of the North-east fork, and about four miles from there to the cabin on the property, which is at an elevation of 700 feet. It is a fair foot-trail

# SKETCH MAP ALICE ARM SECTION NASS RIVER MINING DIVISION

To accompany Report of  
G.A. Clothier Resident Engineer  
919

Scale

0 1 2 3 4 5 Miles



This Area Mostly Sedimentary Rocks and Fragmental Rocks, the latter probably in part Volcanic Origin Cut by Diarite Dykes and Small Andesite Intrusions

This Area Probably Mostly Sedimentary Conglomerates and Arkose Cut by numerous Diarite Dykes With some Volcanic Tuffs

Andesite - Granite Contact Unknown

Geology Unknown

the most of the distance and could be improved to a horse-trail with the expenditure of a few hundred dollars. The trail across the flats should be cut out and improved, and the upper end of the trail up the fork also extended and improved. This area has not been prospected to any extent, but will be. The rock formation up the North-east fork, so far as seen along the trail, is sedimentary or altered phases of it.

The work done on the property has been done by the owner, who deserves credit for the extent to which the property has been prospected and the condition in which he has kept the trail up the river. At an elevation of 850 feet, or 150 feet above the cabin, some stripping and open-cutting on the left bank of the small creek has exposed a number of parallel quartz veins in a slate formation. These veins, which are up to 2 feet in thickness, lie with the bedding-planes of the slate, striking N. 30° W. and dipping from 35 to 40 degrees east. All the veins are well mineralized with pyrite, chalcopyrite, zinc-blende, and a little galena. Several samples taken from different parts of the veins exposed in the cut give fair returns and justify some further work to get well under the surface. A sample across the vein in the bottom of the cut, of 18 inches, gave assay returns of a trace of gold, 1 oz. silver, and 1.5 per cent. copper to the ton. Across the same vein, for 8 inches, on the other side of the cut, a sample gave a trace of gold, 1 oz. silver, and 0.4 per cent. copper to the ton. The vein above this sampled low grade, while a 2-foot vein a little higher, ran \$4.40 in gold, 1 oz. silver, and 1.4 per cent. copper to the ton. A sample of the better-looking copper ore assayed \$2 in gold, 2 oz. silver, and 3.7 copper to the ton. Other quartz veins show above the cut, which should be extended into the hill to expose the full width of the vein series.

Farther north, on the *Betsy* claim, at an elevation of 1,100 feet, there is a cropping of what appears to be a wide belt of shattered slates, throughout which is a network of quartz veinlets mineralized with zinc-blende, galena, a little chalcopyrite, and pyrite. This has not been broken into at all. A few pieces picked from the surface assayed a trace of gold, 1 oz. silver, and 4.8 per cent. lead to the ton. In places where slabs have slid off the surface it shows a heavier mineralization, and I think it would be worth while to drive an open-cut into it to prove its worth.

*Mother Lode and Silver Bar.*—These claims also belong to A. McGuire and are situated on the opposite side of the river, farther north along the trail. A small open-cut partially exposing a quartz vein is the only work done.

*Waverly, Kitty, and Maxwell.*—These claims are located on the opposite side of the river from the *War Dance* group and a little farther south. They are owned by A. McGuire, who claims a big quartz-exposure on them, but they have just recently been staked and no prospecting done.

#### ILLIANCE RIVER SECTION.

This section, as the name indicates, includes all the country reached by way of this river from its mouth, at the head of Alice arm, to the Nass River divide and beyond, as some claims have been located over the divide on the Nass River slope.

The Government this year went to a great deal of expense in putting the trail in first-class condition for packing. It is now in good shape to about 11-Mile and doubtless will be completed through to the head of the river next season. There are a number of small, high-grade silver veins in this section that will pay to mine and ship with the trail in good condition. Also it is the shortest and best route to get over on the Nass slope.

All the properties described in last year's Report on McGrath mountain—namely, *Silver Bell* claim, *Lone Star* group, *Silver Band* group, *Standard* group, etc.—have had the yearly assessment-work only done on them, and it is therefore unnecessary to repeat the details of them in this report.

The United Metals Mining Company's holdings comprise three mineral claims—**United Metals.** *Joplin*, *Silver Star*, and *Silver Horde*—situated fourteen miles up the Illiance on its west bank. From six to eight men have been employed all summer on the property and an appreciable amount of development done. This work, however, has not tended to open up the showings to any advantage, the greater part of the work being confined to surface work, to open-cutting along the different veins, and to gophering out what croppings of high-grade ore can be found. No attempt has been made to gain any working depth on any of the veins, and the result will be that, when all the surface ore is taken out, deeper development will have to be done for the continuation of operations. Not more than 50 tons of ore was ready for shipment at the time of my visit, and I understand that only a few tons of this has yet

reached the beach, though some twenty pack-horses were taken in for the purpose of getting this ore out. A commodious camp and stable were erected at Copper creek, seven miles up from the beach, to facilitate this work.

The "Cabin vein" has been open-cut for a length of 35 feet and some shipping-ore obtained. The face was 7 feet high, with about 18 inches in width of good ore in it. A crosscut tunnel driven from the creek-level would, in about 150 feet, cut this vein at a vertical depth of about 90 feet if it extends to that depth. Such a tunnel would in all probability cut parallel veins before reaching the "Cabin vein," which I judge to be the main vein, and could be continued beyond if it were thought other veins could be found. The main vein and parallel ones could be drifted on both ways from the tunnel and some definite idea thus gained as to the worth of the property. In drifting north on these veins from a tunnel level a considerable gain in depth would be made, as the ground slopes gradually up the valley. As it now stands, there is no possibility of estimating any tonnage other than a few tons which can be gained from a few small surface showings.

This group consists of the two claims—*Silver Star* and *Silver Star Extension*.  
**Silver Star** They were staked by Juggins & Jones, but are now owned by A. R. Hodgson,  
**Group.** of Anox, and associates. The claims are situated on the east side of the  
 Illiance river opposite the United Metals Company's holdings, from whose  
 camp there is a fair foot-trail over the first ridge, 3,650 feet elevation, to the *Silver Star* camp,  
 at an elevation of 3,525 feet.

The workings are 150 feet lower than the camp. The main work to date consists of a tunnel driven in from a bluff above a small creek. At the time of my trip this tunnel had crosscut the vein for about 6 feet and then drifted north on the hanging-wall of the vein for 20 feet. The crosscut, with the portion of the vein outside of it, shows a total width of vein here of 12 feet lying in a country-rock of light-coloured, clayey schist. There are streaks up to 6 inches in width of very high-grade ore assaying as high as 1,900 oz. silver to the ton, and the whole width of 12 feet will make an excellent mill-feed. Hand-sorting would produce an appreciable tonnage of high-grade shipping-ore. The vein is a more or less silicified country-rock with considerable quartz, in bands and bunches, carrying galena and grey-copper. Later work consisted of cross-cutting back across the vein again for 9 feet and continuing the hanging-wall drift to 40 feet. The drift shows stringers of galena and grey-copper in the light-grey schistose rock the whole distance, and the crosscut at 20 feet in exposes about the same grade of ore. So far as opened up this body of ore would all be of good milling grade. This work is about 30 feet above the old tunnel mentioned in last year's Report.

About 60 feet down the gulch the vein again crops in the wall of the bluff and has been open-cut for a few feet at this point, disclosing 14 inches of solid high-grade galena and grey-copper ore. Just above this another small open-cut shows bunches of ore.

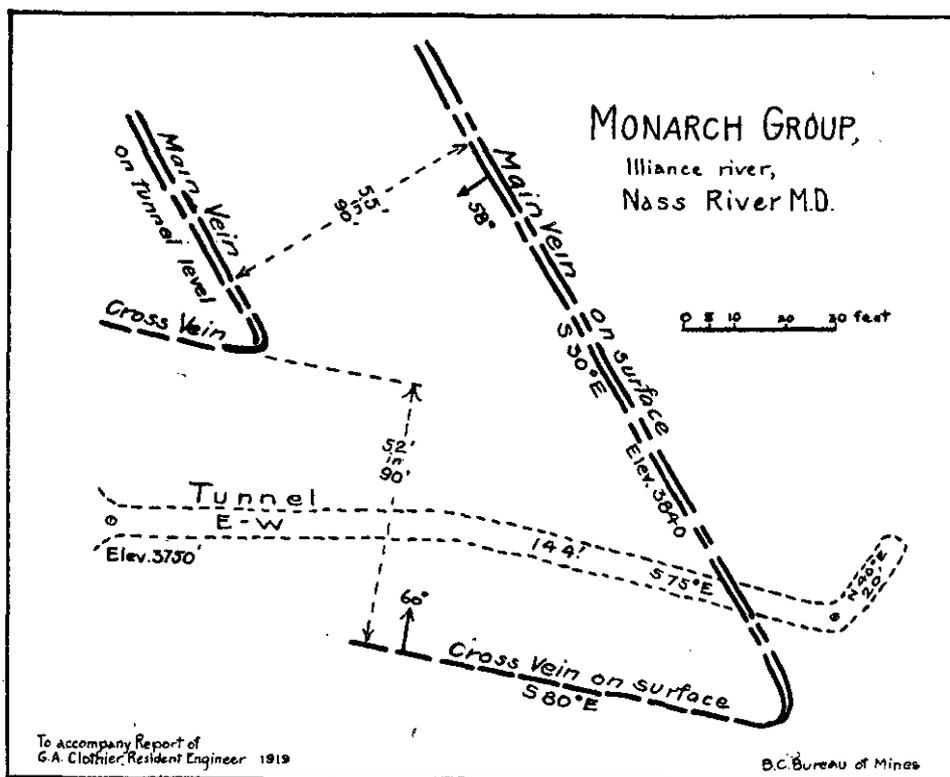
Other croppings on the ridge and along the west side of it, following another small creek, indicate an ore-zone of about 100 feet in width containing small (so far as known) parallel stringers and kidneys of galena and grey-copper. They all conform with the strike of the schistosity of the country-rock, of N. 35° W., similar to veins on other properties in this vicinity. The vein, on which the tunnel has been driven, crops again about 500 feet north at an elevation of 3,550 feet, and again at 3,650 feet elevation about 900 feet north of the tunnel. Altogether this is a very promising property and might easily develop into a profitable concentrating proposition.

A good 14- x 26-foot two-room cabin has been built this summer. It is the owner's intention to commence operations as soon as snow conditions will permit in the spring. The tunnel will be continued, a crosscut driven to the left from a point 40 feet in (the present face), and as much ore as possible sacked and shipped, depending on the time of completion of the trail.

This group, consisting of five claims owned by Joe Hayes, W. J. Bradley, and  
**Silver Bell** associates, was fully described in last year's report. Hayes & Bradley have  
**Group.** done considerable work on the claims again this year, cleaning up all the  
 surface strippings and drifting on the vein where opened up by an open-cut  
 between No. 2 and No. 3 strippings. This was looking fairly well when I saw it, but unfortunately I have no information of the results of the later work at this point. With a good pack-trail to the beach, this property, judging from surface showings, should be able to produce sufficient ore from the surface to be profitable to the owners.

A crosscut tunnel from the main valley above the cabin would procure a working depth under these veins, and from which development would in all probability expose sufficient ore of milling grade to justify the installation of a small concentrator. The silver content in ounces is probably eight times the percentage of lead, consequently a lead concentrate would be a high-grade ore.

There are two claims in this group—*Monarch* and *Monarch No. 2*—owned by **Monarch Group**. W. B. Bower, of Anyox, and associates. The claims are located just above Summit lake, the source of the Illiance river, on the summit of the divide between the Alice Arm and Nass River valleys, about sixteen miles from tide-water. The elevation at Summit lake is 3,600 feet. There is a cabin on the property, built years ago by Stark & Juggins, who were the original locators of the claims.



The property was under bond a few years ago and a good deal of prospecting-work was done during that time. The surface croppings were stripped for several hundred feet, an open-cut run along the vein for about 200 feet, and another cut, 6 feet deep in places in the solid, was driven about 100 feet on a cross-vein. (See sketch.) A crosscut tunnel was started at an elevation of 3,750 feet, or about 90 feet vertically lower than the croppings, and driven 144 feet toward the main vein. From this point a crosscut was turned to the left at right angles to the tunnel and driven 20 feet, making a total of 164 feet from the collar, which undoubtedly would have cut the vein had it extended down on the same dip as indicated on the surface. No sign of the vein, however, was found in this work.

The surface work exposed a strong vein and a very fine showing of ore. The vein is quartz and silicified country-rock, with a little calcite, heavily mineralized with pyrite, chalcopryite, chalcocite, and a little galena and blende. The country-rock is a schistose tuff, weathering to a dark-brown colour. A grab sample from the surface gave assay returns of a trace of gold, 8 oz. silver, 8 per cent. copper, 6.7 per cent. zinc, and a trace of lead to the ton.

The main vein, as disclosed by open-cuts and stripping, strikes S. 30° E. and dips 58 degrees to the west. There is no indication on the surface of its continuation south of the cross-fracture. The cross-vein strikes S. 80° E. and dips 60 degrees to the north. It will be seen by the accom-

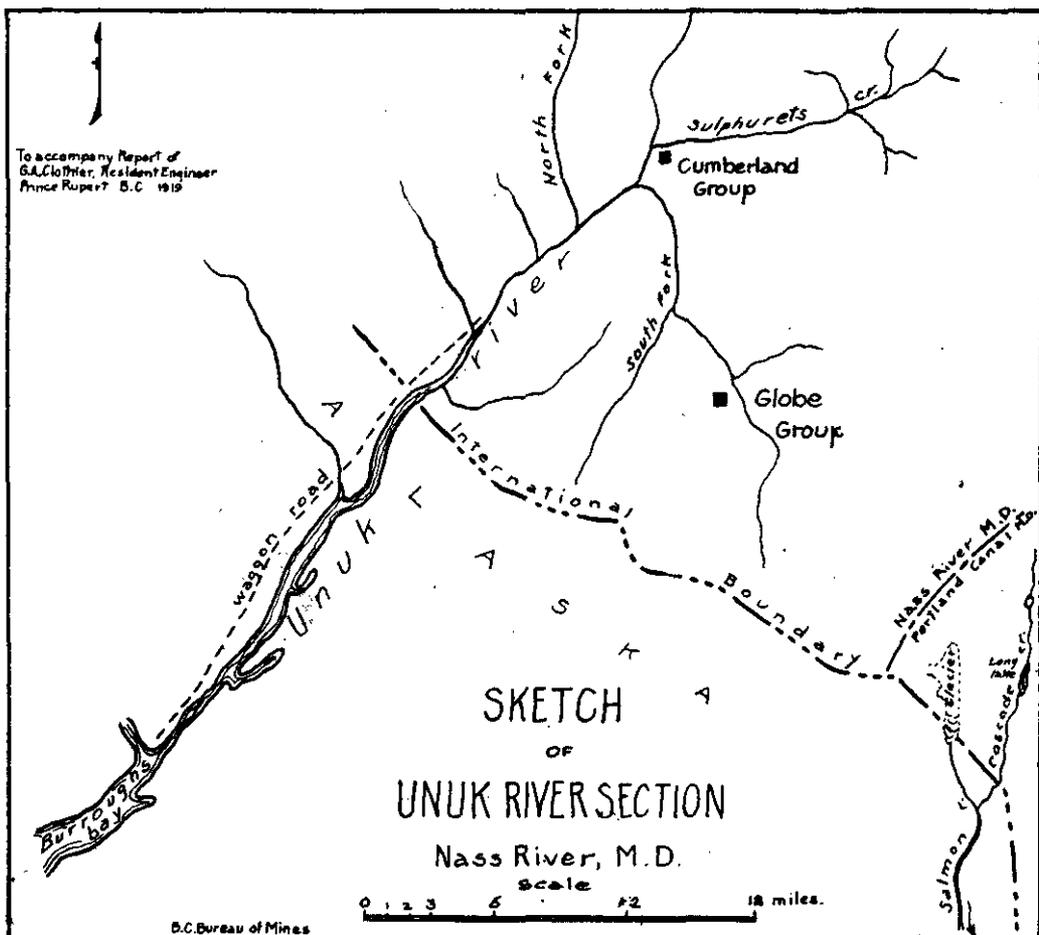
panying sketch that, if the dip of the cross-vein persists below the surface, the tunnel has been driven under the cross-vein and south of the main vein all the way. A tunnel started 70 or 80 feet north of the present one might pick up the vein in about 30 feet.

This season's work consisted of surface strippings and tracing the vein for a considerable distance farther north.

Yearly assessment-work was done on a number of claims in this section and a number of claims staked.

#### UNUK RIVER SECTION.

As yet the only way to reach this section above the Alaska-British Columbia boundary-line on the Unuk river is from Ketchikan to the head of Burroughs bay, and from there by poling and lining a small boat up the Unuk river. It is about twenty-four miles from the head of the bay to the boundary-line, seventeen miles farther to the mouth of the South fork and a mile or two beyond that to the mouth of Sulphurets creek.



There was some work done in this section in 1908 and three or four following years, when two groups of claims were Crown-granted and are still held by the owners. Claims have been staked from time to time since then, but little or no further work has been done.

From old reports I gather that the rock formation and mineralization is identical with other known areas in the Eastern Contact Belt.

The following are assays of typical minerals from the South fork from a group about twelve miles up: Pyritic ore assays 13 oz. silver and \$40 in gold to the ton; steel galena, 12 oz. silver, \$20 in gold, and 23 per cent. lead to the ton; complex ores, 17 oz. silver and \$18 in gold to the

ton; galena, 36 oz. silver, \$20 in gold, and 59 per cent. lead to the ton; pure chalcopyrite, 68 oz. silver, \$1.22 in gold, and 32 per cent. copper to the ton; grey-copper, 5,000 oz. silver, \$1.75 in gold, and 16 per cent. copper to the ton.

In 1904 a wagon-road was built from the head of Burroughs bay by John W. Dally, who owns a group of claims at the mouth of Sulphurets creek. This road was completed through for eighteen miles, at which point there is a break of 1,200 feet consisting of a rock bluff. Beyond that it was built for six miles to the boundary and two miles beyond. From reliable information I believe the heaviest portion of the construction is over, with the exception of the 1,200 feet of rock-work just mentioned. If this road were put in repair for the twenty-six miles and continued with a trail to the head of the river, it would provide adequate transportation for some years, or until such time as the country was sufficiently developed to justify the continuation of the wagon-road.

#### PORTLAND CANAL MINING DIVISION.\*

This is the smallest Division in the Province, including only that portion along Portland canal west of the summit of the range between Portland canal and Observatory inlet, which extends north to the headwaters of Bear river, American creek, Cascade creek, and Salmon river. It contains, therefore, a comparatively small portion of the Eastern Contact Belt. However, all that part of it north of the head of Salmon river toward the Unuk river is reached by way of Stewart, up the Bear river and over its divide, or up the Salmon river and over the glacier at its head, or over Long Lake glacier at the head of Cascade creek. As Portland canal is the natural outlet for all the country, it should possibly be contained in the Portland Canal Division rather than the Nass River Division, as under the present boundaries.

*Note by Provincial Mineralogist.*—Since this report was written there has been a change in the boundaries of the Portland Canal Mining Division, to take effect on and after the 2nd day of July, 1920. The boundaries as now defined are as follows:—

“Commencing at Ramsden point separating the entrance to Portland canal from the entrance to Observatory inlet; thence northerly along the divide separating the drainage area of the said canal from the drainage area of the said inlet to Mount Brown; thence easterly along the divide separating the drainage area of the Kshwan, Kitzault, and Kluskuch rivers on the south from the drainage area of White river and Paw creek on the north to a crossing of the Nass river north of Cottonwood creek at the north-west corner of Lot 3402, Cassiar District; thence north-easterly along the divide separating the drainage area of Cottonwood creek on the south from the drainage area of Wolverine creek on the north to a point on the western boundary of Omineca Mining Division, east of the south end of Meziadin lake, approximately where the said western boundary of Omineca Mining Division is intersected by the 56th parallel; thence north-easterly and north-westerly following the divide separating the drainage area of the Nass river and its tributaries from the drainage area of the Skeena river and its tributaries to a point where the latter divide is intersected by the divide separating the drainage areas of the Klappan and Iskut rivers on the north from the drainage areas of the Nass and Unuk rivers on the south; thence westerly along the latter divide to the International Boundary; thence south-easterly and southerly along the International Boundary to a point on Portland canal immediately north of Pearse island, and thence south-easterly to the point of commencement at Ramsden point.”

That area from the head of Portland canal and which is now demanding the attention of the mining world is reached by way of Stewart, at the head of the canal, 120 miles from Prince Rupert, from which there is now a bi-monthly boat service, which will in all probability be improved to at least a weekly service this coming spring. From Stewart to the head of Bear river is about twenty-six miles over a good wagon-road for fourteen miles to the forks of American creek and Bear river, and from there to the head by a first-class pack-trail which continues through to Meziadin lake and to the telegraph-line at the 6th Cabin. The Portland Canal Short Line Railroad was constructed in 1910 and 1911 from Stewart to the Red Cliff Mining Company's property, fourteen miles up. It has not been operated since 1911, but if mining conditions continue to improve the road will doubtless be again put in commission.

From Stewart to the heads of Salmon river and Cascade creek, by way of Hyder and up the Salmon River valley, is about twenty-six miles. There is a good winter road, which will be completed into a wagon-road next summer, from Stewart to about a mile above the boundary-line,

\* Memoir 32, by R. G. McConnell, Geological Survey of Canada.

a distance of fourteen miles, from which point there is a trail through to the property of the Forty-nine Mining Company, a further distance of nine miles. Prospectors going over to the Nass slope can have supplies delivered by pack-train to the Forty-nine camp for about 10 cents a pound, or less when the wagon-road is finished. From the Forty-nine camp it is about eight miles over to the Nass slope, part of the way being over a large glacier. This is the shortest route for prospectors, but any ores developed in that area will eventually be brought out by way of the Bear river, at the head of which the divide is less than 1,500 feet elevation and a feasible route for railroad-construction. The continuation of the railroad for twelve miles to the head of Bear river, and from there following around on that grade on the Nass slope, would be in the Eastern Contact Belt all the way, and in approximately twenty-five miles would reach the area over the divide at the head of Salmon river.

A little prospecting was done on the Nass side during this summer and some very fine specimens of ore brought in. This area will receive increasing attention as the Salmon River basin is proven, and should the mineralization prove as rich as in other parts of the contact it will make one of the greatest mining districts on the continent. It is therefore a matter of the greatest importance to provide ways and means of getting into that section of the country.

For this report the Portland Canal Mining Division will be subdivided as follows: Portland Canal section; Marmot River section; Bear River section; and Salmon River section.

#### PORTLAND CANAL SECTION.

This may be somewhat confusing with the Portland Canal Division, but is here used to take in that portion of the Division along the canal proper from Portland inlet north to its head at Stewart. Any part of it is easily reached by launch from Stewart or Prince Rupert.

This group consists of eight claims—*Elsie, Tunnel Fraction, Copper King, Outsider Group, Regina, Hope, Brown, Summit, and Constance Fraction*—situated at Maple bay, about thirty-five miles down the canal from Stewart. This is the old Brown-Alaska property which was worked in 1905 and 1906, shipping several thousand tons of ore, averaging 2.8 per cent. copper, to the Hadley smelter, then operating on Kasaan peninsula, Prince of Wales island. The property was equipped with an aerial tramway from the mine to the beach, commodious ore-bunkers, freight-dock, power plant, etc., all of which are at present in a bad state of repair. The property lay idle for several years, passing into the hands of the present owners, Martin Woldson and associates, of Spokane, Wash., who resumed operations two years ago. The new work was described in last year's Report, and, as little has been done since, I will not repeat the details here. Its very advantageous situation on tide-water, together with the extensive ore-shoots, though low grade, which have been exposed, make the property well worth investigation.

The *Maple Bay* group at Maple bay and the *Guggenheim* group on Georgia river were also reported on last year, and, as no work has been done since, I would refer the reader to the Minister of Mines' Report of 1918.

*Swamp Point*.—The Granby Consolidated Mining, Smelting, and Power Company has been operating its lime-quarries here all year under the superintendence of Roy Price, obtaining 41,000 tons of lime rock for its smelter requirements.

#### MARMOT RIVER SECTION.

This section takes in the area accessible by way of the Marmot river, which flows into the head of Portland canal on the east side, about four miles south of Stewart, from which point it is reached by boat. There is a good comfortable cabin at the beach on Marmot bay, from which there is a first class pack-trail to the cabin at the forks, where the North fork joins the river, a distance of two miles and a half. The cabin is at an elevation of 650 feet. The trail continues up the main river, running east and west, three miles to the glacier, the foot of which has an elevation of 1,375 feet. There is also a trail up the North fork from the cabin to the North Fork basin, a distance of about three miles, to an elevation of over 4,000 feet. It is rather steep in places for horses, but on the whole is a fair trail. This section is therefore very accessible. The mountains on each side of the valley are very precipitous and rather dangerous in places above the forks in winter-time on account of snowslides down the steep draws.

This group consists of seven claims—*Montana, New Republic, Arizona, Comstock, Peach No. 1, Peach No. 2, and Horseshoe*—owned by G. W. Bruggy, of Alice Arm, and H. C. Magee, of Stewart. There are two other claims—*Maud*

and *Mary*—also owned by them, which are not grouped with the other seven, but are included in the property for sale. The claims are situated above the foot of the glacier on the west side of the river.

At an elevation of 2,350 feet, or about 1,000 feet above the valley-level, a crosscut tunnel has been driven a distance of 60 feet to a rather flat vein which shows on the surface about 20 feet above the portal of the tunnel. The vein is quartz, varying in width up to 6 feet, mineralized in short lenses with galena, blende, and grey-copper carrying high silver values. The widest part of high-grade ore has been about 2 feet. The vein lies in a spur of granite from the main range, which lies about a mile to the west and is easily seen from the trail. The vein strikes N. 40° E. and dips into the hill at 25 degrees to the north-west.

Two drifts have been run on the ore from the end of the tunnel, one 10 feet south-west and the other 40 feet north-east, and a winze sunk on the vein for 30 feet. This was full of water, but is said to show good ore all the way down and in the bottom. The vein has been traced on the surface for about 800 feet. Small shipments of high-grade ore have been made from ore sorted from the underground work and some taken from the surface. The tunnel is reached by following up a small steep creek, which I consider dangerous at any time. A good-grade, safe trail could easily be built and would be a distinct asset to the property.

On the *Horseshoe* claim of this group there are some showings on the east end of it that are reached by following on the glacier around the end of the hill, and from there a trail which has been built up to the croppings at an elevation of 2,950 feet, or 350 feet above the glacier. These showings are of quartz, mineralized with pyrrhotite, with a little chalcopyrite and galena showing in places. A shallow open-cut across a small ridge shows from 6 to 10 feet of mineralized quartz. It is claimed that the heavier iron carries gold and silver values up to \$20 a ton. Above this showing about 20 feet, and to the right of it, can be seen another cropping of quartz about 12 feet wide, and all along the end of the range, paralleling the river and broken across at right angles here by the glacier, is heavily iron-stained, but as yet no work has been done to investigate it, except the two cuts mentioned.

High up on the hill above the quartz-croppings a broad belt of limestone crosses the country, while numerous dykes can be seen, running with the general strike of the formation, which appears to be a little east of north. This hill looks well worth close prospecting, and altogether the property is rather promising.

This group consists of seven claims—*Red Bluff*, *Red Bluff No. 2*, *Ivy*, *Bessie*, **Fraser Group**, *Mt. Marmot*, *Rusty Ridge*, and *Jewel*—which are situated on the east side of the North fork of the Marmot river about three miles from its junction with the main river. They are owned by Wm. Fraser, of Stewart. The camp at the claims, a tent, is at an elevation of 3,400 feet, or about 2,700 feet (two hours' walk) above the cabin at the forks.

The rock formation appears to be a large intrusive mass of altered, more or less schistose, igneous rock, heavily pyritized throughout, with veins of solid pyrite traversing the formation in all directions. There are also pyritized quartz veins cutting through the mass and said to carry fair values in gold and silver. These quartz veins would be difficult to find on account of the whole mass, for a width of 1,000 feet or more, being covered with a reddish to yellow coating of iron oxides. The iron is mainly pyrrhotite, but there is also considerable arsenopyrite and a slight mineralization of chalcopyrite, especially in the small quartz veins and in the oxidized seams and fissures.

The area of oxidization is so large that diamond-drilling suggests itself for prospecting purposes. If the ore was of commercial grade an immense tonnage could be developed. It is well situated for transportation, as the ore could be trammed to the forks and from there to the beach. The valleys are full of timber and water-power could be developed on the North fork. It is worth a careful examination for large operations.

This claim is owned by Fraser, Woods & Magee, of Stewart, and is situated above the *Fraser* group in the basin at an elevation of 4,300 feet. The work consists of a shaft sunk 42 feet, following the vein part way, but bearing off into the foot-wall, necessitating a crosscut of 17 feet from the bottom of the shaft to pick up the vein again. The vein is of quartz, 8 to 12 inches wide, carrying high silver values where mineralized with galena and zinc-blende, with grey-copper. A small shipment of 2 tons from the shaft and several places on the surface gave assay returns of 22 per cent. lead,

22 per cent. zinc, and 200 oz. silver to the ton, the whole amounting to \$142 a ton at the time of shipment.

The wall of the vein was traced from the shaft down the hill and a tunnel driven along it, getting under the shaft, but finding no vein or ore. This is at a depth of 30 feet below the bottom of the shaft. On the supposition that the tunnel followed the same slip that carried the shaft into the foot-wall, it would take a crosscut of about 29 feet from the tunnel to get over to the vein. The country-rock is a badly folded and distorted schistose rock, seemingly overlying the igneous rock in the *Fraser* group below.

There is a good trail to the tunnel passing Fraser's camp. Some tonnage may be won from the shaft and spots on the surface, and the vein may be picked up on the tunnel-level and more ore found. It could only be worked, on account of the altitude, for a few months in the year, and would probably return the owners good wages while under operation.

A number of claims have been staked in this basin, as well as along the main river, and I believe that further prospecting will prove it to be a promising section.

#### BEAR RIVER SECTION.\*

This section includes all the country north of the head of Portland canal contiguous to the Bear River valley and is reached from Stewart. It was the scene of a considerable boom in 1910 and 1911, which, however, "pinched out," leaving this section in a rather bad position from a mining standpoint. At that time the country had been run over by prospectors, "wild cats" promoted and money lost, while the few more promising properties failed to come up to expectations. Work, however, was continued by the owners on many of the prospects, and though results were encouraging it was hard to induce capital to even take a look. The advent of the *Premier* mine, however, on Salmon river, into the mining limelight has revived interest in the whole section and confidence is gradually being regained. At least six properties in this section were bonded in the late fall, on which work will be commenced as soon as possible in the spring.

There will in all probability be quite a rush of prospectors into this section next year, as it has not been so thoroughly prospected or staked as the Salmon River section. It is the natural route into the upper Nass River country and the outlet for any products, mineral or otherwise. It has been previously pointed out in this report the feasibility of the continuation of the Portland Canal Short Line Railroad over the Bear River divide to open up the country inside of the Coast range when sufficient development has been done to justify it.

The section is well provided with roads and trails, both up the main valley and the tributary creeks. This year the Government completed a wagon-road from Stewart to the mouth of the Salmon river, connecting with the road up that valley to the *Premier* mine. The outstanding need is a dock at Stewart, for the old one is in a dangerous condition.

Since practically all of the properties up the Salmon river are in British Columbia, Stewart will naturally be the business centre for both the Salmon and Bear rivers.

#### *Bear River.*

This group contains two claims—*Bayview No. 1* and *Bayview No. 2*—owned by **Bayview Group.** George Cameron and W. Cameron, of Stewart. The claims are located on the summit of the divide between Bear and Salmon rivers, overlooking the town of Stewart from an elevation of 4,000 feet. They are reached by a trail starting about half a mile below the Bear River bridge, and the climb is "straight up" to the camp-site at 3,000 feet elevation.

Very little work has been done on the claims. A small open-cut on the *Bayview No. 1* exposes a narrow quartz vein showing galena and grey-copper. About 1,000 feet above this, on the strike of the vein on the *Bayview No. 2*, an open-cut has been driven for 20 feet along a quartz vein about 30 inches in width, well mineralized with galena and grey-copper.

A two-mile tramway would land ore at tide-water. The property is under bond to Everett, Wash., interests, who intend opening it up in the spring.

This property consists of nine claims—*Prince John No. 1* to *Prince John No. 9*, inclusive—and is owned by James Nesbitt and Andy Archie, of Stewart. The **Prince John Group.** group is located on the west side of Bear river about five miles up from Stewart, on the opposite side of the river from the railroad. It is ideally

\* Memoir 32, by R. G. McConnell, Geological Survey of Canada.

situated for mining and transportation. A tunnel at an elevation of 2,350 feet has been driven 185 feet across the formation and mineralized belt. The cross-section exposed in the tunnel shows 30 feet of greenstone-schists from the portal; then 45 feet of banded slate or argillite mineralized with pyrite and chalcopyrite, disseminated in grains throughout the slate or in small veins and bunches lying in the bedding-planes and cross-fractures; then 45 feet of a light-grey acidic dyke-rock; and beyond that, 65 feet to the face, of slates slightly mineralized with pyrite and chalcopyrite, hardly of milling grade, but worth drifting on. The 45-foot section of ore will average about 2 per cent. copper and \$1 a ton in gold and silver values, with portions in it of fairly good ore.

A lot of surface work has been done on this showing, disclosing ore of about the same tenor as that in the tunnel. A little work has recently been done in the tunnel just beyond the dyke, a few shots showing some nice streaks of chalcopyrite. This belt deserves deeper exploration.

The owners were opening up a quartz-cropping in the slates below the tunnel at an elevation of 1,750 feet. Sufficient work had not been done to get a very definite idea of it, but it appeared to be a strong vein, probably 6 feet wide, paralleling the belt above. The quartz is mineralized with pyrrhotite and chalcopyrite, the heavier iron said to assay \$5.75 a ton in gold.

This group is composed of four claims and is owned by H. P. Gibson, of **Gibson Group**. Stewart. They are located in the argillite-belt, termed by McConnell "the Bitter Creek formation," south of the Portland Canal Mining Company's claims on the Bear River slope. The claims are reached by way of the old *Portland Canal* mine trail, passing the workings and continuing up the hill for probably a mile. In the event of the showings developing into any appreciable tonnage of shipping-ore, a tramway about a mile in length straight down the hill would land ore at the railroad.

Very little work has been done, consisting only of a few open-cuts and a little stripping. The first showing, at an elevation of 3,900 feet, where a little stripping has been done, shows a vein width of about 6 feet of heavily oxidized material in which are ribs of quartz. The quartz is mineralized with pyrite, galena, and zinc-blende, and I should judge from its appearance that it would be well worth while to obtain some depth on it in order to get under the surface oxidization. A deep open-cut or a tunnel could be driven in on it from the surface at a considerable depth, or it could be traced down the hill by stripping off the overburden and any desirable depth obtained.

About 400 feet east of this showing and at 3,700 feet elevation is another similar vein shown up by a small open-cut to be about 4 feet wide, with about a foot of quartz in the centre heavily pyritized and showing some galena. This also could be easily opened up at depth.

Judging from other similar veins in the same formation, there is a good chance of opening up high-grade silver ore, and the showings are certainly worth some exploratory work.

On the other claims of the group there is a good-sized cropping of hard flinty quartz in argillite country-rock showing along the top of the hill at 4,150 feet elevation. This vein has been broken into in a couple of places down the hill by open-cuts, which expose the vein from 8 to 12 feet wide, mineralized with arsenopyrite and said to carry fair gold values. It might make a concentrating-ore if sufficient tonnage and values could be opened up.

This group is comprised of four claims—*Mayflower*, *Trade Dollar*, *Kitty*, and **Mayflower** *Blaine*—situated on the east side of Bear river between Glacier and Bitter **Group**. creeks, and is owned by H. P. Gibson, of Stewart. The property has had some little work done on it by way of open-cutting and a short crosscut tunnel driven, all of which were described in last year's Report. Recent work was done farther up the creek on the surface, with, I understand, satisfactory results. There is a good trail from the valley to the showings, over which ore could be packed.

This is owned by Sam and Jack Fitzgerald, of Stewart. There are six claims in the group—*Independent* and *Independent No. 1* to *No. 5*, inclusive—situated **Independent** just over the ridge from the head of Goose creek on the Bear River slope. **Group**.

The cabin on the property is at an elevation of 2,700 feet and is reached by a rather poor, steep foot-trail following up Goose creek, and is about two hours' walk from the railroad. The location is ideal for mining and transportation, for a tramway could be built

straight down the hill to the railroad from any tunnel-site on the vein. The hill is heavily timbered and a fine water-power could be developed on Goose creek.

The formation appears to be a greenstone, McConnell's "Bear River formation." The work done so far consists of an open-cut at an elevation of 3,300 feet, exposing a vein 14 feet wide, striking N. 75° W. and dipping 65 degrees to the south. Across the face of the open-cut, which is about 10 feet high, shows 4 feet 6 inches in the centre of quartz rock heavily mineralized with pyrite and carrying also some galena and zinc-blende, in which the principal values are silver, with a little gold. This appears to be the main portion of the vein. On one side of it is a small, dark-coloured basic dyke about a foot in width. Bordering on both sides of the vein and dyke is quartz diorite, in which are bands of quartz and jaspery-looking quartz. The less silicified portions on each side of the vein are also heavily pyritized and show traces of galena and zinc-blende. Fair average values are claimed across the 14 feet exposed. The bottom of the cut shows a distinct improvement in mineralization over the upper portion.

At the same elevation, and some 50 feet south of the first cut, another smaller cut shows some silicification, sparingly mineralized with pyrite, with a little chalcopryrite showing in decomposed and oxidized places.

The "vein" can be traced for 1,000 feet up the hill, and in one place has been broken into by a 7-foot cut, showing it to consist of more quartz, with little galena in evidence. The whole appears to be a broad band of rather fine-grained igneous rock which has become silicified and mineralized. Average values across the exposures are encouraging, and possibly, with greater depth to get away from surface oxidization and fracturing, it may prove to be an important deposit.

I am informed that the property has since been bonded to W. A. Meloche, who contemplates diamond-drilling it in the spring.

(See Minister of Mines' Reports for 1917 and 1918.) This property, owned  
**George** by W. B. George, of Stewart, and R. George, of Vancouver, includes ten  
**Copper-mines.** claims—*Mamie, Bessie, Gold Crown, Copper King, Copper Queen, Copper Lord,*  
*Castle Rock, Helena, Royal, and Waterfall*—situated on the south side of the

Bear river about six miles by first-class trail from the end of the wagon-road, and railroad at the junction of American creek with Bear river. The property and work has been described in detail in two previous reports. The work this year has been done almost entirely on the "Blue vein." It has been shot into in a number of places, tracing it up the hill for several hundred feet; it has also been exposed at the foot of a high, perpendicular bluff, about 1,000 feet below its upper croppings. This would be about the lowest point on the vein at which a tunnel could be advantageously started to drive on it. A trail could be built connecting this point with the camp on the hill, or extended to meet the main Bear-Nass trail along Bear river in the valley below. The "Blue vein" shows a width of 12 feet of a fair grade of chalcopryrite ore.

The "White vein," running with the hill and at right angles to and into the "Blue vein," has the best surface showings on the property. It has been opened up in several places, exposing from 4 to 8 feet of solid chalcopryrite, and has been traced for over 2,000 feet on the surface.

The "Green vein," about 200 feet above and paralleling the "White vein," shows good ore on the surface, and the intervening ground between these two veins has several interesting-looking iron-croppings which deep development might prove extensive enough to make this whole belt workable.

I would like to see a tunnel driven in on the "Blue vein" at the foot of the upper bluff, 4,000 feet elevation, far enough to reach the "White vein" at their intersection, and the "White vein" then explored at that depth.

The tunnel under the big low-grade showing was continued 5 feet, making a total length of 85 feet. The face shows better indications of ore than ever before, in that there are small veins of solid, fine-grained pyrite, with considerable magnetite and hæmatite, all showing traces of chalcopryrite.

I must say that each year's work improves the showings and the value of this property. For examination purposes, probably the most advantageous work would be the further open-cutting of the "White vein."

It would appear, looking up from the valley, a most difficult undertaking to open up and operate this property, but after a few trips over it I am convinced that the drawbacks are not insurmountable.

I am informed that the property has recently been bonded to W. A. Maloche.

There are about fourteen claims in this group, owned by J. McNeil and J. J. **Red Top Group.** Conners. The claims are located about three miles beyond the George copper-mines cabin on the west side of Bear river. There is a fair foot-trail to the camp, elevation 2,400 feet, from a point about half a mile beyond the bridge crossing the Bear river above the Georges' cabin. It has been adequate for the amount of yearly work done on the property and can be inexpensively converted into a pack-trail when any extensive development-work is assured.

The property was bonded in 1910 and considerable surface work was done, which, however, was not sufficiently encouraging to justify taking over the property, and it therefore reverted to the present owners, whose policy with regard to development-work has not been a very vigorous one.

The lowest showing, at an elevation of 2,550 feet, consists of an open-cut 15 feet deep at the face, exposing a slightly mineralized, broken up, oxidized, slaty-looking rock about 15 feet in width. The hanging-wall, of a coarse-grained igneous rock, probably andesite, is well defined, striking east and west into the hill and dipping 60 degrees to the north. Sufficient depth has not been gained to get any idea of what the solid vein-matter may be. Above this cut, about 15 feet, another cut has been excavated, and the overburden stripped from the vein for a further distance of 50 feet, showing the same decomposed and shattered slaty material as below, slightly mineralized with chalcoppyrite. Seemingly the shattered slates have absorbed the surface iron oxides until the whole is a soft earthy mass.

At 2,600 feet elevation the vein has been stripped for a length of 100 feet or more along the side-hill, exposing in places ribs of fairly good chalcoppyrite ore. There does not appear to be any definite strike or dip to the vein at this point, or to the hanging-wall, which was so well defined below. It seems to be a mixture of bunches of sulphides in quartz, country-rock, and oxides, all blending into the country-rock above. About 15 feet is the greatest depth obtained anywhere, and it will necessitate extensive exploratory work to define the vein and prove the ore bodies. The property is now under bond.

A number of claims have been staked beyond the *Red Top* this year. The most important of these is the ground of the old *Lucky Frenchman* group, on which considerable work was done in the earlier days of the camp.

This group, consisting of three claims, is situated on the north side of Bear **Rufus Group.** river, below and across from the *George* copper-mine. This group has been held for some years by the owners, B. Erickson and associates. Unfortunately the owners were not on the property when I was in that locality and I was therefore unable to see it.

*Vetron and Comet.*—These claims are owned by the same partners and lie north of the *Rufus* group. It is said that some high-grade ore was uncovered on the *Comet* claim this summer.

#### *American Creek.*

This is a tributary of the Bear river, flowing into it from the north, about fourteen miles up from Stewart, at the *Red Cliff* mine. It heads in the divide between the Coast and Nass slopes, forming a pass which, owing to its precipitous sides and consequent danger from snow and rock slides, is practically impassable.

There are a number of properties on this creek and extensive development-work was carried on in the early days. There was a good pack-trail from the end of the wagon-road, but it is badly overgrown and needs brushing out for four or five miles up to be of any service. The only property examined was the *Mountain Boy* group.

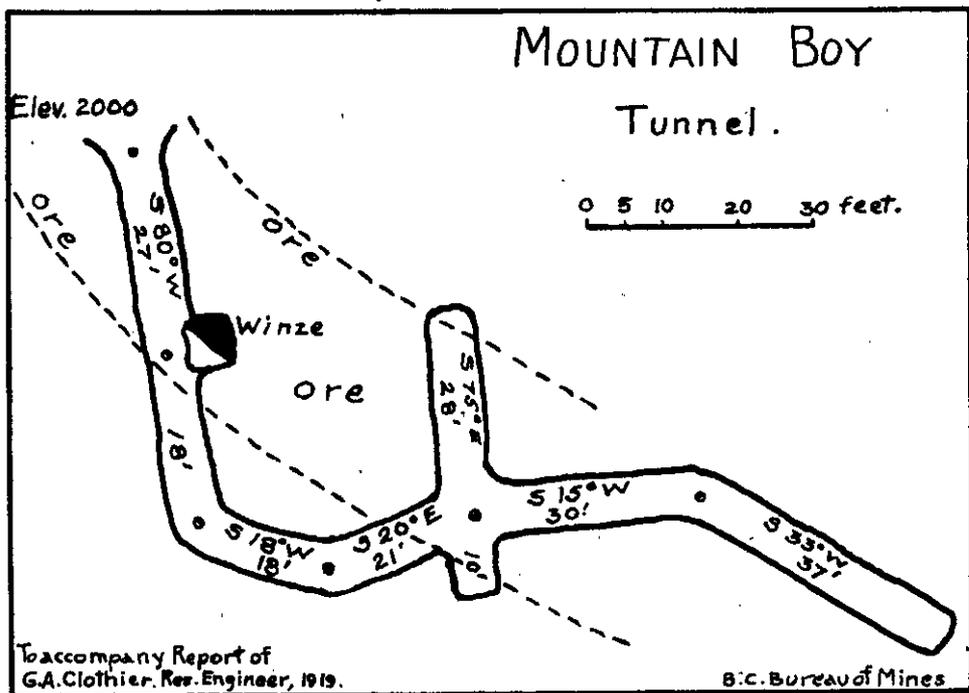
This property is Crown-granted and is owned by John Conway, of Prince Rupert, and associates. There are four claims in the group—*Mountain Boy*, **Mountain Boy** *American Girl*, *Northern Belle*, and *Hard Money*—which is situated on the west **Group.** side of the creek, about five miles from the end of the railroad and wagon-road at the *Red Cliff*. The camp is located on a small wooded hill, or "island," in the middle of the valley, which at this point is probably over half a mile wide.

The general rock formation is a reddish-coloured, medium-grained, sometimes porphyritic rock, probably a red andesite. The hills on both sides of the valley are high and very abrupt,

resulting in talus-banks on both sides along the base of the bluffs to an elevation of from 800 to 1,200 feet above the valley.

The tunnel is at 2,000 feet elevation just above the edge of the slide-rock and 1,200 feet above the camp, from which it is reached by a switchback trail now entirely overgrown with willows. A dry day or a diving-suit is now necessary to get to this property from the mouth of the creek until the trail is cleared.

The vein is well defined on the surface, from 16 to 18 feet wide, and consists of quartz and calcite heavily mineralized with zinc and a little galena. It occupies a shear or crushed zone in the andesite country-rock. At the portal of the tunnel (*see sketch*) the strike of the ore is S. 50° W. and dip 50 or 60 degrees to the south. The tunnel has a bearing of S. 80° W. for the first 45 feet, and consequently runs out of the vein into the hanging-wall at about 30 feet from the portal. It was then swung back and again enters the vein about 60 feet beyond, or 90 feet



from the portal, and at this point a crosscut was run 28 feet through the ore. A peculiar feature is shown in the tunnel, where numerous intrusions cut the vein and formation, leaving open crevices running in all directions, which, however, do not appear to interfere with the continuity or contents of the vein in any way. At a point 27 feet in from the portal of the tunnel a winze was sunk 25 or 30 feet in ore. There was no water in it, but the ladders were unsafe and I did not explore it. I did not have time to sample the ore, but the vein is certainly a big, well-defined one, and an immense tonnage could be developed if the values were sufficient for mill-feed.

On the *Hard Money* claim a tunnel has been driven a distance of 70 feet on a similar vein and mineralization about 12 feet wide.

On the *Northern Belle* claim, in No. 1 tunnel, which is 32 feet long, the vein is shown to be 18 feet wide and consisting of quartz and galena, a sample of the galena assaying a trace of gold, 2.8 oz. silver, and 52.5 per cent. lead to the ton.

I judge this property warrants a thorough examination and sampling. Conditions for mining and milling are good and there appears to be plenty of available ore suitable for milling if the values are satisfactory.

*Bitter Creek.*

This group consists of two claims—*Jutland No. 2* and *Jutland No. 3*—belonging to J. Cowan, Alex. McGinnis, and Jack Watkins, of Stewart. The claims are situated at the head of the North fork of Bitter creek, eighteen miles from Stewart, nine miles from the railroad at the mouth of Bitter creek, and two miles and a half beyond the old *Roosevelt* property, a little above the junction of the North and South forks. There was a good trail from the Bear River wagon-road at the mouth of Bitter creek to the *Roosevelt*, but it is now badly in need of repairs in several places. This year the owners cut out a foot-trail which crosses a small creek just above the *Roosevelt* camp and follows up the east side of the North fork to the camp. A new cabin has been built not far below the foot of the glacier at an elevation of 2,300 feet.

The general rock formation around the glacier is greenstone or andesite, cut by many dykes, and enclosing in places small masses of sedimentary rocks, all badly contorted.

The first showing on the claims, on the right-hand side of the glacier at an elevation of 3,200 feet, is a small vein about 18 inches wide of quartz and ground-up material, containing from 1 to 8 inches of galena and grey-copper, running high in silver values, the best ore assaying over 200 oz. silver to the ton. This vein strikes S. 50° E. into the hill and stands about perpendicularly. It has been picked into in only one place, and there is therefore no chance of forming an opinion of its worth.

Farther up on the same side of the glacier and at an elevation of 3,525 feet a small quartz vein of high-grade galena and tetrahedrite can be seen on the surface, following along the foot-wall of a band of schistose, slaty rock contained in the greenstone, which in this vicinity has been badly shattered judging from the network of healing veinlets of quartz and calcite. No work has been done on this showing. These two veins may yield sufficient high-grade ore to be profitable.

This group belongs to the same owners as the *Jutland* group. There are five claims in the group—*St. Elmo*, *St. Elmo No. 2*, *St. Elmo No. 3*, and *St. Elmo No. 4*—situated on the west side of the glacier and higher up. I did not get up to these claims on account of the snow, but was informed by the owners that the ore is much the same as on the *Jutland* group, but the veins are larger.

*Glacier Creek.*

This property consists of four mineral claims—*Lakeview No. 1*, *Lakeview No. 2*, *Lakeview No. 3*, and *Silver Bell Fraction*—owned by James McKay and Charles Bibeau, of Stewart, but now under bond to Welch, Fetter, and associates, of Seattle, Wash. The claims are located on the north bank of Glacier creek, about two miles and a half by good trail from the railroad spur at the Portland Canal Mining Company's concentrator, four miles from Stewart. There was a good cabin on the property and additional buildings have been erected by the present bonders. The owners have shipped a few tons of high-grade silver ore from the property each year for a number of years.

The vein strikes about east and west, dips 50 degrees to the south, and can be followed on the surface for several hundred feet. Where exposed by an open-cut the vein shows a cross-section of about 9 feet, of which 4 feet on the foot-wall is mainly quartz carrying a little pyrite, the balance being a heavily pyritized quartz. The whole vein mineral content would probably concentrate 7 or 8 into 1. At the time the property was bonded a crosscut tunnel had been driven 250 feet, which should have cut the vein at a depth of 100 feet, but which, however, failed to find the vein. The present work consists of a crosscut driven west from a point 200 feet in the tunnel, where the vein should have been cut had it maintained its dip as indicated on the surface. At a distance of 50 feet in this crosscut it was turned to the right and encountered the light-grey dyke which lies along the hanging-wall of the vein on the surface. The dyke where cut in the tunnel is 4 feet wide, and at the time of writing the crosscut has been driven a foot or two through it into the vein, which has about the same mineralization here as on the surface.

Since the vein has been definitely located at depth further development will be of keen interest to the remainder of this vicinity. Work is being vigorously pushed this winter, with Al. Harris in charge of operations.

**Nabob Group.** This group, adjoining the *Lakeview*, was staked during the summer by J. Watkins and J. Cowan, of Stewart, and this fall bonded to C. G. Skoning and associates, of Lead Point, Wash. Mr. Skoning has informed me that it is their intention to equip the property with a suitable power plant and commence work next year as soon as weather conditions will permit.

**Ruth and Francis Group.** This group was reported in last year's Minister of Mines' Report. Additional work this summer has located the extension of the vein below the present tunnel about 50 feet. The owners, Nesbitt & Archie, of Stewart, are well satisfied with the showing at this point and will continue driving in on it.

**Sunshine Group.** This group is situated on the North fork of the Middle fork of Glacier creek, about five miles by trail from the railroad spur at the *Portland Canal* mill.

There are three claims in the group—*Sunshine*, *Sunshine No. 1*, and *Morning Star*—the first two owned by Fred Young and Godfrey Anderson and the last by Dan Woodmore, of Stewart. The property is reached by the trail on the north side of Glacier creek, passing the *Lakeview* and *Ruth and Francis* camps, and is about a mile beyond the latter and 200 feet lower. The trail to serve this property should therefore break off from the *Ruth-Francis* trail below that camp and cross to the *Sunshine* cabin, thus eliminating the climb and drop of 200 feet. For ore transportation a mile of tramway paralleling the glacier on its north side would land ore at the bridge on the *Ben Bolt* trail, about three miles from the *Portland Canal* siding.

The claims are well timbered and there is plenty of water for camp purposes, while an ample water-power could be developed from Glacier creek. The rock formation is a greenish igneous rock, varying from andesite to diorite, with bands and bunches of argillite enclosed in it. There are four or five known veins on the property. There are two small quartz veins on the *Sunshine* claims, below the cabin and near the glacier, mineralized with zinc-blende, galena, and grey-copper. They are contained in an andesite country-rock.

A few tons of high-grade ore has been taken out of these veins and sacked; however, the zinc content is so high that the ore was refused by the smelters in 1917. It assays 385 oz. silver to the ton. These veins are so small that the cost of getting the ore out would be very high, and the probable tonnage is so uncertain that I consider them unimportant compared with the other showings on the claims.

There is a fine surface showing of chalcopryrite ore, also on the *Sunshine* claims, about 100 feet from the cabin. The vein has been exposed for a width of 8 feet by an open-cut, which, however, has not been driven far enough to definitely determine the width of the vein or get beyond surface conditions. The vein strikes N. 20° E. and dips from 50 to 60 degrees to the west in an andesite country-rock. The vein-filling is quartz, mineralized with pyrite and chalcopryrite, and for an exposed width of 3 feet will average 10 per cent. copper. Several cuts have been put in below this, showing the vein to have split up into a number of small veins occupying a width of over 100 feet, in which are scattered bunches of ore. About 450 feet up the hill above the cabin, or at an elevation of 3,650 feet, another cropping of probably the same vein has had a couple of shots put in it, disclosing from 3 to 4 feet of chalcopryrite ore in a vein width of from 6 to 8 feet. The vein gangue and mineralization are similar to the lower exposure, and if it be the same vein would prove it for a length of 600 or 700 feet on the surface and a depth of 450 feet. About 50 feet below this cropping there are indications in the bed of the creek of a strong quartz vein striking N. 30° W., which would therefore intersect the other vein in a short distance. It would be good development to drift in on this cross-vein to the main vein, which would be intersected at some appreciable depth and would open up both veins. These are very promising showings and well worth opening up by drifting in on them.

On the *Morning Star* claim another well-defined vein is exposed along the bank of a small creek for a distance of 600 or 700 feet, gaining a depth of about 200 feet on the dip of the vein in that length. The strike of this vein is N. 40° E., slightly more easterly than the vein on the *Sunshine* claims, and dips 40 degrees to the east. Along the creek-bed is a belt of diorite which has been the hanging-wall of the vein, but which has broken away, leaving the vein exposed as stated. A few shots have been put in in one place, obtaining a depth of about 5 feet, showing about 2 feet on the hanging-wall of quartz and calcite mineralized with pyrite and chalcopryrite fairly heavily, while the balance is more sparsely pyritized. This also is a very promising surface showing and deserves more work.

Down the hill a stripping from 6 to 8 feet wide and about 30 feet long has disclosed a lens of quartz in argillite, more sparingly mineralized with pyrite and chalcopyrite than the other veins. It is about 14 feet wide and strikes across the bearing of the other veins. Altogether, this is a property of merit and well worthy of considerable development.

This group of three claims—*L. & L. No. 1*, *L. & L. No. 2*, and *Marion Fraction*—**L. & L. Group.** belongs to Jack Lockwood, of Stewart, and partner. The property is situated on the North fork of the Middle fork of Glacier creek, just across the glacier from the *Sunshine* group. It is, however, reached by a different trail, starting from the Portland Canal Mining Company's concentrator and following what is locally known as the *Ben Bolt* trail to just above the second bridge, elevation 1,025 feet, across the Middle fork. At that point it branches to the left, passing Rush's cabin, which is at an elevation of 3,250 feet, about a mile below the *L. & L.* cabin. (See map.)

The main work on the claims is just beyond the cabin up along the south side of the glacier; the latter is certainly an impressive sight from this bank. The development consists of a number of surface cuts tracing the vein up the hill from the mouth of the tunnel. This has been driven about 125 feet on the vein toward getting under the ore-shoot exposed on the surface by the open-cuts. From the portal of the tunnel the vein on the surface is bare of overburden and can be traced without difficulty for 100 feet or more. The first 30 feet shows a small shoot of ore; the next 60 or 70 feet shows no ore, but the vein-fissure can be traced; and from this point the upper ore-shoot has, as stated, been opened up by open-cuts. The lowest one exposes about 10 feet along the vein of from 12 to 18 inches in width of good-grade ore. The vein is quartz heavily mineralized with zinc-bleude and arsenical iron in about equal proportions, with an additional small percentage of galena and grey-copper. The next cut, about 25 feet vertically higher, has exposed the vein for a length of about 40 feet, showing the ore to be from 12 to 24 inches wide at the lower end and increasing to 5 or 6 feet at the upper end, where a cross-vein joins the main vein at a small angle. The upper end of this cut is approximately 100 feet vertically higher than the tunnel-level. The next cut, at about the same interval and about 250 feet from the portal of the tunnel, exposes a mineralization of about 8 feet in width, of which about 3 feet is good ore and the balance a silicified and slightly mineralized country-rock. The top cut is about 25 feet vertically above the last and discloses a vein about 5 feet wide, of which there is 2 feet of solid ore. This cut is approximately 300 feet from the portal of the tunnel on the surface and probably 150 feet vertically higher. There is about 200 feet of what may be considered a continuous ore-shoot exposed on the surface.

In the tunnel there is a small shoot of ore for the first 40 feet corresponding with its exposure on the surface. From there to the face the vein-fissure is followed. The face is beginning to show signs of mineralization, in that there are slightly mineralized stringers of quartz for a width of a foot or more. Judging from the ore-shoot exposed on the surface and allowing it the same slight rake into the hill as the small shoot at the mouth of the tunnel, the face should be into the upper ore-shoot within a comparatively short distance, providing, of course, that it extends down to the tunnel-level. The country-rock in this vicinity is classified by McConnell as augite porphyrite.

A ton of ore was sorted out and shipped in 1913 from the first small shoot showing on the surface and in drifting through it in the tunnel. This gave assay returns as follows: 273.5 oz. silver, 22.1 per cent. lead, 11.5 per cent. zinc, 21.5 per cent. silica, and 11.4 per cent. iron to the ton. I think it would not be a difficult metallurgical problem to concentrate the ore into its different sulphides. Should the ore-shoot extend down to the tunnel-level and retain its size and values indicated on the surface, this will make a profitable small property.

These claims are owned by W. W. Rush, of Stewart, and are situated on the **Evening Sun and Columbia.** South fork of the Middle fork of Glacier creek, about a mile from where the trail forks from the *Ben Bolt* trail and about four miles and a half from the railroad spur at the *Portland Canal* mill. They are old locations and consequently considerable work has been done on them. They lie within the augite-porphyrite area. At an elevation of 2,500 feet, about 300 feet above the cabin, a tunnel has been driven for about 90 feet on a bearing of N. 30° E., following a very well-defined vein of altered and silicified igneous rock. There is an open-cut about 30 feet above the tunnel, from which a few tons of high-grade silver ore was sorted and shipped some years ago. This ore-shoot as proven by the tunnel does not extend to any depth.

The vein stands perpendicularly, with well-defined, slickensided walls, and contains as a rule a band of siderite on each wall with a light-grey gangue between. The siderite carries the main mineralization, of veinlets of antimony and zinc sulphides and occasionally a little grey-copper. No ore of importance has as yet been exposed in the tunnel.

What is supposed to be the continuation of this same vein crops on the opposite slope on the *Columbia* claim. A few tons of ore has been shipped, obtained from small kidneys along the vein-croppings. Numerous open-cuts have been made along the vein, but none of the ore-shoots appear to have much length, and none have been proven at any depth. However, if one were to draw any conclusions from the size and continuity of the vein and the number of small lenses of ore contained in it, it would be reasonable to expect shoots with appreciable tonnage anywhere.

These claims are owned by A. Baggs and W. W. Rush and are amongst the **Excelsior and Eagle.** oldest locations in the Bear River section. They are situated high up on the ridge, 4,000 to 4,500 feet elevation, south of the South fork of Glacier creek.

There is no trail to them other than the owners' trail from their cabin up over the *Columbia* claim, but a very feasible route has been selected from the *Ben Bolt* camp for a trail to be built next summer. The rock formation is of igneous origin, probably lying within the rim of the angite-porphry area, with many dykes cutting through it in a north-west and south-east direction.

There are on the claims several veins of a light-grey coloured rock having a general strike of from N. 5° E. to N. 20° E., throughout which are small veinlets of stibnite, sphalerite, and tetrahedrite, while along the wall is usually from 4 to 12 inches of siderite and quartz carrying high silver values in grey-copper, some galena, and considerable zinc.

What has the appearance of being the main shear-zone strikes N. 20° E. and dips about 50 degrees to the north-west. This "vein" is up to 6 feet in width, with a streak of high-grade ore in it of from 4 to 12 inches wide; the balance with veinlets of sulphides throughout it, but probably not of milling grade. The main vein has been open-cut in several places and a great deal of stripping and trenching has been done. At one place the work shows a length of 50 feet of ore that can be sorted to a shipping grade. The high grade seems to lie in numerous small kidneys in the vein-filling rather than in a continuous shoot. Some further depth can be obtained under this showing, but a long tunnel would be necessary to gain any considerable depth.

There are also two, at least, almost parallel veins striking N. 30° E. uphill, and therefore converging toward the main vein and also dipping slightly toward it. One of these "spur veins" looks promising where stripped for 30 or 40 feet. Under this a tunnel has been run 10 feet along the hanging-wall, gaining a depth of about 30 feet. The high-grade ore, from 4 to 12 inches wide, is on the foot-wall and has been left standing until such time as transportation has been provided, when it can be easily mined. This vein can also be readily opened up on the opposite side of the gulch, where its cropping can be seen. In my opinion these veins will not be large producers, but sufficient high-grade ore can probably be sorted out to make them profitable for small operations. The property is deserving of assistance for a trail from the *Ben Bolt* camp.

Taking into consideration the advancement made during the past five years in the processes of concentration of ores, notably that of flotation, and the present and probable price of silver, I believe it would pay some of the older companies to thoroughly investigate their properties and equipment again, especially such as the *Ben Bolt*, the *Portland Canal*, and other silver properties in that locality. Now would be an opportune time to continue the drift in the long tunnel of the *Portland Canal Tunnels Company* along the main fissure-zone to prospect it, and also to get under the *Portland Canal Mining Company's* mine-workings.

#### SALMON RIVER SECTION.

This section (*see map*) takes in a very small portion of the Eastern Contact Belt lying west of the ridge between the Bear and Salmon rivers and extending north to the headwaters of Salmon river and Cascade creek; in short, it is the drainage area of these two streams north of the Alaska-British Columbia boundary-line. It is about thirteen miles long and from about three miles wide at its lower end to six miles at its northern end, where it extends across the Salmon River glacier; in all, an area of about sixty square miles.

From the head of Salmon river to Clearwater river, a tributary of the Stikine river, is about 100 miles along the Eastern Contact Belt, which with an average width of ten miles gives an

area of 1,000 square miles for exploration, accessible at its southern end by way of the Salmon River valley.

The Salmon River section has had a season of extraordinary mining activity that will have a far-reaching effect on the whole northern portion of the Province. It has been examined and re-examined, sampled and resampled, by many of the most competent and conservative mining engineers in the profession. The result of this has been that the American Smelting and Refining Company has secured a working interest in the *Premier* mine and may be expected to extend its holdings to other properties; the operation of six new properties this winter; the bonding of at least twelve other groups for next season's development-work; and extensive prospecting extending beyond the limits of this section over the Salmon River divide to the Nass slope. All of this would seem to justify the prediction that next year's operations will dwarf this year's, which has been considered an exceptionally active one. It does not need any stretching of the imagination to foresee a wonderfully productive mineral area in this as well as other sections of this district. As the known mineral areas are explored, developed, and brought to the productive stage they will be extended to the Nass slope and north, on the east side of the Coast range, for which railroad transportation will be provided by way of the Bear River divide as the nearest route to tide-water.

The Geological Survey of Canada made an examination of this section this year under the direction of J. J. O'Neill, and at the same time a topographical survey was carried on by F. S. Falconer. This report and geological map will furnish much important information as to the origin, occurrence, and distribution of the ores and their relations to the different country-rocks enclosing the veins. It will prove of great assistance to both prospectors and operators. It is to be hoped that there will be no delay in the publication of this survey, for now is the time it will be of the most benefit.

Acknowledgment is due to Dalby B. Morkill, B.C.L.S., of Stewart, for the privilege of using his timely and very excellent map of the claims in this section. It is compiled from the surveys of a number of groups and is indeed a very creditable and valuable production.

From this map it will be seen that there is little or no vacant ground for staking in the Salmon River valley. Furthermore, it shows the extent of country from the International Boundary-line to the summit at Summit lake, and when this area and its potentialities are compared with that area north from the Bear River divide that has not as yet been touched, it is not easy for one to be conservative regarding the future of that portion of the Province.

The road from the beach at Hyder, Alaska, connecting with the road completed this year from Stewart to Hyder was greatly improved, and, it is said, will be completed from Hyder to the Boundary, thirteen miles, by the Alaska Government and made into a first-class wagon road. With this road extended a further six miles to the *Big Missouri* and *Mineral Hill* properties, it will place operators in the upper valley in good shape to get in any machinery required; provide for ore transportation, especially in the winter-time; give that section the necessary support and impetus for a rapid development to the productive stage; and place the country over the divide within reach of reasonable transportation costs.

It is unfortunate that the construction of a dock at Stewart has been delayed. The present one is in a very dangerous condition and a serious detriment to the handling of heavy freight, such as machinery and ore.

The road has been completed from Hyder to the present dock by the British Columbia Government, thus establishing a thoroughfare from Stewart to the Salmon River valley, but with no shipping facilities.

As will be seen from the statistics of the Government office at Stewart, a great number of claims have been staked this year. In the early spring several of the older and more meritorious properties were bonded and work commenced on them as soon as weather conditions permitted. Permanent camps were erected on the *Forty-nine*, *Big Missouri*, *Bush* mines, and *International*, while temporary summer camps enabled others to get started immediately on development-work. With few exceptions, this year's exploratory work has been highly encouraging and proving an additional incentive to further bonding of prospects.

A number of new companies have been incorporated for the purpose of developing properties acquired, and several properties have been bonded to individuals representing established mining companies.

Many of the properties now under bond were only staked this year, and consequently little or no work has been done on them. In the absence of the owners I was unable to examine such properties, and am therefore not in a position to pass judgment on them or the prospectus issued. I would, however, suggest that the public use some discrimination in its selection of properties and companies in which to "take a chance," confining itself to those prospects which have been reported on by reputable mining engineers. This will eliminate the inevitable "wild-cat" promoter to a great extent and probably save many regrets.

Several prospects on the Alaska side of the boundary-line are developing very satisfactorily. I have been informed by the owner of the *New Alaska* group, Charles Caldwell, that the vein has recently been cut for a width of 20 feet, exposing a good grade of milling-ore for the full width. Other owners and prospectors are enthusiastic over their showings in that vicinity. Dan Lindeborg has a promising showing at 7-Mile, and there are several exceptionally good showings of high-grade silver ore at the head of Fish creek, a tributary of Salmon river.

Of the formation in the Salmon River section, McConnell, in his Memoir 32, says: "The Bear River formation is the most widely distributed formation in the Salmon River district. It occurs bordering the granite a little to the south-west of the International Boundary, on the western slope of Bear River ridge and in the Salmon valley, and, except where overlain by occasional patches of argillites and cut by granitic dykes and areas, underlies the region east of the Salmon river.

"The Bear River formation is predominantly a greenstone formation and represents the products of a long period of vulcanism. The rocks include fine, medium, and coarse volcanic breccias or agglomerates, tuffs, bands, and areas of massive porphyrites, and occasional argillaceous bands.

"In the Salmon valley the greenstones are usually sheared and pass into coarse greenish and greyish schists, the lines of schistosity being roughly parallel to the eastern edge of the Coast Range granitic batholith and dipping toward it at a high angle.

"The shearing is irregular, some areas being only slightly affected, and usually, but not invariably, increased in intensity approaching the granite."

The chief mineral occurrences of the Salmon River district occur in these schistose greenstones and consist mainly of silicified zones carrying metallic sulphides. Fissuring occurs in connection with some of the deposits; few show well-defined walls, but rather a gradual diminishing of mineralization. The mineralized zones are really bands of country-rock partially and in some places wholly replaced by silica and sulphides. The high-grade silver sulphides appear to occur in the more highly silicified portions of the greenstones or in the quartz veins.

This group is comprised of eight claims—*Cabin Group, Lucky, Daly, Grub-stake, Grub, Boundary, and International*—and is owned by Pat Daly, of International Group. Stewart, and associates. The claims lie just above the boundary-line and are easily reached from the 11-Mile road-house by a good trail. The vein is a silicified country-rock containing small veins of pure quartz, all mineralized with pyrite. The more complete the silicification the better the values appear to be. The surface showing consists of open-cuts on either side of a small creek, disclosing a vein 8 to 10 feet wide lying in a greenish schist. The vein could have been drifted on from this point, but no appreciable depth could have been obtained, and it was consequently decided to run a crosscut tunnel from a lower level. This was started at an elevation of 2,275 feet, giving a vertical depth of 160 feet under the outcropping. It will take about 300 feet of tunnel to reach the vein at that level, and about 90 feet of this was driven when the work was closed down. No further work was done on the surface.

This company was incorporated early this year and is the reorganization of the former Salmon-Bear River Mining Company, Limited. The holdings now consist of seventeen claims and fractions, as follows: *Essington, Rupert, Simpson, Pictou, Cascade Falls No. 4 and No. 8, Daly Fraction, Trites Fraction, and Pat Fraction*, which are the claims of the original company, and the remaining claims, *Forks, Cascade Forks No. 1 to No. 6, inclusive, and Wood Fraction*, being a later purchase from the Bunting Bros. Much romance and the most of the facts have been written of the property, and it would therefore be superfluous for me to go further into its history. I might state that three years ago the property was bonded by R. K. Neill, of Spokane, Wash., associated with whom were Trites, Wood & Wilson, of Fernie. It had been previously extensively explored by New

**Premier Gold  
Mining Co.**

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York people, with unsatisfactory results. Under the management of Mr. Neill, work was started in the upper tunnel, and in a comparatively short distance the shoot of high-grade gold-silver ore was struck which has since brought the property and district into prominence.

The development of the property has been carried on in a businesslike way. Underground exploration has been continuous in a small way. A road from tide-water was started in 1918 and used as a sleigh-road last winter, when 488 tons of ore was sorted, sacked, and shipped to the Tacoma smelter, yielding 3,209 oz. gold and 108,285 oz. silver, approximately \$165,000.

This year the road has been greatly improved and will again be utilized as a winter road for hauling out ore this winter. A great deal of work has been done by way of construction. At No. 1 tunnel a blacksmith-shop, 18 x 20 feet, has been built, ore-bunkers remodelled, and a frame building, 24 x 32 feet, built on them for crushing, sorting, and sacking ore. The following buildings have been erected at the camp, the lumber being supplied by a small sawmill which has been under operation all summer: A four-story bunk-house, 30 x 50 feet, the three upper floors, accommodating seventy men, furnished with single beds, electric-lighted and stove-heated, the lower floor for change-room, wash and bath rooms; a two-story mess-house, 20 x 50 feet, remodelled to accommodate seventy men; a two-story office building, 18 x 24 feet; and a two-story assay office, 16 x 20 feet, the upper floor to be used for a laboratory and the basement equipped with the electric-lighting plant for the camp, run by a Pelton wheel, to which is attached a 1,600-foot 4-inch water-line, and also containing the crushing and sampling plant. At No. 2 tunnel, elevation 1,750 feet, a fan has been installed and a snow-shed, 200 feet long, built.

At the Plate tunnel extensive improvements have been made, consisting of a three-story bunk-house, 20 x 42 feet, the two upper floors for sleeping-quarters for forty men and the lower floor for change and wash rooms; a two-story mess-house, 20 x 42 feet; a blacksmith-shop, 18 x 24 feet; and a timber-shed, 30 x 60 feet, in which a fan and a small compressor will be installed for the winter's work in this tunnel. Accommodations have also been built at 9-Mile for teams and teamsters.

The No. 1 or upper tunnel is now in about 600 feet (November 1st), of which about 200 feet has been driven this year. This work has been following the ore, with a few minor breaks, from a point about 200 feet from the portal of the tunnel, where work was started by the present owners, making a total length of about 400 feet of drifting on the vein. In this are shoots of bonanza silver ore, with the balance of the vein, which is estimated to be 20 feet wide, of rich milling-ore. Crosscuts from the old portion of the tunnel show this ore-shoot apparently extending to a point 85 feet from the portal of the tunnel, where it was disclosed by the first work done by Mr. Neill, or a total length of over 500 feet. Three crosscuts have also been driven this year—No. 5 crosscut for 68 feet, No. 6 for 8 feet, and No. 7 for 20 feet.

In No. 2 tunnel the crosscut has been extended to 215 feet, crossing what appears to be the continuation of the ore-body exposed in the mouth of the tunnel.

Further work this winter will consist of shipping all the ore that can be hauled to the beach; driving No. 1 tunnel and raising from Nos. 1 and 2 stopes; the continuation of No. 1 crosscut in No. 2 tunnel; and the extension of the Plate tunnel, which is now in about 600 feet, toward getting under the ore-shoot exposed in No. 1 tunnel, which is 675 feet higher than the Plate tunnel. It is expected that about seventy men will be employed all winter and from 2,000 to 3,000 tons of ore shipped. A snow-tractor will be tried out for ore-haulage this winter. (Proven useless.)

This fall the American Smelting and Refining Company acquired an interest in the property after exhaustive examinations by its engineers. Mr. Neill retains the management, with Mr. Pitt as superintendent at the property. Under this arrangement a vigorous campaign of development and equipment may be expected that will put the property on a producing basis commensurate with the extent and value of its ore exposures.

**B.C. Silver  
Mines, Ltd.**

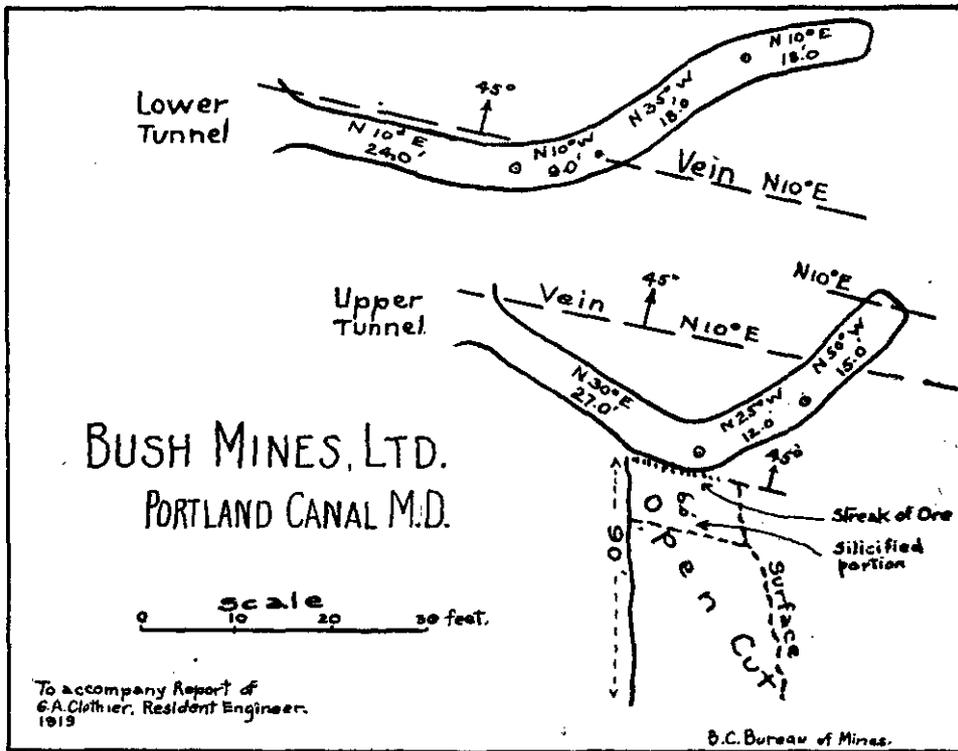
This company has recently been incorporated for \$1,500,000 by O. B. Bush to take over the *Lake* and *O'Leary* claims, lying between the *Premier* and the *Bush Mines, Limited*; and some claims north of the *International* group. I believe that a little work was done on the *Lake* and *O'Leary* property this summer, but as there was no one on it when I was in that vicinity I was unable to make any examination of it.

**Bush Mines, Ltd.**

The prospectus of the company states that the property consists of six claims—*Leslie*, *Leslie M.*, *Leslie No. 2*, *Leslie No. 5*, *Leslie No. 6*, and *Mahood*. The company is capitalized for \$1,000,000 for 1,000,000 shares, and has its head

office in Vancouver. The claims are situated on the East fork of Cascade creek, the showings being about a mile north of the *Premier* camp, and are reached by a trail branching from the *Premier* wagon-road.

A very creditable amount of work has been done this year under the superintendence of Harry Tanner. Good camp buildings were erected early in the spring and a crew of eight or ten men put on development-work. An open-cut was put in along the side-hill for a distance of 90 feet in the solid rock, crossing an altered belt of greenstones. The schistosity parallels the strike and dip of the belt, which is N. 10° E., dipping about 45 degrees to the west. The zone is more altered and silicified, and therefore better mineralized, on both walls than in the central portion. For about 6 feet on the hanging-wall there are small stringers, running in all directions, carrying the main mineralization of high-grade silver sulphides, mainly argentite, while right on the wall is an inch or two of fairly solid ore. On the foot-wall of the zone, also, is about 6 feet of similar formation, but even more sparsely mineralized, and in either the average values would be very low grade. The central part, about 80 feet in width, is slightly pyritized, and with a few unimportant stringers of silver sulphides near the more silicified portions on the walls, the whole giving no indications of containing any appreciable amount of ore. About 15 feet



below the big cut another cut was made 15 feet wide, from which a tunnel was driven, starting on the hanging-wall as indicated in the cut above. The tunnel has a bearing of N. 30° E.; therefore bearing away from the hanging-wall for a distance of 27 feet through a blocky, cross-fractured schist slightly mineralized in places. The tunnel was turned to the left from this point and driven 12 feet at N. 25° W.; then N. 50° W. for 15 feet to the face, where it exposes a small streak of ore striking N. 10° E., the same as on the surface, and evidently the hanging-wall of the zone. Farther down the hill about 20 feet another tunnel had been driven about 60 feet on different bearings. (See sketch.) It looks as if this tunnel were off in the hanging-wall. No ore was showing except an occasional streak. Altogether the work done here has not been productive of very encouraging results.

Another tunnel was being driven into the hill about 400 feet farther down the creek. There is a small showing on the surface just above the mouth of the tunnel, but as it was in about

90 feet the face was far beyond this cropping. In the absence of the superintendent I could get no information as to the purpose of this tunnel. It was in country-rock all the way.

*Northern Light Group.*—This group, consisting of ten claims and a fraction, has been bonded to W. A. Meloche. The claims are situated west of the claims owned by the Bush Mines Company, Limited, and were owned by the Bunting Bros.

*Cobalt Group.*—This group of three claims, situated north of the *Northern Light* group, was owned by J. Hovland, of Hyder, Alaska, but has been bonded to W. A. Meloche.

There are three claims in this group—*Spider*, *Spider No. 2*, and *Spider No. 3*—

**Spider Group.** situated about three-quarters of a mile north-east of Long lake, which is the source of Cascade creek. They were owned by Bill Hamilton and Charlie Larsen, two "old-timers" of Stewart, and are now under option to W. A. Meloche. In the early spring the property was bonded by Trites & Wood, part owners in the *Premier* mine, who did a little development-work, but did not exercise their option. I have not been on the claims, but I understand from the owners and others that some very high-grade silver ore was exposed with the small amount of work done. Mr. Meloche is now taking in supplies over the snow (February) and will commence development-work as soon as permissible.

Several claims were staked this season over the Long Lake divide on the Nass slope, and some high-grade samples of silver ore brought out, assays as high as 600 oz. silver to the ton being obtained. The owners went back late in the fall to build a cabin with the intention of staying in during the winter and developing their finds. It is significant that the same class of ores as in the Salmon valley are being found on the other side of the divide.

This is a recently incorporated company formed to take over the *Silver Hill* group of claims, situated on the east side of Dillworth glacier. (See map.)  
**Silver Crest Mines, Ltd.** The group contains eleven claims—*Idaho*, *September Frac.*, *Argentite*, *Polybaccite*, *Proussite*, *Pyrargyrite*, *Stephanite*, *Native*, *Hessite*, *Cerargyrite*, and *Stromeyerite*. In the absence of the owners I was unable to find the showings, but I understand that it was examined by P. W. Racey, on whose recommendation the incorporation was made for the purpose of acquiring and developing it. The capitalization is for 200,000 shares at 25 cents each.

Four claims—*Unity*, *Unicorn*, *Unicorn No. 2*, and *Unicorn No. 3*—compose this  
**Unicorn Group.** group. They are situated east of the upper claims of the *Big Missouri* group. The property has been under bond all summer to J. R. McDonald and considerable work done by way of stripping and open-cutting. Unfortunately the season's work was completed when I was on the property, and in the absence of any one familiar with the ground I did not find all the workings. In the cuts examined there was good-looking ore exposed and Mr. McDonald is enthusiastic with the values obtained. Extensive work is planned for next year, and an attempt may be made this winter to get a diamond-drill started.

*Salmon River Mines Co., Ltd.*—This company was organized in Victoria to acquire and develop the *Sunset* group, situated at the foot of Dillworth glacier, north of the *Unicorn* group. The property consists of two claims—*Sunset No. 1* and *Sunset No. 2*—staked this year and owned by Dalby Morkill and Bill Fiiller.

*Silver Tip Group.*—This is an old group of claims consisting of *Silver Leaf*, *Bella Coola*, and *May P. J.*, now owned by J. V. Clegg, of Hyder, Alaska, and associates. There is a quartz-outcropping carrying about 8 inches of galena, in which were found high values in silver. A tunnel 40 feet long has been driven in on the vein from Silver creek, showing a little ore.

*Montana Group.*—This group lies between the *Forty-nine* and *Unicorn* groups and was staked early in the year by Bill Murphy and associates. I understand that a little work has been done on some promising surface showings.

This company was incorporated in March of this year with a capitalization of  
**Forty-nine Mining Co., Ltd.** \$1,500,000 for 1,500,000 shares at \$1 par value. The head office is 701 Rogers Building, Vancouver. Its holdings consist of the *Forty-nine* group of mineral claims located by Dan and Andy Lindeborg, from whom they were purchased by the company. The claims comprising the present group are nine in number—*Dickens*, *Darwin*, *Dumas*, *Chicago*, *Boston*, *Million Dollar Fraction*, *Yellowstone Fraction*, *Forty-nine*, and *Oxidental*. They are situated about twenty-three miles away from tide-water on the east side of Salmon glacier, and are reached by a continuation of the trail to the *Big Missouri* cabin, a distance of about three miles.

Considerable surface work had been done by the owners, who in the early days hauled their supplies on a sled from the beach, crossing the Salmon river at 9-Mile; then across the Texas Creek flat over the little divide to the foot of the Salmon glacier, and from there up over the glacier to the shore below the property, from which point the back-pack was used to the claims.

The first work was on the *Forty-nine* claim, on which an open-cut was run across a cropping for 20 feet, showing ore for that width, of which 8 feet was of better grade, but the whole averaging \$3.20 in gold and 19 oz. silver to the ton. On the foot-wall of this vein there is a 25-foot dyke which must lie within the vein, as a later open-cut on its south side exposed an additional 6½ feet of ore, assaying 80 cents in gold and 65.6 oz. silver to the ton. This has always been considered the main vein.

Open-cuts above this cut exposed two smaller veins—one 2 feet wide assaying 72.6 oz. silver a ton, and another 10 feet wide assaying \$1.20 in gold and 6 oz. silver to the ton.

South-west of the big cut a width of 20 feet of broken-up quartz has been exposed by an open-cut, from which sorted ore assayed \$6.40 in gold and 29.8 oz. silver to the ton. There has been no work done any farther north, but the surface gives every reason to believe that extensive ore-bodies will be found when the ground is explored.

It will be seen from the above that the surface showings on the property look very promising. The present company did not get started until July owing to the lateness of the season, and credit is certainly due the energy of Harry Howson, manager: Vince Lade, in charge on the hill; and the Crawford Bros.' pack-train for the amount of work that had been accomplished by the middle of October. A two-story bunk and mess house, 16 x 52 feet, to accommodate fourteen men, and an assay office, 12 x 14 feet, has been built on the camp-site and a blacksmith-shop at the tunnel, all the lumber being packed on horses from the beach. A force of from eight to twelve men was maintained, and extra supplies for winter, including 200 cases of kerosene to be used for cooking and heating purposes, as no wood was available, were packed in.

A tunnel was started at an elevation of 4,100 feet, or about 100 feet above the camp, on the main vein exposed on the surface by the old cuts. This had been driven over 100 feet, cutting diagonally across a milling grade of ore in which are streaks of high grade. It is said that the grade of the ore has materially improved as the tunnel approached a point under the exposure on the surface. I have no doubt that there will be developed in this vein a big tonnage of milling-ore, with the probability of encountering shoots of shipping grade. A contract was let to Boyle Bros. for diamond-drilling this vein. They put a machine on the ground, but very little drilling was accomplished on account of insufficient power. It was unfortunate that this work could not have been carried out for the information it would have afforded in planning the underground work.

The surface has been systematically prospected and sampled all season and an assayer employed at the property. This work was successful in discovering a cropping of ore on the *Ocidental* claim, on which a tunnel had been driven about 30 feet, disclosing a quartz vein from 18 to 36 inches wide, lying in greenstone formation and carrying high values in silver sulphides. The vein has been traced on the surface for some distance above the tunnel, showing good values and size, and has every appearance of becoming a very valuable producer. Work is being pushed in both tunnels by a crew of from eight to fourteen men. The camp, notwithstanding the arctic appearance of its location, is proving to be most comfortable. The most detrimental feature to this property and the country north of it is, of course, lack of adequate transportation facilities. However, the improvement of the main pack-trail from the Salmon River wagon-road to the old cabin on the *Big Missouri* group, and the extension of it through to the *Forty-nine* camp, would be of the greatest benefit until such time as the wagon-road is continued through.

The country beyond the *Forty-nine* group has all been staked this year, and it is said that there are several showings worth investigation. The trail should be extended beyond the *Forty-nine* camp as far as it can be built.

Across the glacier a number of claims were staked all along the shore, and also along the north shore of the west branch of the glacier.

**Yellowstone Group.** The three claims—*Yellowstone*, *Bute*, and *Old Timer*—comprising this group are situated west of the *Forty-nine* group and just above the glacier. They are owned by Bill Murphy, of Hyder, Alaska, and associates. This is one of the oldest groups in this section and has had considerable surface work done in open-cutting, stripping, and trenching, disclosing some very fine ore. It no doubt contains

the extension of the vein being opened up on the *Forty-nine* claim and has therefore about the same possibilities.

**Hercules Mines, Ltd.** This property consists of five claims—*Glacier, Martha Ellen, Cornelius, Empire,* and *Leckie Fraction*—situated north of and adjoining the *Tip Top*, the end claim of the *Big Missouri* group. The trail to the *Forty-nine* crosses these claims. It was worked in 1910, the work consisting of several hundred feet of open-cutting, trenching, and shaft-sinking, which exposed a vein from 5 to 30 feet wide, lying in greenstone-schists and mineralized with galena and considerable chalcopryrite carrying gold and silver values. The croppings, at an elevation of 3,500 feet, have been traced for nearly 2,000 feet. The company's head office is in Vancouver, and I am reliably informed that work will be resumed on the property next summer.

**Big Missouri Group.** This group consists of sixteen full claims and four fractions, extending along the east side of Salmon glacier for over two miles and about twenty miles from tide-water. It is one of the oldest groups in the section and was owned by Dan and Andy Lindeborg and the Stevenson and Proudfoot estates until bonded to the Pacific Coast Exploration Company, Limited, last year. The property has been described from year to year in the Minister of Mines' Report. It has been examined by many of the best mining engineers on the continent, and it is generally conceded that it contains one of the largest surface showings of ore in the country.

The work of the last two years has been on another portion of the property, the *E Pluribus* and *Laura* claims, adjoining the *Mineral Hill* group, on which there are some fine outcroppings of high-grade silver ore that extend on to the *Big Missouri* ground. On the *E. Pluribus* claim the showings have been extensively exposed on the surface by open-cutting and trenching, which have exposed very fine ore.

This year, under the supervision of C. F. Sturtevant, a substantial and comfortable camp was established on the *Joker* flat and further open-cutting and trenching done on a lower bench just above Silver creek. This surface work proved so encouraging that a tunnel was started on the east side of the creek for the purpose of undercutting the showings exposed. A blacksmith-shop, housing for a fan, and snow-shed over the track to the dump were built at the mouth of the tunnel. It had been driven 80 feet at the time I was on the property (October 18th), through greenstone-schist country-rock. This tunnel is being driven with two shifts this winter.

Diamond-drilling was started as early as possible with the object of determining the surface exposures at depth. In all, nine holes were drilled, aggregating 2,400 feet, on the south-east corner of the *E Pluribus* claim. Five of these holes were vertical from the top of the hill, where some high-grade ore cropped; one horizontal from the side of the hill; two flat holes and one vertical hole at the creek-level. While no information is available for publication, I may say that the results obtained have been sufficiently satisfactory to warrant further development on a comprehensive scale. To this end, camps will be erected on the *Province* claim next spring and an exhaustive investigation, by diamond or other drilling, made of the "big showing."

Experiments are being carried on with the complex ores of the "big showing" to work out, if possible, an economical separation and concentration process. When this is successful the *Big Missouri* will develop into one of the big producers of the continent, if surface showings can be taken as indicative of quantity and quality of ore. Next year's diamond-drilling will be of the utmost interest and importance to the Salmon River section.

The high-grade silver ores are now claiming all the attention, but the ultimate success and permanency of the section depend on the tonnage of milling-grade ore.

**Mineral Hill Mines, Ltd.** This company, with its head office at Vancouver, has recently been incorporated with a capitalization of \$2,500,000 for 2,500,000 shares to exploit the *Mineral Hill* group of claims. The company's holdings now consist of seven mineral claims—*Little Joker, Lookout, Mystery Fraction, Pass Fraction, Mineral Hill, Midas,* and *Midas Lake Fraction*—situated east of and adjoining the *E Pluribus* and *Laura* claims of the *Big Missouri* group. The property has been worked under bond for the past two years by Welch, Fetter, Carlton, and associates, of Seattle, Wash. Under the energetic supervision of Al. Harris a great amount of work has been done, consisting of numerous trenches and open-cuts on the surface and several hundred feet of underground work. The main tunnel has been driven about 400 feet and about 300 feet of crosscutting and drifting done. The surface work exposed several showings of silver ore rich in native silver and argentite. The tunnel was driven to get

under the more promising of these surface exposures, and although some high-grade ore was found, the general results did not fulfil expectation indicated on the surface. However, the work was satisfactory in that sufficient milling-grade ore was encountered to justify opening up the property on an extensive scale.

Several short tunnels were put in under the high-grade shoots nearer the surface, showing them to extend to that depth at least. The underground work shows some very interesting features, indicating two sets of filled and enriched fractures at right angles to each other.

Drifting on an east-and-west fracture, crossed in the second north crosscut, has disclosed a shoot of very fine ore. A drift east from the No. 1 north crosscut is also showing up some good ore.

The property, though well supplied for all winter work, was closed down the first of the New Year for the purpose of completing the organization of the company. Work will resume about May 1st, and an aggressive policy of equipment and exploration of the property may be expected for the future. The placing of the property on a producing basis is within sight, and it would be greatly benefited if adequate means of transportation were available.

**Pay Roll Group.** This group consists of two claims—*Pay Roll No. 3* and *Pay Roll No. 4*—owned by Bill Murphy, of Hyder, Alaska. They lie south of Noname lake and north of the claims of the Indian Mines Company, Limited. The property was under bond early in the year and some little work done in surface trenching, etc. This work proved unsatisfactory and the bond was not exercised.

**Boundary Group.** This group is owned by Dan McIntominey. The claims, four in number—*Boundary No. 1*, *Boundary No. 2*, *Boundary No. 4*, and *Missing Link Fraction*—are situated north-west of and adjoining the *Indian* group. A 40-foot tunnel and a series of open-cuts were driven in 1911 and the claims Crown-granted in 1913; no further work has been done since. A strong pyritized quartz vein was crosscut by the tunnel and traced for some distance on the surface. It carries some galena, but the whole was low grade. The size of the vein and encouraging values warrant further work.

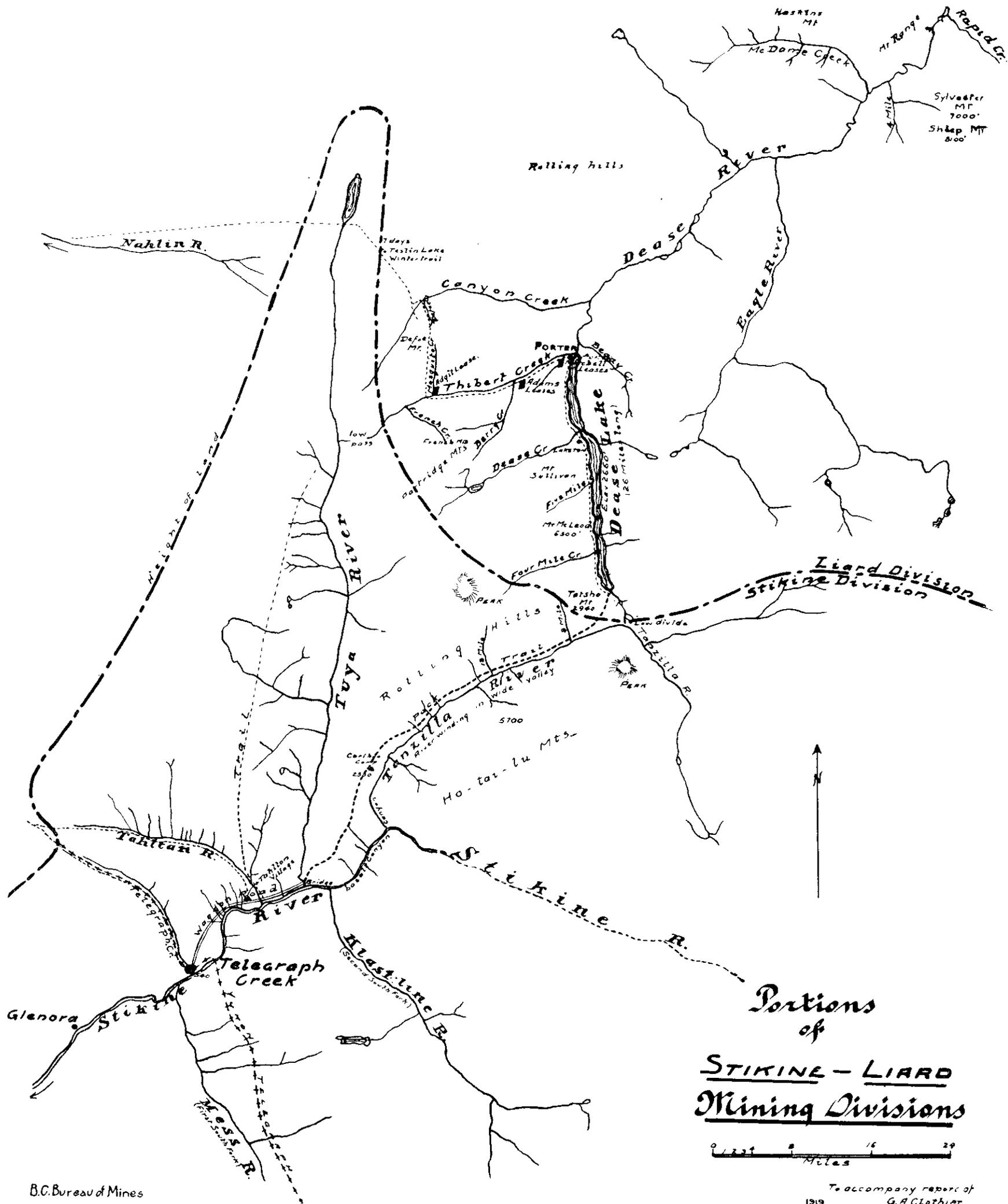
**Indian Mines Co., Ltd.** This property was reported on last year and no work has been done this season. This is one of the old prospects in this section, on which several hundred feet of underground work has been done, exposing ore-shoots which deserve further development. The face of the upper tunnel shows a width of 14 feet of ore, which is no doubt the downward continuation of the surface exposure on the top of the ridge. The vein can be traced to the upper limit of the claim, and altogether the property is worthy of more work; the tunnel seemingly was stopped just when it was opening up ore which may prove a valuable shoot. The registered office of the company is Prince Rupert and L. W. Patmore is secretary.

*Woodbine and Kitchener.*—These claims, belonging to Dave O'Leary and situated just above the forks of Cascade creek, on the west side, have been bonded to W. A. Meloche.

#### STIKINE MINING DIVISION.

This Division takes in the whole drainage area of the Stikine river and is accessible from the Coast by way of Wrangell, a port of call of the Canadian Pacific Railway Coast boats running through to Skagway, and from there up the Stikine by river-boats to Telegraph Creek. The southern end of the Division is traversed by the Iskut river, a tributary of the Stikine, which is navigable for small boats for about forty miles, and safely for the Stikine river-boats for about ten miles from its mouth. It has been pointed out in reports to the Dominion Government that the expenditure of about \$25,000 in cleaning out the channel of snags and other debris would make it navigable for its full length to the canyon, about forty miles.

For the past two years there have been good transportation accommodations furnished by the Barrington Transportation Company up the Stikine river. A river-boat of 50-ton freight capacity and accommodation for twenty or twenty-five passengers leaves Wrangell each week, meeting the Canadian Pacific Railway boat from the south, and reaches Telegraph Creek in from two to three days, a distance of 160 miles, stopping at the Boundary each way, where there is a Mining Recorder's Sub-office. The fare from Wrangell, including meals, is \$25 and freight rates \$45 a ton through to Telegraph Creek, with proportionate charges for intermediate points. The return fare is less, as the down-trip is made in about twenty-four hours. Prospectors can have supplies



Portions  
of  
STIKINE - LIARD  
Mining Divisions

0 5 10 20  
Miles

discharged at any desired point along the river, and when traffic warrants a side-trip of ten miles up the Iskut can be made, which will be a big help to prospectors going into that section of the country.

The Iskut river appears to be about the line of contact of the granite with interior rock formation. The south side of the river is apparently massive granite.

On the Stikine the Coast granites extend to the "big glacier" on the west side of the river, or possibly a little farther; beyond that, up the river near Glenora, where the basalt-flows appear, is within the Eastern Contact mineral-zone. There have been a few claims staked along the river, but the amount of prospecting done is negligible in such an extent of country. Telegraph Creek, the head of navigation, is the central point from which all the interior country in this Division is reached.

#### CLEARWATER RIVER.

The Clearwater river flows into the Stikine from the west, about thirty-eight miles below Telegraph Creek or about ninety miles above the boundary-line. It is navigable for powerful gas-boats and small river-boats by poling and lining for a distance of thirty miles, and traverses a portion of the Eastern Contact Belt that should be worthy of any prospector's time.

The only work being done at present is by J. M. Jackson and partner, who are sluicing on a lease situated about a mile up the North fork, which joins the main river about eleven miles from its mouth. They have been working here for some years, prospecting along the creek on rim-rock wherever available and on the bars and benches. Their present work consists of dyking off about 200 feet in length along the creek and the installation of a pump. Everything was in readiness to take advantage of low water, when it would be possible to pump out the dyked-in portion, get down to bed-rock, and work into the bank toward the rim. The prospects they had found at the spot were very encouraging and they were very optimistic of a fair clean-up. No later information has been obtainable.

Some years ago Conover and Wilson (two "old-timers" who have lived about two miles above the mouth of Clearwater on the Stikine for about twenty years) and Jackson took out several thousand dollars from a low bench about half a mile below Jackson's diggings. The run of gold was practically on the surface, not more than 12 feet of depth being reached anywhere over an area 200 or 300 feet long and about 100 feet wide.

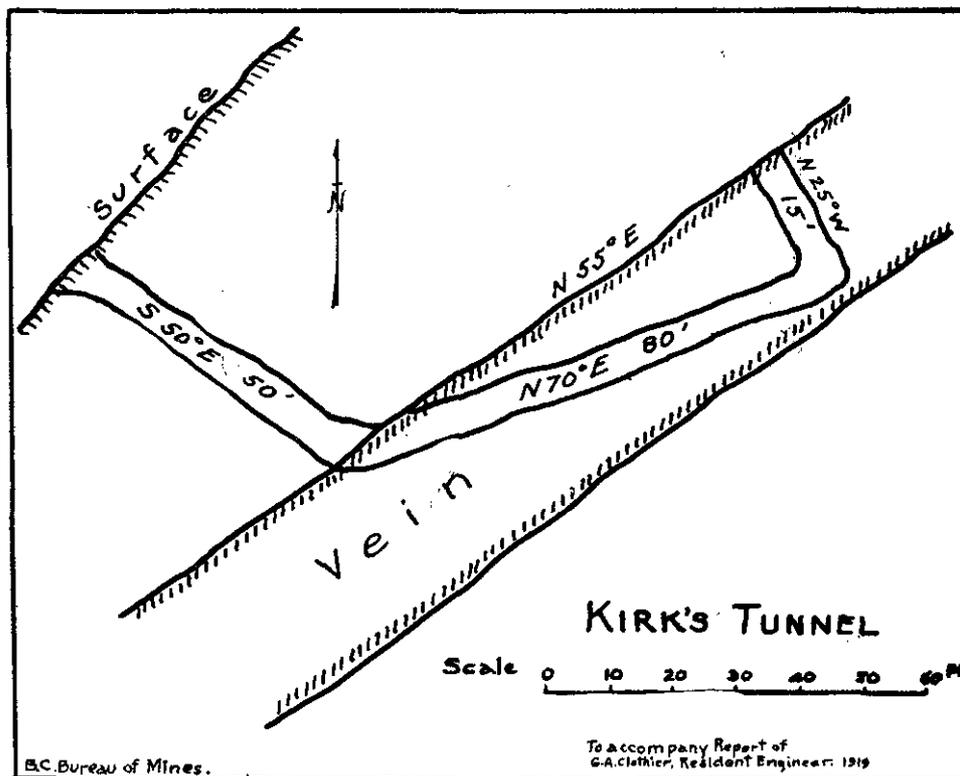
From the mouth of the main river up there are extensive bars and benches of river-gravel showing colours wherever panned, and which, I believe, would be well worth drill-testing for hydraulicking and dredging purposes. A drill could be landed from the river-boat anywhere near the mouth of the river or at Conover & Wilson's cabin and taken up the river in the winter without any difficulty. There is a fair trail from Conover's cabin, with the exception of a few stretches along the river-bank where it has been washed out by high water. The upper six or seven miles are along gravel benches and with a little brushing-out of the jack-pine growth would make a first-class wagon-road.

**August.** This claim is owned by L. Kirk, who has a ranch on the east side of the Stikine just above the mouth of the Clearwater. Mr. Kirk is another "old-timer" along the Stikine and is deserving of much credit for the fine little ranch he has cleared and under cultivation. The mineral claim is situated on the mountain-side about two miles from the ranch, from which there is a first-class foot-trail built by the owner. The camp on the claim is at an elevation of 2,900 feet, and the owner, who is well over seventy years of age, has certainly accomplished a very creditable amount of work alone. At an elevation of 3,175 feet a tunnel has been driven of 145 feet in length. (*See sketch.*) The first 50 feet is driven through a dioritic-looking igneous rock, encountering the vein or mineralized belt, which appears to be a brownish, altered and silicified, igneous rock, somewhat porphyritic. Throughout the vein matrix are small veinlets of quartz carrying bornite and chalcopyrite. The tunnel turns to the left and cuts diagonally across this belt for 80 feet at a small angle, and from that point turns again to the left, back across the vein for 15 feet to the wall, on a bearing of N. 25° W. The vein strikes N. 55° E. It is about 15 feet wide on the surface and is evidently of average low grade, probably from 2 to 4 per cent. copper.

Below the tunnel there is a similar zone from 40 to 50 feet in width, in which are stringers and veins of quartz up to a foot wide, well mineralized with bornite and chalcopyrite. There is another outcropping, north of the one under which the tunnel has been driven, at an elevation of 3,475 feet, from 2 to 6 feet wide, striking north and south and dipping from 60 to 65 degrees to

the east. This zone or vein is more silicified and consequently better mineralized than the other showings. The continuation of the crosscut portion of the tunnel would probably encounter this.

I doubt if any appreciable amount of shipping-ore could be produced by hand-sorting, but so far as can be seen there is sufficient bornite to make a high-grade copper concentrate, but it



would require extensive exploration-work to ascertain if there is sufficient tonnage of milling-grade ore to justify a concentrator. Mining and milling conditions are good and transportation would not be a detriment.

This claim also belongs to Mr. Kirk. It is situated about six miles north of **Mountain Goat.** the *August* claim, at about the same elevation. There is a good trail to it from the ranch. The owner states that there are two or three parallel veins similar to those on the *August*.

This group consists of at least the four claims—*Stikine Nos. 1, 2, 3, and 4*—**Stikine Group.** owned by Tervo & Bodell, and possibly the two claims—*Tonopah* and *Vesuvius*—owned by Pete Hamlin. The claims are situated at the Devil's Elbow, about four miles below Frank Jackson's ranch at Grand Rapids. The group was under option in 1915 to the Stikine Mining Company, a company formed by Sam Silverman. Considerable work was done on them at that time, consisting of three tunnels; good camps were built at an elevation of 1,900 feet, to which there was a good trail from the cabin on the river at the foot of the rapids.

At an elevation of 2,200 feet the upper tunnel was driven in about 80 feet on the foot-wall of a limestone-belt which showed a width of from 20 to 25 feet at the mouth of the tunnel, overlying a slaty formation. On the foot-wall of the limestone it has been somewhat altered to an epidote, in which occur bunches of zinc-blende. In the tunnel the limestone has been gouged out in every direction, apparently following these zinc bunches. The lime-belt strikes N. 50° W. and dips S. 30° toward the river. Below this tunnel the surface has been open-cut, following along the foot-wall of the limestone, and here showing some zinc and stained with copper. Another tunnel, 2,140 feet elevation, was driven 70 feet across a mixed slate and limestone formation. There is no mineral showing in this tunnel. At 2,100 feet elevation the lowest tunnel was driven 300 feet, following some calcite and quartz seams, in which occasionally

occurs a little zinc-blende lying in a slate formation. No indications of any appreciable mineralization in this tunnel. Altogether the showings do not hold out much encouragement.

This claim, owned by Peter Hamlin, is north of and adjoining the *Tonopah*.

**Vesuvius.** A small open-cut on the top of the hill at an elevation of 3,375 feet exposes a length of 6 feet and a face of about 6 feet, in which there is about a foot of quartz well mineralized with galena and zinc. A little farther along another cut shows a small vein of zinc-blende associated with a diorite dyke, and also showing hornblende, epidote, and actinolite, and is therefore probably an altered portion of the dyke. There is a little chalcopyrite exposed here.

This claim is owned by Frank Jackson and Walter Vivian, of Telegraph Creek.

**Grey Bird.** On the top of the hill, at an elevation of 3,550 feet and north of the *Vesuvius* claim, there are widely distributed outcroppings of pyrrhotite, with a little chalcopyrite scattered through it. In an area of 200 or 300 feet square there are several croppings lying in a greenish igneous rock, probably diorite. No work has been done, and as the surface is heavily oxidized the nature of the ore underneath could not be ascertained. The owners claim to have obtained an assay of 48 oz. silver a ton across several feet. The extent of the croppings are very favourable-looking and some depth should be obtained to get into the solid. Sinking would have to be done as the surface is almost flat, though 50 feet depth could be obtained by a 100-foot tunnel at one point. The claim is favourably located, overlooking the river, which could be reached with a short tramway. I would recommend some exploratory work.

There is a group of claims up 4-Mile creek, four miles below Telegraph Creek, on which the owner, Guy Carson, was doing some work, but having no guide on my trip down the river I was unable to find the property.

#### ISKUT RIVER SECTION.

This area consists of about thirty or forty miles along the Iskut river, for the greater part in the Eastern Contact Belt. The Stikine boat got up thirty-six miles with me, but the risk is so great on the return trip that the present cost is prohibitive. With the exception of two groups staked thirty-six miles up, there has been practically no prospecting done in this section.

This company was incorporated about ten years ago and has its head office in **Iskut Mining Co.** Wrangell, Alaska. Its holdings consist of two groups of claims, Crown-granted, situated on Johnny mountain, about thirty-six miles up the Iskut river. The upper claims, known as the *Iskoot* group, are the *El Ora*, *Golden Pheasant*, *Iskoot*, *Margurritte*, *Copper Queen*, *Silver King*, *Brown Bear*, *Silver Dollar*, and *Blue Grouse*. The lower claims, the *Red Bluff* group, are the *Red Bird*, *Katherine Frac.*, *Red Bluff*, *Homestake*, and *Mermaid*.

The rock formation in the comparatively small area I was able to cover in the short time at my disposal is predominantly greenstone, in which broad bands or belts of it have altered to schists and have become silicified and pyritized. There are also belts of slates and intrusions of spurs and masses of granite, all very similar to the areas at the heads of Alice arm and Portland canal, except that the different formations here appear to have a more definite trend, of nearly east and west.

On the upper group, at an elevation of 2,100 feet, an open-cut has been run in a greenstone-schist, in which are seams and small veins of quartz mineralized with pyrite and chalcopyrite, and small veinlets of solid sulphides occurring mainly in the decomposed seams. About a ton of chalcopyrite ore was sorted from this cut and shipped several years ago, giving returns of \$1.20 in gold, 44.2 oz. silver, and 12.45 per cent. copper to the ton.

Traces of argentite are found associated with the sulphides, accounting for the high silver values in some of the samples taken by the owners. Across the exposed mineralized width of 3 or 4 feet the total ore content would be about 6 inches; the sulphide seams are not continuous, but rather are small lenses lying along the planes of the schist. The general strike of the schist is about N. 70° E. About 50 feet north of this cut another was driven into the vein, which here shows a little chalcopyrite. South of these another trench has been made along the side-hill for 75 feet, uncovering the vein, but no depth was obtained. A little chalcopyrite is showing. This mineral-belt might develop a tonnage of commercial ore with further work.

Down the hill from these showings the greenish schists gradually blend into a white chloritic schist fairly well pyritized with disseminated small grains. This belt is about 800 feet

wide and carries traces of gold wherever sampled. No work has been done on it. Basaltic dykes cut the formation at almost right angles, S. 10° E., into the hill.

The *Red Bluff* group is staked to include an immense outstanding red bluff, of which about 800 feet of a straight wall is exposed. This vein where uncovered farther along the side-hill gave assay returns of a low percentage of copper and a trace of gold and silver across 30 feet. The amount of work done altogether is totally inadequate to form any opinion as to the possibilities of the property, only showing that there are mineral-belts worth prospecting.

From an elevation of about 4,000 feet the course of the South fork of the Iskut could be seen for about ten miles, running in a south-easterly direction and apparently flanked on its west side with granite. I judge that a trail ten miles up the South fork would be within twenty-five miles of the head of the Unuk river. The South fork looks as if it would be navigable for poling boats for about ten miles, and even without a trail toward the Unuk there is an immense area already accessible for prospecting along this fork and the main Iskut.

#### LIARD MINING DIVISION.

This Division comprises the north-eastern part of the Province and is the drainage-basin of the Liard river, which empties into the Mackenzie river at Fort Simpson. Practically little is known of the area, with the exception of the western corner of it around Dease lake and along the Dease river, which drains the lake and flows into the Liard river.

Several million dollars in placer gold were produced from this section in the early days, from 1873, principally from Dease and Thibert creeks, emptying into Dease lake, and McDame creek, flowing into Dease river fifty-five miles below the lake. Numerous other small creeks yielded good returns for a short time. Official records show that the gold-output from 1874 to 1887 totalled about \$5,000,000. In several places the gold found was very rough and contained in quartz, suggesting possibilities of rich gold veins. Taking into consideration the extent of country in which gold has been found, it must be admitted that there has been practically no prospecting done. The greater part of the country was hurriedly run over by the early-day placer-miners in search of rich diggings, and it would therefore seem reasonable to suppose that there is much ground that has never been prospected at depth, which could be done by later-day methods, with hydraulicking and dredging operations in view.

There are promising coal-croppings on the Tahltan and Tuya rivers and natural-gas and oil seepages are reported from the lower Dease river and Liard river. The Dease river is navigable for gas-boats from the lake to the Liard.

Dease lake is reached by way of Telegraph Creek, from which there is a first-class pack-trail, improved into a wagon-road for twenty-five miles, to the head of the lake, a total distance of seventy-two miles. A pack-train leaves Telegraph Creek every five days, freighting to the lake for 7 cents a pound. From the lake there is a big scope of country accessible for prospecting. The country is full of game and is the mecca for an increasing number of big-game hunters every year.

The Government Agent at Telegraph Creek, H. W. Dodd, is exceptionally well informed on all parts of the country, from the boundary on the Stikine to the Liard river.

The success of this year's operations on Thibert creek has revived interest in this section and a considerable amount of prospecting is looked for next season. Many of the old leases on the three principal creeks—Dease, Thibert, and McDame—which have not been worked for years, have been cancelled by the Minister of Mines this fall and the ground again made available for new blood. A number of leases have been staked and applied for this summer.

On Dease creek, flowing into Dease lake at the old camp of Laketon, two or three placer-miners were operating in a small way about six miles up the creek. The extensive flat at the mouth of the creek shows evidences of early-day placer-mining. This ground was tested in 1913 and 1914 by drilling, and I am informed that satisfactory results were obtained. This ground might pay to dredge, although the absence of a bed-rock some distance out from the mouth of the creek might be a serious detriment. The flats at the mouths of Thibert and McDame creeks have also been drilled and paying values reported.

On Thibert creek the most important work of the season was carried on. This creek empties into the foot of the lake below Porter. Since about 1900 the Thibert Creek Mining Company has been operating a hydraulic plant on its leases about six miles up, producing from

\$10,000 to \$25,000 a year, of which very little was profits because of the heavy cost of operating. Two years ago the plant was closed down and the work abandoned as unprofitable.

This spring George Adams, an Atlin operator, secured an option on the plant and ground and commenced operations under very unfavourable conditions; a portion of the flume had been taken out by a mud-slide, sluice-boxes had been buried, etc., and labour very scarce. However, the flume was repaired and a monitor started to dig out the sluice-boxes, which, when uncovered, had to be moved a couple of hundred feet to the piece of bed-rock that the old company was about to clean up when the flume went out. This was expected to yield good returns, but proved to be discouragingly poor, giving only about 40 oz. of gold. The season was getting pretty well along, but it was decided to try to take another pit out farther into the hill, believing that the old channel was farther back. This entailed a lot of work in moving a bank of gravel 200 or 300 feet high; however, in twenty-two days a strip about 150 feet long and 20 feet wide had been stripped and cleaned up, yielding about \$14,000 in coarse, well-worn gold. There was an appreciable amount of platinum with the gold. Mr. Adams is naturally very optimistic and is planning extensive alterations and improvements in the plant for next year.

The trail from Telegraph Creek to the lake should be improved to a winter road by cutting down some of the steep grades, widening in places where high banks have filled it in, and repairing the bridges that would be required in winter. This would provide adequate transportation for drills, pipe, machinery, and supplies of all kinds for prospecting and operating.

Deloire creek flows into Thibert creek about three miles from the mouth. The principal work done on this creek was by the Mitchell Bros., who owned two leases near the mouth. Considerable gold had been recovered by them from the rims and bars, and in 1907 a steam pumping outfit was taken in and a shaft sunk 25 feet to bed-rock, where coarse gold was found in paying quantities. From the shaft a crosscut had been driven across the channel a distance of 40 feet in good pay-dirt, when the whole workings caved in. Since that time bed-rock has never been reached. This fall Captain Barrington and associates secured these leases and staked others above them, and this winter have two men testing the ground by drilling. No report is available as to the results of this work, but if the test proves satisfactory a plant will be installed in the spring.

On Mosquito creek, flowing into Thibert from the north, about twelve miles up from its mouth, George Adsit has held and worked a lease for a number of years. Good "pay" has been found, but the work done has necessarily been small with only one man operating. Some platinum has also been found here.

Three leases have been taken up above Adsit's, on Mosquito creek, and one on Defoe creek, which heads near the head of Mosquito creek and flows into Canyon creek, which empties into Dease river.

There is a good trail, a wagon-road part way, from Porter to Adams's camp, and an old trail from there on up the creek to Adsit's. From Adams's camp up, the trail should be put in better shape to enable prospectors to get supplies up Thibert and its tributaries and across to the head of Canyon creek.

I did not get down to McDame creek, but I understand that there is some good ground there well worth testing for dredging or hydraulicking. A few men were prospecting on the creek this year. A number of mineral claims were staked on Haskins mountain on the north side of McDame creek several years ago, but no amount of exploratory work was done on any of them. Some claims were also staked on the First South fork several years ago.

Since in the early placer days the prospecting was all superficial, I believe it would be a profitable investment to test many of the creeks by drilling to bed-rock. The country is comparatively easy to get over, and a light Empire drilling outfit could be handled to good advantage by three or four men. A season's prospecting might be done in advance and the more promising creeks selected for drilling.

#### SMELTER.

A smelter in the vicinity of Prince Rupert, or anywhere along the north-western Coast, has been under discussion for the past two or three years. During that time the only class of smelter thought of was a copper-furnace since that was the predominating class of ore produced in this north-western district. However, the fact of having the Granby smelter at Anyox for the treatment of custom copper ores, and also that the Ladysmith copper plant has been unable to secure

sufficient copper ore to maintain steady operation, has precluded the advisability of erecting another landmark in the shape of a smelter.

Attention was given the possibility of the installation of a lead-stack, but the lack of silver ores and the improbability of the country developing and producing a sufficient tonnage of this class of ore has heretofore never justified even the possibility of a lead-stack.

However, in the light of the extraordinary development of the mining industry during the past years and the extremely bright and favourable prospects for its continued growth, the time, I believe, is now opportune for the consideration of the erection of a lead-stack at some point most convenient for its requirements.

I think that an investigation of the ore probabilities, rail and water transportation, and water and power requirements would result in the installation of such a plant.

On Dean channel several iron claims have been staked by Filip Jacobson and arrangements made for mining and shipping the ore to the Smelters Steel Company, of Seattle. This company has erected a smelting plant at Seattle, in which the electric process will be utilized to reduce the magnetite ore to soft-grade iron or alloys steel castings, as may be desired.

About 1,200 tons has already been shipped and equipment is being installed at the property on Dean channel to provide for continuous shipment.

This looks like a good start in the right direction, and should it prove successful every inducement should be offered by the Province for the installation of a similar plant at the most advantageous point along the Coast.

#### ATLIN MINING DIVISION.

I did not have time to get over any portion of this Division this year and am indebted to the Gold Commissioner at Atlin, J. A. Fraser, for the following outline of the mining situation in that section for the year and for the output from the different creeks.

Placer-mining has been carried on on a smaller scale than ever before, and the estimated total production will be about \$160,000, as against \$175,000 for last year.

In lode-mining nothing has been done on any of the properties other than the necessary yearly assessment-work, except on Fourth of July creek, where J. M. Ruffner has been investigating some claims owned by the late Thomas Vaughan. Several additional claims were staked, and I understand that Mr. Ruffner will endeavour this winter to interest sufficient capital to commence exploratory work in the coming spring.

No work of any note has been done on the *Engineer* mine, and owing to the many complications encountered in adjusting the affairs of the late Captain Alexander, the resumption of operations on this property at an early date is problematical. The property was described in detail in the Minister of Mines' Report of 1915. It is regrettable that this, seemingly the only property in the Division, cannot be brought into production operations and so provide a stimulant to the present stagnant mining conditions in that portion of the Province.

#### SPRUCE CREEK.

On this creek there were only four main operators throughout the season and not more than twenty-five men employed.

I. Matthews and laymen were the principal producers, their output being about \$25,000, or about 50 per cent. of former years.

Smith, Conroy & Carlson, working a total of six men, have had a very successful season, their returns being \$12,104 for about six weeks' work. They are very optimistic for next season's output.

Otto Miller and partners took out about \$4,700. Koppacher & MacPherson secured about \$500. A. Grier, prospecting on Wilson creek, took out \$250. Hodges and partner, prospecting on Wright creek, produced about \$1,200.

#### PINE CREEK.

There were several laymen on the holdings of the Discovery Mining and Power Company, Limited, who secured fair returns in places. Strom & Burger, employing twenty men, cleaned up about \$13,600 in one place, \$9,000 in another, and about \$800 in another. Auld & McLaren, laymen, took out \$3,300 in drifting.

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BOULDER CREEK.

Fair returns were obtained from this creek for the length of the season and the number of men employed, the total output being approximately \$35,000, as follows: The ground owned by Charles Miller was worked under three lays, Anderson and partners cleaning up \$22,000 drifting; Rasmussen and partners cleaned up about \$1,600 hydraulicking; Sands and partners cleaned up \$2,600 in drifting.

On other parts of the creek Carlson and partners took out \$1,610; Black and partners, \$2,000; and Gus Anderson, \$5,000.

RUBY CREEK.

The Placer Gold Mines Company, the only operators on this creek, encountered serious difficulties toward the end of the season. The pay-shoot has evidently been thrown to the west by a high bed-rock, and at this point has been covered by a basalt-flow, making it impossible for hydraulic operations. This volcanic flow can be seen lower down the creek along the rims, but I understand it did not interfere with the gold run or operations at that point. The whole plant has been moved up the creek beyond that basalt-flow and preparations made to commence operations at that point. The company's output this year, employing about seventeen men, was in the neighbourhood of \$40,000. Laymen are now engaged in drifting under the basalt, following the "pay."

On Otter creek work was continued throughout the season by the Mines d'Otter Creek Company and about \$5,500 recovered.

On Birch creek Mr. Pearce again worked on the leases on which he has had a "lay" for a number of years. Conditions on this creek, so far as water is concerned, are very adverse. The clean-up this year amounted to only \$1,860, but I am informed that the apparent location of the "pay" in the west bank has greatly added to the prospects for success for next year.

On O'Donnel river a few men operated for a short time, with very satisfactory results for the time worked. White and partners took out about \$3,900.

Prospecting was done on several creeks, notably Slate, Lincoln, portions of O'Donnel river, and Wilson creek, from which little or no gold was obtained.

It is to be hoped that the property on Fourth of July creek will develop into a producing property and that the *Engineer* mine will in the near future be operated on a scale proportionate to the value and extent of its showing.

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## CASSIAR DISTRICT.

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### ATLIN MINING DIVISION.

REPORT BY J. A. FRASER, GOLD COMMISSIONER.

I have the honour to submit my report on mining operations in the Atlin Mining Division of Cassiar District for the year ending December 31st, 1919.

This was another lean year from the standpoint of production, with about the smallest number of men producing since there has been any gold production here; but there were more men prospecting in various directions than for some years past, and I have no doubt the results of their efforts in that direction will be apparent in coming seasons, and thus compensate for the present minimized production. At the same time, there was about the smallest aggregation of people in the camp, all told (not including tourists), in or for any season yet, so that the results taken from every standpoint may still bear favourable comparison with some bygone seasons.

There was a falling-off in the aggregate amount of gold reported, but only a very small difference between the amount of revenue received therefrom in 1919 and in 1918. The revenue from all sources in 1919 was only \$130 less than in 1918, and were it not for the early and persistent blockade in the matter of mail transportation, which prevented certain remittances arriving here before the end of the year, 1919 would have made a considerably better showing than did 1918, but the returns for 1920 will be enhanced in consequence.

The period between "high water" and the "freeze-up" was one of the shortest on record on some of the creeks.

#### McKEE CREEK.

Taking the creeks in the same order as for some years past, I may say that on McKee creek nothing was done this season beyond protecting the plant and workings during high water. There is some reorganization being attempted apparently, but just what is contemplated has not yet been made public and in the meantime the works are idle.

#### PINE CREEK.

On Pine creek from twelve to sixteen laymen operated throughout the season upon the *Eastern* group and other leases held by the Discovery Mining and Power Company, Limited (formerly the Pine Creek Power Company, Limited, and associated companies' holdings), with very satisfactory results in some parts and with rather indifferent results in other parts, but, on the whole, with reasonably gratifying results and returns.

On the *Queen* leases, above Discovery, a small crew of laymen operated throughout the season and secured fair returns.

Some drifting operations were carried on by the Atlin Gold Mines Company, but again the manager has failed to respond to the usual request for a report as to the season's operations, and I am therefore unable to report with any confidence as to the results.

A number of miners have been reprospecting ground on this creek and are doing so this winter, so that next season it may be possible to report renewed activity on Pine creek.

#### SPRUCE CREEK.

This creek still led in the matter of production, although the output was not quite up to that of 1918.

On the *Lovell* group of leases Isaac Matthews carried on partly through laymen and partly by personally conducted operations, which were more or less of an exploratory character, but the operating force, all told, was smaller than for some years and the output correspondingly less.

On the *Shovel* group of placer claims Smith, Conroy & Carlson, with from three to seven and an average of six men, operated by ordinary individual sluicing methods from August 12th to October 7th and recovered over \$12,000, which seemed like a recurrence of old-time experiences



Thibert Creek, Liard M.D.



American Creek, looking down from Mountain Boy.

on this creek. They were operating in ground which for various reasons they were compelled to pass over in the past, and also sluicing tailings dumped upon their ground in bygone seasons. They expect to continue and to do better next season.

On the *Chicago Bill* claim Otto Miller and partners operated throughout the season and secured satisfactory returns.

On the *Peterboro* lease, on *Discovery* claim, and upon a number of other properties crews in varying numbers operated throughout the season, with satisfactory results in most cases, but as I have not had individual reports I am unable to particularize.

A few men operated above *Discovery* and at and near *Blue canyon*, but nothing worthy of special notice has been reported.

There were about sixty-five people on *Spruce creek* during the summer and about the same number are there this winter, and nearly all are engaged in drift-mining.

#### BIRCH CREEK.

On this creek H. Peplow Pearse, with a crew of five men, commenced operations on June 24th and closed down on or about October 3rd on account of frost, making an exceedingly short operating season.

The lateness of the season's opening on account of frost retarded operations, and also the peculiar situation in which they found themselves on account of local conditions suggested the wisdom of not attempting any mining until after the high water had come and gone. High-water mark was reached on June 27th, and in order to protect dams, etc., no gravel was sluiced until it began to wane, which it did rapidly until from the end of July forward it was very low until the "freeze-up" put an end to sluicing operations, as already said, about October 3rd.

In the short working season at their disposal, however, they succeeded in creating a new reservoir about 2,000 feet farther up-stream (whence an additional head of about 140 feet was secured) and in moving and relaying their pipe-line from their works up to this point, and while they did not succeed in removing as much gravel as usual, they had the satisfaction of working into better "pay" than they have seen for four seasons, the last two pits being in paying ground; and they are consequently very sanguine and optimistic as to the results of the coming season's operations, from which they hope to recoup themselves for much (if not all) of the loss experienced during the last four years, and incidentally to demonstrate the existence of pay-gravel which will justify a number of seasons' continued operations.

#### BOULDER CREEK.

On *Boulder creek* from twenty-five to thirty men were operating throughout the season.

On lower *Boulder creek* Charles Miller had three sets of laymen at work; one gang of three or four men was working hydraulically, whilst the other two crews—one of seven to twelve men and the other of from two to five men—were drifting and hoisting. I have not received any report from the manager, but I believe some of the ground operated was very good, while some other parts gave rather unsatisfactory returns.

Next above Miller was Gus Anderson, who with a force of from two to six and an average of three men operated from May 19th to October 27th, with very satisfactory results indeed.

On upper *Boulder creek* J. H. Black and partners operated hydraulically from about the middle of May to October 7th, with fair returns for part of the season, but it took them longer than was anticipated to get through and away from the lean ground encountered in 1918, so that the results of the season's operations were not up to those of some former years. They are still hopeful for the future. About a dozen men are drifting on the creek this winter.

#### RUBY CREEK.

On *Ruby creek* T. M. Daulton, manager for the Placer Gold Mines Company, commenced operations on May 1st, and with a force of from sixteen to nineteen and an average of seventeen men continued until early in October. During the period of operation they moved up-stream 325 feet on the left limit and 110 feet on the right, making an average advance of 217 feet the full width of the creek, and in so doing handled nearly 53,000 cubic yards of gravel, from which the usual gratifying results were obtained.

Near the upper end of the area covered by this season's operations a bank of basalt from 200 to 300 feet in height, which overlies the pay-gravel, was encountered intruding from the

right limit, but which it was deemed advisable not to undermine because of the danger to life and plant. The entire plant was therefore moved to a point above this basalt intrusion just before closing down, so that they can commence operations next season above it and continue on until bed-rock is again encountered. A small force of men is drifting on that ground this winter and recovering very good "pay." I understand they are drifting out the gravel underlying the basalt. From seven to twelve people are wintering on the creek.

No report has been received as to the results of development-work on Volcanic, Cracker, Granite, Horse, or Hemlock creeks, although there has been more or less work done on the first three mentioned at least, and they are all regarded locally as being probable producers eventually.

#### WRIGHT CREEK.

On Wright creek four men were employed throughout the season, but mostly upon dead-work, the benefit of which they expect to enjoy next season.

#### OTTER CREEK.

On Otter creek the Mines d'Otter, with J. E. Moran as foreman and H. Maluin as general manager, commenced operations on May 1st and continued until November 1st, and expended about \$16,000 in a continued effort to hydraulic their way down to the solid bed-rock, upon which the pay-gravel lies from which they expect to be recouped for all their outlay and to secure a substantial profit as well.

This season's operations were mostly confined to widening the channel paralleling last season's operations, in order to determine its full width and also to recover the gold known to exist in the gravel overlying a stratum of hard-pan which acted as a sort of false bed-rock, and from which a certain quantity of gold has always been recoverable. The width of the channel was found to be a little under 200 feet. In widening this channel it was necessary to remove an overburden about 140 feet in depth, and in doing so a considerable deposit of glacial mud and clay was encountered which was absolutely barren, but which it was deemed necessary to remove to attain the desired information and results. About 220,000 cubic yards of material was thus removed to get down to the gravel.

A comparatively small quantity of gold was recovered this year, and consequently a deficit of nearly \$10,000 was experienced, but they had the satisfaction of finding an increasing quantity of gold near the upper end of their pit, which appeared to increase as they advanced, and also to find the hard-pan bed-rock (so called) giving place to hard (genuine) bed-rock, and the apparent association of the increasing quantity of gold with the appearance of the hard (genuine) bed-rock encourages the hope and belief that next season will see them properly installed at last upon the real bed-rock of the creek, and that they may find the rich "pay" which is confidently believed to exist thereon.

Other work undertaken during the season consisted in part of the repairing and reriffing of about 2,500 feet (lineal) of sluice-flume; the dismantling, removing, and relaying of about 1,000 feet of pipe-line; extending the Wright Creek water-supply ditch about 1,200 feet; strengthening the reservoir dam on the *Paris* lease, etc.

The force employed throughout the season varied from six to ten men, with an average of eight men, and the wages paid were on a basis of \$7 a day.

This company certainly deserves success and encouragement for its tenacity and manifest faith in the potentialities of the creek, and it is to be hoped next season will afford it the relief and reward which it anticipates.

Nothing beyond a little "sniplug" was done on upper Otter creek this season.

#### LINCOLN CREEK.

On this creek a small force of men operated for a portion of the season, endeavouring to reach bed-rock, but on account of certain unexpected contingencies they were compelled to suspend operations before the end of the season. Amongst other obstacles with which they had to contend was the fact that their plant was inadequate to handle the quantity of water encountered in their prospecting-shaft, and before they were able to install the necessary plant winter set in and they were compelled to close down.

This creek has all the characteristics of a successful hydraulic proposition, except that the existence of gold in paying quantities has not yet been fully demonstrated, but even the modest

amount of work already done has disclosed sufficient evidence of the presence of gold in the gravels to encourage the owners to believe that proper exploration will reveal its presence in paying quantities and will add another good one to the list of our producing creeks.

#### WILSON CREEK.

On Wilson creek Andy Grier was prospecting upon his lease, the *Yellow Demon* (No. 558), from April 1st until October 16th, during which time he installed an hydraulic plant and operated it for about eighty days, chiefly prospecting.

Some prospecting is being done on the creek this winter and I expect considerable activity there next season.

#### SLATE CREEK.

On Slate creek a few men continued prospecting throughout the season, but do not appear to have secured anything very tangible; but with commendable pluck and determination they intend continuing their operations until they discover whether or not there really is "pay" on the creek, or, at any rate, on that portion of it.

#### O'DONNELL RIVER.

On this stream two or three men prospected throughout the season at the mouth of Feather creek, but I have had no report as to results.

On the *Gold Hill No. 3* bench lease a crew of five or six men operated for a portion of the season and secured very good returns for the time they were actually operating, and I understand it is intended to continue those operations next season.

Arrangements are being made this winter for systematic development on O'Donnell next season, and on other streams also, which have been idle for some time, so that increased activity and production may reasonably be expected.

#### BURDETTE CREEK.

Prospecting operations are in progress on Burdette creek this winter and on other outlying creeks, so that altogether a more hopeful feeling exists.

No new strikes have been reported.

#### MINERAL CLAIMS.

Not much apart from the necessary assessment-work to protect titles appears to have been done throughout the district this year, but more attention has been given to prospecting than for several years past, and there appears to have been more inquiry with respect to such properties on behalf of would-be purchasers than for some time past.

Some properties have been bonded and others are under consideration, all of which indicates renewed interest in that class of property and probable activity in the near future, but I am unable to definitely state more than this at present.

With respect to the *Engineer* mine, nothing has been done this year because of the unsettled state of affairs consequent upon the sudden death of the recorded owner last year, but an administrator has been appointed, and such progress as was possible under the circumstances has been made in the matter of adjustment, and it is probable this property will be in active operation again before the end of next season.

The *Maid-of-Erin* and associate properties in Rainy Hollow have been bonded to the representatives of strong capitalistic interests, and it is confidently expected that active development upon the properties will be commenced as early next season as climatic conditions will permit, and as the people interested contemplate the construction of comprehensive transportation lines and schemes the outlook for much activity in this camp is decidedly promising.

The silver-lead properties and deposits situated on Crater and Fourth of July creeks have received a more exhaustive examination during the past season than ever before in all probability, and as a result a number of new claims have been located, and the whole (new and old), with few exceptions, have been optioned to prospective purchasers who are even now considering ways and means of development, and it is expected that the coming season will witness the inception of active development upon those properties also, which will all contribute to the introduction of a new era into this camp.

I may say that some of the material found in one mineral-deposit near Atlin is now under investigation with a view to ascertaining what percentage (if any) it possesses of the latest and best steel-hardening material ever discovered.

Nothing was done towards the development of the coal-deposits in the district, nor of the hydromagnesite-deposits, although the latter are still under investigation by scientists and would-be purchasers. The question and cost of transportation is the principal deterrent.

OFFICE STATISTICS—ATLIN MINING DIVISION.

Free miners' certificates issued (individual) .....	329
Free miners' certificates issued (company) .....	4
Placer records issued .....	3
Placer rerecords (representing 205 claims) .....	192
Leases located and applied for .....	2
Leases issued .....	..
Leaves of absence (representing 104 claims) .....	30
Fillings .....	1
Bills of sale, etc. (placer) .....	15
Bills of sale, etc. (hydraulic) .....	21
Bills of sale, etc. (mineral) .....	7
Mineral records .....	26
Certificates of work .....	93
Fillings .....	8
Certificates of improvements .....	15
Crown grants issued .....	13
Gold reported (individuals) .....	\$ 98,942 00
Gold reported (companies) .....	69,487 00
<b>Total</b> .....	<b>\$168,429 00</b>
Royalty paid (individuals) .....	\$ 1,363 70
Royalty paid (companies) .....	1,612 75
<b>Total</b> .....	<b>\$ 2,976 45</b>

*Revenue.*

Land revenue .....	\$ 2 00
Water revenue (rentals) .....	132 60
Free miners' certificates (individual) .....	1,561 75
Free miners' certificates (company) .....	600 00
Mining receipts (lease rentals) .....	1,100 00
Mining receipts (lease applications) .....	40 00
Mining receipts (other sources) .....	2,045 30
Mineral-tax (royalty) .....	2,976 45
Receipts from all other sources .....	12,650 01
<b>Total</b> .....	<b>\$21,108 11</b>

## STIKINE AND LIARD MINING DIVISIONS.

REPORT BY H. W. DODD, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Stikine and Liard Mining Divisions of Cassiar District for the year ending December 31st, 1919.

The past year has shown a marked increase in mining activity, and it is safe to assume that the coming season will see more development on placer-diggings than has taken place since the early days of the Cassiar.

On Thibert creek Geo. Adams, of Atlin, has taken over the seven hydraulic leases of the Dease Syndicate (formerly the Thibert Creek Mining Company) and considering the amount of dead-work done on these the returns were encouraging; and it is the intention the coming season to place two hydraulic plants on this property for the better working.

On Mosquito creek four placer leases have been granted to S. J. Gothard and associates, of Vancouver, and on which development-work is to be started the coming season.

On Deloire creek the Mitchell property, consisting of Leases Nos. 50 and 54, has been taken over by Captain S. C. Barrington, of Seattle, who will have two men at work all winter testing.

On Dease creek one lease has been applied for by Bryan & Hankin, who are busily engaged in getting out timber for a flume.

On McDame creek, from reports received, it is expected that the Pendleton Mining Company will have a force of men at work the coming season on Lease No. 69. On Lease No. 86 a steel frame for a water-wheel and a centrifugal pump with 1,000 gallons a minute capacity has been ordered by Max Enderly.

The annual report of the Resident Engineer, Geo. A. Clothier, who visited the district, will practically cover everything, so I will have nothing more to add.

### OFFICE STATISTICS—STIKINE AND LIARD MINING DIVISIONS.

Revenue collected from free miners' certificates .....	\$ 375 00
Revenue collected from mining receipts .....	1,816 40
Revenue collected from other sources .....	5,962 78
<b>Total .....</b>	<b>\$8,154 18</b>

## SKEENA DISTRICT.

### SKEENA AND BELLA COOLA MINING DIVISIONS.

REPORT BY J. H. McMULLIN, GOLD COMMISSIONER.

I have the honour to forward you herewith the office statistics of the Skeena and Bella Coola Mining Divisions.

The report of the Resident Engineer fully covers the mining development for the year and I have nothing further to add to his report.

#### OFFICE STATISTICS—SKEENA AND BELLA COOLA MINING DIVISIONS.

Free miners' certificates (individual) .....	458
Free miners' certificates (company) .....	3
Free miners' certificates (special) .....	3
Mineral claims recorded .....	208
Certificates of work issued .....	197
Bills of sale, etc., recorded .....	27
Certificates of improvements issued .....	18
Filings .....	11

#### *Revenue.*

Free miners' certificates .....	\$2,261 75
Mining receipts, general .....	1,422 95
Total .....	\$3,684 70

### QUEEN CHARLOTTE MINING DIVISION.

REPORT BY J. L. BARGE, MINING RECORDER.

I have the honour herewith to submit my annual report for the Queen Charlotte Mining Division for the year ending December 31st, 1919.

The year 1919 seems to have been a year of recuperation after the war, very little ore having been shipped to the smelters. The *South Easter* mines at Skidegate, the *Producer* at Jedway, and the *Ikeda* mines, also at Jedway, have been steadily prospecting and developing, and a general resumption of activity is looked for in the early spring.

#### OFFICE STATISTICS—QUEEN CHARLOTTE MINING DIVISION.

Free miners' certificates issued .....	86
Mineral claims recorded (quartz) .....	40
Mineral claims recorded (placer) .....	4
Certificates of work issued .....	77
Bills of sale and records .....	9
Filings .....	9

#### *Revenue.*

Free miners' certificates .....	\$ 373 25
Mining receipts .....	533 00
Trade licences .....	205 00
Firearms licences .....	107 50
Police Court fines .....	245 00
Marriage licences .....	55 00
General receipts .....	4 50
Total .....	\$1,523 25

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 PORTLAND CANAL MINING DIVISION.

REPORT BY P. S. JACK, MINING RECORDER.

I have the honour to submit herewith office statistics for the Portland Canal Mining Division for the year ending December 31st, 1919.

George A. Clothier, Resident Engineer, is furnishing full reports on the mining activities in this Division for the past year.

## OFFICE STATISTICS--PORTLAND CANAL MINING DIVISION.

Free miners' certificates (individual) .....	340
Free miners' certificates (company) .....	2
Mineral claims recorded .....	549
Certificates of work issued .....	354
Bills of sale, etc., recorded .....	192
Filings .....	43
Certificates of improvements recorded .....	13

*Revenue.*

Free miners' certificates .....	\$1,767 00
Mining receipts, general .....	4,598 65
Other sources .....	156 00
	<hr/>
Total .....	\$6,521 65

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## NORTH-EASTERN DISTRICT (No. 2).

REPORT BY JOHN D. GALLOWAY, RESIDENT ENGINEER.

## GENERAL REMARKS.

During the year 1919 the North-eastern District progressed favourably in mining development, and the total production was nearly as large as that of the previous year. The actual production of placer gold will show a slight decrease as compared with 1918, but placer development has been active in the Cariboo and Quesnel Divisions. The output of silver, lead, and zinc for the district is mostly made by the *Silver Standard* mine at Hazelton. This mine has had a satisfactory year, with about the same production as in 1918. The copper production will be considerably lower this year than in previous years owing to the *Rocher Déboulé* mine having been closed down all year.

A small production of coal, amounting to about 1,750 tons, was made by the Telkwa Collieries.

The following figures give the output for the year 1919 and the corresponding figures for 1918:—

	1918.	1919.
Placer gold (oz.) .....	4,400	3,900
Lode gold (oz.) .....	985	147
Silver (oz.) .....	84,125	72,573
Lead (lb.) .....	123,568	180,455
Copper (lb.) .....	643,843	16,205
Zinc (lb.) .....	313,112	224,539
Coal (tons) .....	470	1,752
Miscellaneous (dollars) .....	7,400	4,000

While the production of the North-eastern Mineral Survey District for the year 1919 does not show any increase over that of 1918, nevertheless, considered as a whole, mining activity for the year was satisfactory. This district is as yet in the prospect or development stage; no real development was possible until the Grand Trunk Pacific Railway was completed in 1914, and although since that time several properties have been brought to the shipping stage, the district as a whole has not progressed as fast as might have been expected. Many reasons could be given for this, chiefly that during the war labour and financial conditions were not conducive to the opening-up of a new country.

During the last year a considerable change has taken place in the country, and it is particularly noticeable in the way in which settlers are taking up the land. This increase of population will no doubt add to the prospecting carried on in the country, as well as gradually improving the wagon-road transportation.

There are in the North-eastern District hundreds of claims in the prospect stage, many of which warrant more extensive examination and development than has yet been given to them. While the war was on but little attention was paid to these by examining engineers, but gradually many of these properties are being investigated. The counter-attraction of a decided "boom" in the Stewart country to some extent prevented the North-eastern District securing the attention it might have had in 1919.

Generally, however, the outlook for the future is promising, and a steady growth in mining development and production may be expected in the future.

It is very encouraging to be able to report that, whereas gold-mining and production seems to be on the decline in many parts of the world, in the Cariboo District the outlook for the future, due to present activity, is satisfactory.

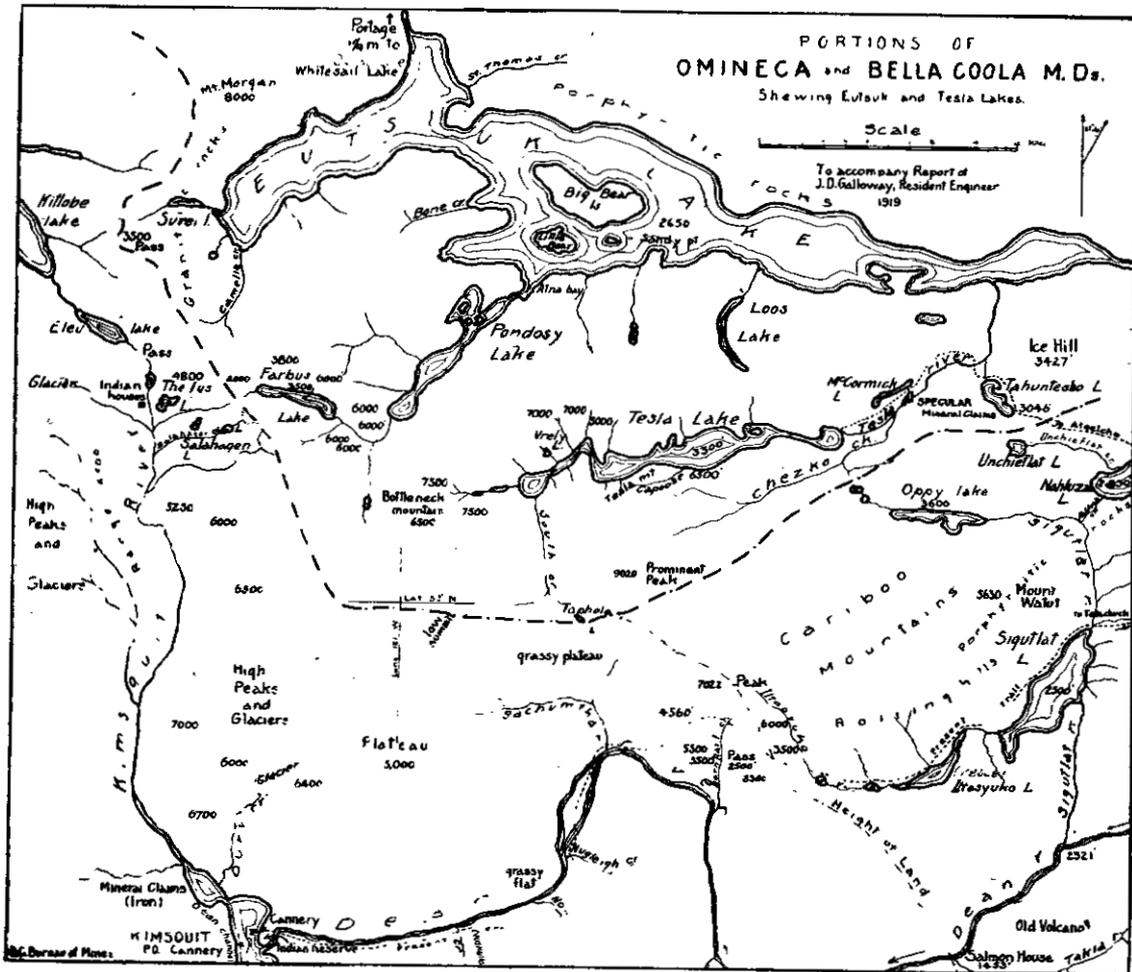
For some years past placer-mining in the district has been confined to half a dozen hydraulic outfits and a few individuals working in a small way.

During the seasons of 1918 and 1919 a number of prospective placer enterprises were considerably advanced; so much so that some of them now give promise of soon reaching the productive stage. Of these enterprises, the proposed installation of a dredge on Antler creek is a most important one. The area to be dredged is owned by Moore and associates, and has been thoroughly tested by Keystone-drilling. There is a considerable yardage available for dredging, in which the values are much higher than is usually obtained in dredging-ground.

PORTIONS OF  
**OMINECA and BELLA COOLA M.D.s.**  
 Showing Eutsuk and Testa Lakes.

Scale \_\_\_\_\_ Miles

To accompany Report of  
 J.D. Galloway, Resident Engineer  
 1919



Other placer propositions are being equipped with a scraper-dredge system of dredging, and one of this type was in operation during the season at Harpers camp.

The amount of placer-work being carried on by drifting is comparatively slight, but shows an increase during the past season. Most of this work is exploratory, as, for instance, on the Antler, Jack of Clubs, and other creeks. The *Kitchener* mine on Keithley creek had a highly satisfactory season, as some rich ground was struck in a portion of the old bench-gravel.

During the year the gold-quartz properties on Proserpine mountain owned by Armstrong, Tregillus, Blair & Carey were optioned to Robert A. Bryce, representing a Toronto syndicate. Work was commenced in the fall and it is expected that by spring a considerable amount of development will have been accomplished.

Another important development in the Cariboo District during the season was the commencement of the testing of the placer-gravels at Harpers camp. The prospecting of this area by Keystone-drilling has been under consideration by the Mines Department for some time past, and about the end of November the work was begun.

A description of the general physiographic, topographic, and geologic features of the North-eastern District can be found in the Annual Reports of the Minister of Mines, 1914 to 1918.

#### ROADS AND TRAILS.

During the season of 1919 the Resident Engineer examined and reported on numerous applications for assistance in building roads and trails under the provisions of the "Mines Development Act." Following are the more important mining trails and roads that were built or improved during the year:—

(1.) Repairs and new construction on the Hudson Bay Mountain road, converting it from a sleigh-road into a wagon-road.

(2.) New double-ender sleigh-trail from end of wagon-road on Driftwood creek to McCabe property in Babine range.

(3.) New trail from Harvey property to wagon-road on Driftwood creek.

(4.) New trail from Ootsa Lake wagon-road to Sweeney mountain; work commenced.

(5.) Improvements to trail from Houston to Sweeney mountain.

(6.) New trail from Schufer property to Lake Kathlyn Station; work half completed.

(7.) In the Cariboo District various small grants were made to improve and repair trails in the vicinity of Barkerville. This work was in aid of both placer and lode mining.

During the first five months of 1919 the Resident Engineer was in the Victoria office of the Department of Mines. Very little field-work could be done until July on account of snow in the mountains, and an early cold snap with snow coming in the middle of October made the field season an unusually short one.

#### OMINECA MINING DIVISION.

##### SKEENA RIVER SECTION.

This section includes the territory contiguous to the Skeena river and its tributaries between Copper City and Skeena Crossing. Many mineral claims are held all over this area and during the year 1918 development-work was done in several places.

The more important localities in which work was carried on are: Vicinity of Usk, Kleanza creek, and Legate creek. Most of the important claims have been reported on by Government Engineers in the past five years; their reports can be found in the Annual Reports of the Minister of Mines. The *Fiddler* group on Fiddler creek was described in detail in the 1916 Report, and since that time no further work has been done on the property.

##### *Usk.*

The town of Usk, situated 100 miles north-east of Prince Rupert, on the Grand Trunk Pacific Railway, was the centre of considerable mining activity during 1919.

During the summer this company was organized for the purpose of developing Kleanza Co. properties acquired near Usk. To begin with, the main business of the company would appear to be in lumbering and sawmilling. A considerable area of valuable timber limits was secured and the construction of a large sawmill commenced. The development of the water-power on Kleanza creek with an hydro-electric plant was commenced and work is being continued all winter. This company is also a mining company and

has acquired the *Golden Crown* group by purchase from the owners, Wells & Durham. A crew of men was kept at work during the summer and fall stripping the two quartz veins that occur on the property. These veins, which carry values in gold and copper, have been exposed for considerable distances and are reported to be showing up well. It is proposed to further develop these veins by means of drift-tunnels, but this work will not be started until power is obtainable from the power plant now in course of erection.

The rock formation on the *Golden Crown* is a granite rock, in places quite schistose. Cutting this and also the veins are black lamprophyre dykes. There are two quartz veins on the property, one of which splits into two stringers. This vein below the split has been prospected by three tunnels—No. 3, 105 feet long; No. 2, 33 feet long; and No. 1, 115 feet long—which were driven some years ago. Throughout these workings the vein varies in width from 5 feet down to a few inches and is very irregular. Arsenopyrite in small quantities is irregularly disseminated through the quartz. In places the oxidization of the arsenopyrite gives a rusty, honeycomb appearance to the quartz. Specimens showing particles of free gold are found in these veins.

The values are in gold and are irregular. It is probable the gold is mainly carried in the arsenopyrite, although some of it may be free in the quartz. The results of the samplings of the veins by the Kleanza Company are said to have been satisfactory and the veins have been stripped for considerable distances on the surface. It is said that active development will be carried on in 1920.

This property was reported on in detail by W. M. Brewer in the 1914 Annual Report.

**Cordillera Group.** This property, situated one mile from Usk and owned by the Kitsalas Mountain Copper Company, has been fully described in previous Annual Reports. During the summer the erection of a small mill on the property was commenced. A site was cleared and the necessary buildings erected. When the property was visited this work was in progress and some of the machinery on the ground. A good deal of delay was experienced in getting in the machinery, but it is believed the mill was completed late in the fall. The mill will consist of a jaw-crusher, Gibson mill for fine grinding, and a Wilfley table. The motive power will be gasolene-engines.

The development on this property consists of an incline shaft 60 feet deep and a crosscut tunnel 400 feet long, which taps the vein prospected by the incline shaft. In driving the crosscut tunnel 121 feet from the portal, a vein, which apparently does not outcrop on the surface, was cut and then drifted upon for 122 feet to the south, where a winze was sunk to a depth of about 15 feet. In the winze the vein widens out to 3 or 4 feet, consisting of, roughly, one-third quartz and two-thirds schistose gangue. Bornite and chalcocite occur through the quartz, while free-gold specimens are quite often found. This vein, which occurs in schistose rock, is faulted along the roof of the drift. During the winter this vein is to be developed.

**Lucky Loop.** This property, which adjoins the *Cordillera* to the south, was described in last year's Annual Report. Last year it was leased by A. Roark, C. Seeber, and Harry McMahon. They drove a drift-tunnel 60 feet in on the vein and sank a winze 18 feet deep at a point 30 feet from the portal. A cabin was erected and also an ore-sorting shed at the mouth of the tunnel. From the drift, winze, and a short stope which was put up 10 feet about 30 tons of mixed ore was taken out. About 10 tons of clean ore was sorted out from this and sacked up, but was not shipped and is still on the property. At present no work is being done.

The property, which is owned by L. E. Moody and Richard Lowrie, is favourably situated, being only a short distance from the railway and at about 1,000 feet higher elevation. The vein occurs in schist and is well defined, being from 1 to 2 feet wide. The gangue is schistose rock with a certain amount of quartz scattered through it, often in bands. The sulphides occurring in the vein are bornite, chalcocopyrite, and a little pyrite.

**Paystreak Group.** This group of eight claims is situated on the west side of Kitsalas mountain, practically at the top of an elevation of about 4,500 feet. The present trail, used to reach the property from Usk, is a very poor one and is not passable for horses on the upper end. The main showing on the property is a quartz vein striking N. 60° E. (mag.) and dipping slightly to the south-east. This vein is exposed in a bluff for a height of about 25 feet. The fracture is about 3 feet wide and on one wall has about 4 feet of soft schistose rock. Next to this is a hard flinty rock believed to be a quartzite.

It would appear that there is at this point a soft basic dyke cutting the quartzite, and that the quartz vein has formed in the hanging-wall side of the dyke. A tunnel has been driven in at the foot of the bluff and on the vein for a distance of 20 feet. At the face of the tunnel the quartz is about 3 feet wide.

The quartz carries some chalcopyrite disseminated through it and in places a little galena. A sample taken across 3 feet of the vein assayed: Gold, trace; silver, 1.6 oz.; copper, 1.5 per cent. Another sample of selected ore gave: Gold, 0.04 oz.; silver, 6.8 oz.; copper, 7.1 per cent.; lead, 14 per cent.

Another showing on the property is called the "Big Lead." This is a dyke of soft, black basic rock cutting through the quartzites. It is from 10 to 20 feet wide and in places split up. There is some mineralization throughout the dyke and the quartzite walls with chalcopyrite and a little bornite and galena. Where the dyke is split up the mineralization is most pronounced. An open-cut had been made in the dyke, but this had filled in again, so could not be examined, but some good-looking copper ore had been taken out. More work is required to determine if the showing would be of value.

This group is situated on the south-east face of Kitsalas mountain, near the top. L. E. Moody and partners are the owners. On these claims there are a number of black basic dykes cutting the quartzite, and in these dykes there is a slight irregular mineralization with copper minerals. This mineralization is either in the dykes or in the quartzite, but close to the lines of contact. The general strike of these dykes is north-east and south-west. The copper minerals noted were chalcopyrite, bornite, and carbonates of copper. Several exposures have been prospected by small open-cuts. The most important is one at the top of a bluff. A grab sample from this cut, which would represent the best of the rock seen, assayed: Gold, 0.02 oz.; silver, 0.8 oz.; copper, 1 per cent.

**Frying Pan Group.** This group, consisting of the *Queenie, Elizabeth, Nancy, Alice, Maria,* and *Princess* claims, owned by Andrew Pete and A. Baxendale, is situated near the top of Bornite mountain, some eight miles from Usk by pack-trail. The main showing on the *Queenie* claim is a quartz vein varying from 2 to 4 feet

**Bornite King Group.** in width and exposed naturally. The only metallic mineral noted in the quartz is chalcopyrite, occurring in sparing quantities. A selected sample of ore assayed: Gold, trace; silver, 0.6 oz.; copper, 2.2 per cent.

On the *Elizabeth* claim a quartz vein is exposed in a draw near the top of the mountain. It is from 12 to 18 inches wide and occurs in a diabase rock. The quartz gangue carries small quantities of galena and chalcopyrite. A sample taken across 1 foot returned on assay: Gold, trace; silver, 10.6 oz.; copper, 1 per cent.

On the *Maria* claim a small irregular fracture in diabase occurs which carries some high-grade copper minerals—namely, bornite and chalcocite. The widest place noted was about 5 inches. A selected sample of the copper minerals assayed: Gold, 0.05 oz.; silver, 68.8 oz.; copper, 34.4 per cent. The owners were about to commence work on this showing when the property was visited.

#### LEGATE CREEK.

The showings on the claims at the head of the Legate creek were described in the 1916 and 1917 Annual Reports. The creek was visited again this year and it was found that about a dozen prospectors were at work on their claims during the season.

This camp should attract some attention during the season of 1920. The showings of ore consist of high-grade copper and silver ore and the veins are such that they warrant exploration.

From Pacific, a divisional point on the Grand Trunk Pacific Railway, a good trail runs up Legate creek on a small grade to the forks, a distance of twelve miles. The various properties are situated on the mountains around the forks of the creek and are connected by branch trails to the main trail.

A shipment of ore amounting to about 30 tons was made last season from the *M. & K.* property.

This property, which is owned by Whitmore & Orr, is situated about three miles from the forks of Legate creek and has been developed each summer by the owners for the past four years. In 1916 the property was bonded by Price & Aitkin, who shipped 120 tons of ore and then allowed the bond to lapse. This ore was "float," as it occurred irregularly distributed up and down the hill in surface clay. The work

of the owners since that time has been directed to tracing up this float-ore to find the vein from which it came.

Open-cuts and tunnels have been driven and certain ore-showings have been discovered, but the class of ore in these showings differs somewhat from the float-ore. The stripping of the overburden on the hillside is a serious hindrance and necessarily a great deal of work is required.

During the season of 1919 an open-cut up the hill some distance from where the float-ore was taken shows a vein apparently in-place. This vein is lying on the slope of the hill and has a strike of N. 30° E. and a dip of 35 degrees to the west. The vein is from 1 to 2 feet wide and shows some good ore, but consists partly of leached material. Above this cut is another one in which the vein is narrower and lies almost flat. Below the large cut a small tunnel has been run in on the vein 20 feet. This drift has a small stringer at the face.

Much more work will be required to tell much about these occurrences, but the grade of the ore and the quantity exposed on the hillside are sufficient reasons to warrant extended search.

The ore shipped in 1916 consisted of a mixture of galena and bornite which returned about 25 per cent. lead, 20 per cent. copper, and 25 oz. silver to the ton. The ore shipped this year apparently carried less galena. It was shipped to a copper-smelter and only the copper and silver recovered. It is not known what the returns were.

It is reported that the property has been bonded and that it will be further developed in 1920. This property has previously been described in the 1916 and 1917 Reports.

**Independence Group.** This group consists of three claims—*Grizzly*, *Grand View*, and *Independence*—and is owned by J. Burns and Wm. Pierce. The claims are situated on the west side of the basin at the head of the centre fork of Legate creek, at an elevation of 4,000 to 4,500 feet. These claims are easy of access and it would not be hard to put in a good trail to them from the forks, a distance of about three miles.

The vein on this property is a well-defined sheared zone in andesite, striking north-west and angling up the hill. The vein is exposed naturally and by some small open-cuts. In the largest open-cut there is a width of 10 feet of vein-matter, with a horse of country-rock in the centre 2 feet wide. In an open-cut 50 feet above the first one the vein is considerably oxidized, but shows some ore. There are several smaller cuts farther up the hill which show the vein to be continuous, but not exposing the walls. Apparently the vein is split up to some extent. Very little work has been done on the showing, not sufficient to expose the vein properly.

The gangue-matter of the vein consists of andesitic rock and a little quartz. The metallic minerals noted were chalcopryrite, pyrite, arsenopyrite, small amounts of bornite and grey-copper, and some specks of galena. Oxidation on the surface has produced hæmatite in places and some copper carbonates.

The following samples were taken:—Across 5 feet in lowest cut: Gold, trace; silver, 13 oz.; copper, 1.1 per cent. Grab sample from dump, lowest cut: Gold, trace; silver, 11 oz.; copper, 3.4 per cent. Across 4 feet in second cut: Gold, trace; silver, 20.5 oz.; copper, 0.5 per cent. Across 2 feet in third cut: Gold, trace; silver, 0.8 oz.; copper, 3.3 per cent.

This property should prove an attractive proposition to take over and prospect and develop.

**Legal Tender.** This claim, owned by J. Burns and Jens Anderson, lies about 1,000 feet down the hill from the *Grizzly* claim. The vein varies from 1 to 2 feet in width. The chief mineralization occurring in the quartz is galena, which is scattered through it. A selected sample of the ore assayed: Gold, 0.14 oz.; silver, 58 oz.; copper, 0.2 per cent.

**Bullion.** This claim is situated on the west end of the basin at the head of the centre fork of Legate creek. J. Burns is the owner. The *Jumbo* claim lies to the north and the *Columbia* to the south. A quartz vein is exposed along the foot of a bluff for a distance of 700 feet. The vein strikes N. 25° E. and dips at 40 degrees to the south-east. It is exposed on the dip and so the outcrop runs up the mountain-side. The country-rock in the vicinity is diorite, but the vein lies within a diabase dyke cutting the diorite. Mineralization in the quartz is with chalcopryrite, copper carbonates, and a little galena. A sample of selected ore returned: Gold, trace; silver, 29.6 oz.; copper, 6.4 per cent. An average sample across 1 foot at the lowest outcrop gave: Gold, trace; silver, 1.6 oz.; copper, 1.9 per cent.

The showings on this group were described in the 1917 Report. Since that time a dispute has arisen as to the ownership of the ground and now is claimed as part of the Halliday property. The owners of the *Regina* group have there-

fore been this past season working on the *Hunter* and *Pacific* claims, which ground is not disputed. The owners are Jones, Brown, Burnes & McManamon. These claims are situated on the mountain facing into the forks of Legate creek.

On the *Hunter* claim two places have been prospected by large open-cuts. The ground here is broken up and badly leached, and while some vein-matter occurs, no definite vein in-place is apparent as yet. One cut is on the line of continuation of the *Regina* vein across the ridge. In the material taken out of the cut a little mineral can be seen.

On the *Pacific* claim two small quartz veins are exposed. One of these, striking east and west, is exposed near the top of the ridge. Several small cuts have been made on it and show it to vary from 1 to 2½ feet in width. The quartz contains a little galena and iron oxide. A sample across 2 feet on assay only returned traces of gold and silver.

#### HAZELTON SECTION.

In this section the only producing mine during the season was the *Silver Standard*, as the *Rocher Déboulé*, a former big shipper, remained closed all year. This latter property is a copper-mine, and apparently the management considered it good policy to wait for a better copper market. At the present time the mine has a considerable amount of milling-ore proven, but no shipping-ore is available until further development is undertaken.

If the property was equipped with a small concentrator and a comprehensive development plan laid out, there seems to be no reason why this mine should not repay further exploitation. Probably this policy will be adopted in the near future.

The holdings of this company comprise the *Delta* and other groups of claims and a control of the stock in the company owning the *Highland Boy* group. **Delta Copper Co.** The showings, development-work, etc., have been fully described in previous annual reports. In the winter of 1918 to 1919 a crosscut tunnel was started on the *Delta*, but after driving about 100 feet the work was stopped and nothing further has since been done. Apparently the delay in continuing vigorous development of this property has been due to the inability of the company to finance such work. However, it is believed that this condition is now changed, and it has been announced that work will commence early in 1920. W. G. Norrie-Lowenthal has been retained as consulting engineer, and under his direction the work will be commenced in a short time. The property undoubtedly has merit, and it seems probable that in a short time it will enter the shipping class.

This mine was reopened in April after having been closed down from December, **Silver Standard.** 1918. The main reason for closing down last winter was the inability to satisfactorily market the silver-lead and silver-zinc concentrates. Conditions, however, are now such that continued operation may be expected. By the end of October about 3,000 tons of ore had been treated in the mill, from which were produced 390 tons of silver-zinc concentrates and 128 tons of silver-lead concentrates. The lead concentrates carry about 225 oz. silver to the ton and 35 per cent. lead, and the zinc concentrates about 120 oz. silver and 35 per cent. zinc.

Development during the year has been satisfactory. The No. 4 vein now has a continuous ore-shoot of over 400 feet in length. During the year ore was steadily stoped from the main vein, but a considerable tonnage is still in reserve, which can be augmented by further development. The No. 1 vein was stripped on the surface and a good shoot of ore 200 to 300 feet in length was uncovered. Generally the mine is in good shape, and undoubtedly with further deep development the nine veins on the property will yield a large tonnage of ore.

The mill now treats about 25 tons of ore a day. The crusher and jigs are run one 8-hour shift and the tables two 8-hour shifts. The mill is now running pretty well, but a high extraction cannot be expected in a water-concentrator running on a quartzose ore containing galena, zinc-blende, and grey-copper.

The management is at present considering the advisability of remodelling the mill and putting in an oil-flotation plant to treat the fallings, which would result in a much improved extraction. At the same time a deep-level tunnel will be driven to crosscut the vein system at some depth below the present workings. This tunnel will be about 1,000 feet in length. For the present the mill will be kept running, but before long a decision may be made to remodel the mill this winter so as to have everything in readiness for large-scale production next summer.

*Nine-mile Mountain.*

Nine-mile mountain is an isolated mountain lying to the north-east of Hazelton. Claims have been staked on different parts of the mountain, but the most important are those situated on the slope overlooking the Shegunia river. This camp is known as "9-Mile" and is distant about thirteen miles from Hazelton. The more important properties are the *Sunrise*, *Silver Cup*, *Lead King*, Miller property, and adjoining claims. This camp was described in the 1914 Annual Report.

Many of these claims were developed to some extent prior to 1914, but since that time little work has been done. In 1914 a wagon-road was constructed from 2-Mile, running along the base of 9-Mile mountain and extending to a point below the *Silver Cup* property. This road is in bad repair and the last half of it is now only a pack-trail. Another trail can be used to reach these claims, going up over the mountains, but the road is generally used.

In the summer of 1918 an option was secured on the *Sunrise* and several other properties by J. Errington, who was acting for an Eastern syndicate. Some time was spent in thoroughly examining and sampling the claims, and then a little work was done in stripping the veins on the *Sunrise* claim. Work was stopped in the fall of 1918, and so far as could be learned everything was satisfactory and the intention was to resume the work in 1919. However, in 1919 Mr. Errington did not resume work and in the fall his option expired.

About the end of the year an option on the *Sunrise* was secured by the American Smelting and Refining Company, and under the terms of the deal some work was to be commenced immediately. It is not likely that any extended development can be commenced until the spring of 1920, but it is expected that during the coming year the property will be thoroughly tested.

The formation on 9-Mile mountain consists of Hazelton formation rocks, intruded by a core of granodiorite. The veins, which occur both in the granodiorite and in the metamorphosed rocks, are well defined and vary in size from a few inches up to several feet. The gangue consists partly of quartz and partly of wall-rock. The valuable minerals contained are galena, zinc-blende, stibnite, and grey-copper. The principal value in the ore is in silver, and as a rule the clean ore assays very well in silver. The lead and zinc contents are also important and add to the total value in the ore. In the veins the ore occurs in places as bands and shoots of clean mineral and in others disseminated through the gangue-matter. In past years small shipments of hand-sorted ore have been made from several claims in this camp, but the future depends on developing the properties to the point that one or more concentrators can be operated and the whole of the veins mined and milled. The ore is similar to that of the *Silver Standard* mine, which is being concentrated in the company's mill on 2-Mile creek.

On the *Sunrise* claim there are two veins, which vary in width from 2 to 10 feet. They are exposed for some distance on the surface and are fairly well mineralized throughout. If deep development shows the veins to continue in size and value as they show on the surface, this property should prove a paying one.

## TELKWA SECTION.

*Hudson Bay Mountain.*

During the year 1919 there has been more activity in mining on Hudson Bay mountain than in previous years. While no production is recorded, it is expected, as a result of the work inaugurated this year, that a considerable production may be made next year.

Early in the year the Skeena Mining and Milling Company was organized to develop the *Victory* and *Coronado* groups of mineral claims, situated on the southern slope of Hudson Bay mountain and distant about twelve miles from the town of Smithers. The company started operations in the spring, but stopped work during the summer. A start was made again in October, but shortly after work was again stopped.

The *Victory* group is owned by Donald Simpson, who has worked the property intermittently during the last ten years and who has shipped in all about 50 tons of ore. The ore consists of galena and zinc-blende occurring in a gangue of siliceous rock.

The Skeena Company immediately after acquiring the properties purchased the machinery for an hydro-electric power plant and for a 50-ton water-concentrating mill. This mill is of the Faust type and supplied by the Faust Concentrating and Manufacturing Company, of Vancouver. This milling machinery consists of jaw-crusher, jigs, tables, and screens. In addition, machinery

for a small hydro-electric power plant and an air-compressor was purchased. Most of this machinery was shipped to Smithers and some of it hauled part way to the property.

The company started some development on the *Coronado* group, but this work was confined to some surface stripping. No work was done on the *Victory* group, the management of the company apparently considering that the property was sufficiently developed. It was planned to erect the mill and power plant and then commence mining and milling ore.

During the summer a considerable expenditure was made by the Government (a grant being made from the "Mines Development Act"—Supplementary) on the sleigh-road from Smithers, thereby improving it so that it can now be classed as a wagon-road. This road serves a number of properties on the southern slope of Hudson Bay mountain. It is now laid out on a good grade and as development of the mineral properties warrants will be further improved.

In October this group, owned by J. Aldrich and situated close to the *Victory Mamie Group*, was bonded by J. Turner and work on the property commenced. This property has a good strong vein mineralized with zinc-blende, arsenical iron, and in places a little galena. The development will consist of a drift-tunnel on the vein.

Schuler & Woods continued development of this group on the north-eastern side of Hudson Bay mountain. The 30-ton shipment made from the property in 1918 was concentrated at the *Silver Standard* mill in June, and the ore averaged about \$175 a ton gross in all values. The construction of a new trail to this property was started this year and it will be finished next season. When this is completed transportation to this side of Hudson Bay mountain will be greatly improved.

All the above-mentioned properties have been described in the Annual Reports of the Minister of Mines, 1914 to 1918.

#### *Babine Range.*

**Babine Bonanza Co.** On this property, better known as "Cronin's mine," a long crosscut tunnel was started this year and work on it is being continued all winter. This property has been intermittently developed for the last ten years and there is now a considerable tonnage of silver-lead-zinc ore proven. It is hoped that when the new crosscut tunnel, which is projected to be driven about 1,000 feet, strikes the ore-body a sufficient tonnage of ore will be developed to warrant the erection of a concentrating-mill. The property is connected by a sleigh-road with the town of Telkwa, a distance of thirty miles.

**Social Group.** A new trail was built up Driftwood creek this year to connect this group, owned by McPhee & McCabe, with the wagon-road. This trail serves a number of properties in this section, and as it is a well-graded trail it materially improves the transportation into this part of the Babine range.

**Harvey Group.** This property is situated on the eastern side of Driftwood creek, distant about twelve miles from Smithers. C. G. Harvey and W. J. Larkworthy are the owners. The showings on the property were described in last year's Annual Report. During the year 1919 Mr. Harvey continued development of the lower vein on the property. The shaft was sunk to a depth of 40 feet, following the vein on the incline. The vein is somewhat broken over, the top part having moved down the hill, so that the shaft, which started vertical, soon flattens out. At the bottom the vein is apparently 8 feet wide, but the actual width may be less as the vein is broken.

This vein occurs in andesite and at the bottom of the shaft has a good foot-wall with a talc gouge on it. The gangue material of the vein is mainly sheared andesite, together with stringers and bunches of quartz. The most important metallic mineral in the ore is chalcopyrite, which is disseminated throughout; in addition, there are small amounts of copper carbonates and grey-copper. A sample taken across 8 feet on the south-east side of the shaft assayed: Silver, 24.88 oz.; copper, 3.5 per cent. Another across 7 feet on the north-west side of the shaft returned: Silver, 16.85 oz.; copper, 1.41 per cent.

No further work was done during the year on the upper vein, the development of which is noted in the 1918 Report.

**Silver King Group.** This property is situated just a short distance from the head of Driftwood creek and the showings are right beside the creek-bed. The owner is Patrick J. Higgins. In a formation of rhyolite porphyry a quartz vein outcrops, striking N. 70° E. (mag.) and dipping northerly at 60 degrees. The vein

varies in width from a few inches up to 2½ feet. It is mineralized with galena, zinc-blende, and grey-copper. Occasional specimens are obtained carrying native silver and silver sulphide. The vein crosses the creek and on both sides tunnels have been driven in; on the east side the tunnel is 30 feet long and the other one is 10 feet. The quartz is fairly well mineralized with metallic minerals and good silver values are obtained. The property warrants development. Towards the end of the year it was reported that the property had been bonded to Seattle interests and that development-work was soon to be started.

#### SIBOLA SECTION.

The name "Sibola section" is used to designate an area of country lying to the south-west of Houston, a station on the Grand Trunk Pacific Railway. This area includes the claims around Owen lake, on Sweeney and Sibola mountains, and around Whitesall lake. A description of this country can be found in the Annual Report of the Minister of Mines for 1916. Until the summer of 1919 annual assessment-work on claims and further prospecting had been done, but no extended development had been attempted.

The present route into Sweeney mountain is by an indifferent pack-trail which commences at Houston on the Grand Trunk Pacific Railway, and passes Owen lake; the distance is about fifty miles. Another very rough trail, known as the Bon throne trail, runs from Sweeney mountain to the wagon-road, passing near the western end of Ootsa lake. This wagon-road is one which extends from Houston around the west end of Francois lake to Ootsa lake, continuing on to the settlement at the centre of Ootsa lake, known by the same name. From here the road extends northerly to Francois lake, where a ferry is operated by the Government, and then on to Burns Lake, a station on the Grand Trunk Pacific Railway. From Ootsa lake to Burns Lake this road is in good condition, but the other half out to Houston is very rough. It is possible to take a small boat from Ootsa lake up the Tahtsa river to Tahtsa lake, which is only distant a few miles from Sweeney mountain.

In order to improve the transportation into this section, grants were made in 1919 from the "Mines Development Act" (Supplementary). The trail from Houston to Sweeney mountain was considerably improved by building a new trail around Sibola mountain, thus eliminating one high summit which had to be crossed on the old trail.

Another trail was commenced from a point on the Ootsa-Francois wagon-road and is projected to follow up the Tahtsa river to the base of Sweeney mountain. This work was commenced but not carried very far during the season.

From Ootsa Lake settlement a small boat can be taken up Ootsa lake, on up Whitesall river to Whitesall lake, and only a short portage of about a mile separates Whitesall from Eutsuk lake. In this way a large area of country can be reached for prospecting by means of water-travel from Ootsa lake. Some claims have been staked in the Coast range in this region.

For a more extended description of the Sibola section see the 1916 Annual Report.

The most important property in the district is the *Emerald* group, situated **Emerald Group.** on Sweeney mountain and owned by Sweeney, Benson, and partners. The showing consists of a vein varying from 10 to 20 feet in width and mineralized chiefly with galena, together with subsidiary amount of zinc-blende, pyrite, and chalcopyrite. The percentage of galena to gangue is high, sufficiently so as to make good milling-ore, and in many places there are bands of clean galena from 1 to 3 feet in width. The showing is a remarkable one, and now the vein has been traced for 1,000 to 1,500 feet in length and showing values everywhere. The group was staked in 1915 and would not have remained undeveloped but for its distance from a railroad. The transportation problem is admittedly a difficult one for this property and district generally, but it is by no means insurmountable.

In November, 1917, James Cronin secured an option on the *Emerald* group for one year by making a cash payment; in this deal Mr. Cronin was acting for an Eastern American syndicate. This syndicate sent out an engineer in the summer of 1918, who, after examining the property, reported that the location of the property was such as to make it undesirable to take up the option. The Eastern syndicate thus dropped out of the transaction. Mr. Cronin, however, still held his option and renewed it for another year—or until November, 1919—by making a further cash payment. In this last deal Mr. Cronin was backed by Idaho interests.

A number of other claims are staked on Sweeney mountain, some of which will warrant development when transportation of some kind has been arranged into the district.

During the summer of 1919 Mr. Cronin proceeded to develop the *Emerald* group. Supplies were taken in by means of the Ootsa Lake-Tahtsa River route. From a point on the river a good trail was built to Sweeney mountain and at timber-line a camp was erected. From the camp a well-graded trail was built to the showings on the property, which are at an elevation of about 7,000 feet. The distance from the Tahtsa river to the tunnel-site is about seven miles.

The tunnel was driven 124 feet as a drift on the vein. Where the tunnel was commenced the vein showed practically no ore and but little was found throughout the length of the tunnel. At the face of the tunnel a crosscut for 10 feet exposes the full width of the vein. Throughout the tunnel and at the face there are a few narrow knife-blade stringers of mineral—galena and zinc-blende. The tunnel is apparently in vein-matter all the way and in places there are bands of quartz. It would appear that some of the surface showings carrying ore should have been reached by the tunnel and the failure to find ore in this working is disappointing. Mr. Cronin apparently considered so, as he stopped work and dropped his bond on the property. It should be pointed out that a considerable payment on the bond was due in a short time, and undoubtedly this fact influenced the decision to allow the property to revert to the owners. Without question, the surface showings on the property warrant much more extended development than has yet been given to them. It is to be hoped that further development of the property will be carried out during the coming summer.

**Silver Tip Group.** This group of claims is situated on a mountain lying between Eutsuk and Whitesall lakes, on the northern slope towards Whitesall lake. A. C. Garde and partners are the owners. In the spring of 1919 an option was given to the Consolidated Mining and Smelting Company on the whole property, amounting to twenty-three claims. The terms of the option are not known, but it provided for a certain amount of work being done on the claims during the summer. This work was done and operations stopped and it is not known whether the option is still in force. The property is reached by taking a small boat from Ootsa lake, up that lake; then up the Tahtsa river to Whitesall river; then up that river to Whitesall lake and up that lake about twenty miles. The total distance from Ootsa Lake settlement is about sixty miles. From Ootsa lake a wagon-road runs to Burns Lake, on the Grand Trunk Pacific Railway, a distance of fifty miles.

When the property was visited no one was on the ground, so that the examination was unsatisfactory, as some important undeveloped showings were not seen. Near the lake-shore on the southern side is the cabin camp which was erected when the *Cariboo* group, also owned by A. C. Garde and partners, was being developed. The trail to the *Silver Tip* group commences from a small bay about one mile west of this cabin. From the shore a trail about two miles in length runs to the vein which was prospected during the past summer. This showing is in the timber, at about 1,000 feet elevation above the lake.

The vein is exposed in several places along a small creek and has an irregular strike; in places it runs east and west, with a dip of 70° to the south. The rock formation is very soft and much leached, apparently of igneous origin.

A tunnel has been driven in 60 feet on the vein. At the face the vein consists of three stringers of ore totalling about 6 inches, spaced across 3 feet of rock-matter. In all, about 25 tons of ore has been taken out and piled up in the driving of the tunnel. This ore consists of a mixture of zinc-blende, galena, and pyrite. An average sample of this dump assayed: Gold, 0.28 oz.; silver, 32 oz.; lead, 22 per cent.; zinc, 20 per cent. A piece of selected galena gave: Gold, 0.06 oz.; silver, 72 oz.; lead, 66 per cent. Selected zinc-blende gave: Gold, 0.08 oz.; silver, 11.5 oz.; zinc, 44 per cent. Selected pyrite gave: Gold, 0.46 oz.; silver, 25 oz.

It was learned later that higher up on the mountain there are some small veins carrying high-grade copper and silver ore, but these were not seen.

#### BURNS LAKE SECTION.

**Silver Fox.** This claim, owned by P. Anderson, has been bonded by the Taltapin Mining Company. The property is situated twenty-three miles from Burns lake towards Babine lake. The company started operations late in the fall, and has now built twelve miles of sleigh-road connecting the property with Burns lake and put up camp buildings; eighteen men are at work, and a drift-tunnel, with three shifts at work, is being run. The main vein on the property is exposed in a canyon on 15-Mile creek; it is said to be 8 feet wide, half of which is high-grade ore and the balance milling-ore. Some very high silver assays are said to have been obtained; the ore is a mixture of galena, grey-copper, pyrite,

and chalcopryrite, occurring in quartz gangue. The company will develop the property all winter and expects to put a mill on the ground in the spring.

#### CARIBOO MINING DIVISION.

It is gratifying to be able to report a material advancement in mining in the old Cariboo District. The production from this district up to the present time has been almost entirely placer gold, but the development of mineral claims now taking place gives some promise of lode-mineral production in the near future. A considerable revival of interest is also taking place in placer-mining, and a number of new properties have been taken up and are being equipped with plants.

#### BARKERVILLE SECTION.

The hydraulic placer mines near Barkerville made a somewhat smaller production than in 1918. The water-supply during the year was normal and better than in the previous year. The yardage handled was in most cases quite satisfactory, but was somewhat lower grade than in previous years. But for this the gold production would have shown an increase over that of 1918.

During the season a further examination of the district was made by Dr. B. R. MacKay, of the Dominion Geological Survey. This work was a continuation of the investigation commenced last year. This detailed study of the Cariboo placer deposits will undoubtedly prove of great assistance to the operators in the district.

These mines, consisting of *Lowhee*, *Stouts Gulch*, and *Mosquito Creek*, which **Hopp Mines.** are operated under the management of John Hopp, were worked fairly continuously throughout the season. *Lowhee* is the most important of these mines and a large yardage was handled during the past season. The ground this year was lower grade than usual, but it is expected that the pit will soon be advanced beyond the drift-diggings of the old-timers, where richer ground is expected to be found.

On *Stouts Gulch* claim side-channels and benches of low-grade ground were worked as was done in 1918, the main channel having been worked to its head in 1917. There is still a considerable yardage of this low-grade ground to work out.

On *Mosquito Creek* the water-supply is small so that the operations are intermittent. The results were about the same as in previous years.

*Point Mine.*—This property, owned by Loo Gee Wing, of Vancouver, was worked during the season under the superintendency of Joseph Wendle. The output was about the same as in 1918.

*Perkins Gulch.*—I. I. Felker and W. S. Sparkes continued to operate hydraulically their claim on Perkins gulch. They report a fairly good season, and if a better supply of water was laid on the property a much better production could be made.

The following report on the season's operations at this property was submitted by I. I. Felker, one of the owners:—

"We were handicapped the past season, like so many other operators, on account of the scarcity of labour, working with three men instead of our usual crew of five men. On this account our yardage and output fell below the average of other years. We were unable to bottom up but a quarter part of the pit that we outlined in the spring. Therefore some of the proceeds of this year's work will go over into next year. We moved about 20,000 yards of gravel with thirty days' continuous run in the high water and using the reservoir during the remainder of the season.

"Since the last report, Donald D. Fraser, M.E., has joined the partnership, which enables us to undertake development-work of considerable importance to us. We plan to install a No. 4 plant at the mouth of the creek, using the water from Amador creek, and operate in conjunction with our present plant. This work is progressing as fast as the labour situation will allow, and with no serious drawback the plant will be ready for operation for next season.

"The ditch from Amador creek is just over a mile long and is 3-foot bottom, 1½-foot cut, 1-to-1 slope, with grade of 8 feet to the mile. Flume will be 42 x 36 inches, with 4 per cent. grade. Plant will operate under a vertical head of 250 feet."

This property is situated on Grouse creek, about four miles from Barkerville. **Waverly.** It was operated steadily until a few years ago, when it was closed down. Late in 1918 it was acquired by E. Moore and associates and re-equipped for hydraulic operation. Actual hydraulicking was started in 1919, but most of the work was dead-work, in that no pay-ground was handled. It is hoped that the pay-ground will be worked into in the coming season.

*Proserpine Mountain.*

An important event in the district in 1919 was the commencement of active development of the gold-quartz properties on Proserpine mountain near Barkerville. If the development proves satisfactory a new era of mining will be opened up in the Cariboo, and quartz-mining will receive attention in a district where it has been popularly supposed the only possibilities were in placer-mining. The groups of claims now being tested are typical of many quartz-showings in the district, and if these prove successful others undoubtedly will be developed. These properties have been described in detail in previous Annual Reports, so that only a summary is needed here.

The showings on these properties are quartz veins varying in width from a few feet up to 20 feet and carrying small quantities of pyrite, arsenical pyrites, and smaller amount of galena. The main valuable metal content is gold, which is apparently associated with the iron sulphides. The distribution of the gold values is quite irregular and much development will be required to determine the average gold tenor of the veins as a whole or in workable portions of the veins. It is apparent that when any considerable body of the quartz is considered the average gold value will be low, but it is expected that it will prove sufficient to mine and mill on a large scale and still leave a margin of profit. In other words, a large low-grade mine is the possibility of these properties.

The groups that have been bonded are the Armstrong & Tregillus properties, situated on Proserpine mountain, five miles from Barkerville. The properties have been taken up by Robert A. Bryce, of Toronto, who is backed by a syndicate of Toronto capitalists. Mr. Bryce secured the claims in September and immediately commenced operations. The claims were surveyed and camp buildings erected. The plan of development includes surface work, several drift-tunnels, and one or more shafts. In addition, two diamond-drills will be in operation in a short time. At present about seventy men are employed. The terms arranged were in the nature of a lease and bond extending over some years, with a small cash payment and progressive payments as the time goes on.

*Antler Creek Gold Mines.*

This company, in which H. C. Carry is the principal stockholder, was formed to work an old placer property on Antler creek, some twelve miles from Barkerville. This property has been prospected intermittently for some years past with the hope of finding the old rich channel of Antler creek. Six men, all interested in the company, were at work on the property during the summer and fall. The work consisted of drifting and sinking in an endeavour to locate pay values. Eventually, if pay-ground is found, it is proposed to make an hydraulic proposition out of it, using Antler Creek water.

*Antler Creek.*

It is expected that next year a large modern gold-dredge will be brought in and erected on Antler creek. An area of ground on this creek has been tested by Keystone-drilling and the results are so satisfactory that operation by dredging will be commenced. The ground is owned by E. Moore and associates. Mr. Moore supervised the drilling and is now satisfied to go ahead with the plan to erect a dredge. The securing of the necessary equipment was difficult this year, but it is hoped that the plans will mature in 1920. There is a large yardage of ground to work and the values are said to be high.

## QUESNEL SECTION.

*Lightning Creek Gold Gravels and Drainage Company.*

Construction, repair-work, and Keystone-drilling were carried on by this company during the spring and summer of 1919. In the fall a new shaft was started. This shaft will be sunk through the stream-gravels and is for the purpose of opening up the deep channel of Lightning creek, where drilling has shown good gold values on bed-rock. Shafts have been sunk on this property before, but have been lost owing to the heavy water-pressure. The plant is now well equipped with pumps to handle a very large flow of water, and it is hoped that this shaft will be successful in reaching the channel. Work is progressing during the winter.

*Placer Mines, Limited.*

The property of this company is situated on the Fraser river twelve miles below Quesnel and near the mouth of Kersley creek. The ground to be worked is a bench of the Fraser river.

James F. Reilly is manager in charge of the work. Equipment of the property with a Sauerman scraper was commenced during the summer, eleven men being employed for three months. Work was stopped in the fall.

During the year a company was organized by S. J. Marsh to work gravel-deposits on the Quesnel river ten miles above Quesnel. It is intended to work the ground by the use of a scraper, and the necessary machinery has been bought, but not yet delivered. The work of equipping the property will be commenced in the spring of 1920.

#### QUESNEL MINING DIVISION.

##### KEITHLEY SECTION.

R. W. Harrison continued operating the *Kitchener* placer mine with a small crew of men. This is a drifting proposition, and during the season a rich part of the channel was struck, with the result that considerable gold was taken out, the season's clean-up being more satisfactory than formerly.

##### HORSEFLY SECTION.

###### *Harpers Camp.*

The International Dredging Company operated its plant, consisting of a drag-line scraper, during the season, but as yet the ground being worked is mainly an old tailings, so that but little returns could be expected.

The prospecting of this area by Keystone-drilling has been under consideration by the Mines Department for some time past, and about the end of November the work was commenced. It is expected that, if the weather permits, drilling will be continued most of the winter.

A full report on the Harpers Camp area and the proposed Keystone-drilling of the ground can be found in the Annual Report of the Minister of Mines, 1918, pages 136 *et seq.*

To sum up briefly: A small area lying in bend of the Horsefly river at Harpers camp was very rich placer-ground, having produced from \$500,000 to \$1,000,000. The character of the gold found here showed that it had travelled some distance. It is therefore maintained by many that the small rich area at this point must necessarily have a feeding channel coming into it.

A certain amount of prospecting by means of hand-sunk shafts has been done in attempts to find a continuation of the rich ground, but without success. For such prospecting Keystone-drilling is the most satisfactory method. The work to be done this winter by the Government will be of great assistance to the International Dredging Company in outlining the pay areas in their ground. If the drilling is successful in finding a feeding channel it will mean a great deal to the Harpers Camp area.

So far as the drilling has gone, there is nothing in the way of results to report for the year 1919. So that at present there is nothing to add to the report on the Harpers Camp area written in 1918. When some drilling has been done a more detailed report on the area will be submitted.

During the summer of 1919 a topographic map of the Harpers Camp area was made by Dr. B. R. MacKay, of the Dominion Geological Survey. This has not yet been issued.

###### *The Forks Mining Company.*

This company was formed to operate ground located on the Upper Horsefly river, some fifty miles above Harpers camp. The property was not visited, but a description was obtained from the manager, Mr. Sprinkling.

During the season of 1919 the gravels above the forks of the Horsefly river were tested. There is a considerable yardage of gravel here of varying depths, but generally shallow. The testing by means of sluicing and pits showed pay values in many places. The results of the season's work are considered highly satisfactory by the company officials and plans are now being made to equip the property with machinery in 1920.

As the ground lies flat, it is not possible to work it hydraulically. It is intended to install a scraper system, similar to that in use by the International Dredging Company at Harpers camp.

The taking-in of the necessary machinery will be somewhat difficult. The route from Harpers camp is by wagon-road, twelve miles to Quesnel lake; then forty miles up the lake; then over a trail, which rises considerably, for nine miles to the property. The first work done in the spring will be to materially improve this trail.

The property was examined by B. R. MacKay, Dominion Geologist, but his report has not yet appeared.

## CARIBOO DISTRICT.

### CARIBOO MINING DIVISION.

REPORT BY L. A. DODD, GOLD COMMISSIONER.

I have the honour to submit herewith my annual report on the progress of the mining industry in the Cariboo Mining Division for the year ending December 31st, 1919.

It will be noted that the revenue shows a considerable increase, being nearly double that received for the calendar year 1918.

Beyond the development of quartz properties on Proserpine mountain, about three miles from Barkerville, which were bonded in September last by R. A. Bryce, M.E., on behalf of the Mining Corporation of Canada, and on which a force of from fifty to sixty men has been constantly employed during the past four months, there has been very little change in conditions in the district.

The District Engineer paid two visits to the Division during the season, and a party of the Dominion Geological Survey under Dr. B. R. MacKay worked some weeks near Barkerville. It is anticipated that their reports will cover the progress in mining and conditions, technically and generally.

The Dominion Geological Survey also had a topographical survey party under S. C. McLean in the field. This party established a base-line from which it is proposed to map the Barkerville area.

A discovery of hæmatite near McBride was reported in August; it is stated to be 200 feet wide and traceable for miles.

Transportation of supplies and machinery and labour shortage appear to be the greatest difficulties with which the mining operator has to contend, but with the anticipated completion to Prince George this year of the Pacific Great Eastern Railway these will be largely eliminated.

#### OFFICE STATISTICS—CARIBOO MINING DIVISION.

Free miners' certificates issued (Barkerville, 242; South Fort George, 178; Quesnel, 125) .....	545
Mineral claims recorded .....	234
Placer claims recorded and rerecorded .....	21
Certificates of work .....	91
Conveyances and other documents recorded .....	30
Powers of attorney recorded .....	51
Fillings .....	14
Certificate of improvements .....	1
Application for Crown grants .....	1
Leaves of absence (placer) .....	15
Applications for placer-mining leases .....	90
Placer-mining leases issued .....	50

#### Revenue.

Free miners' certificates (Barkerville, \$1,774.50; South Fort George, \$941.25; Quesnel, \$585.50) .....	\$ 3,301 25
Mining receipts, general .....	11,381 25
Other sources .....	1,105 85
<b>Total</b> .....	<b>\$15,788 35</b>

## OMINECA MINING DIVISION.

REPORT BY STEPHEN H. HOSKINS, GOLD COMMISSIONER (OFFICE AT HAZELTON).

I have the honour to forward herewith the office statistics for the Omineca Mining Division for the year 1919, from which, unfortunately, a large decrease in revenue to that received in the year 1918 will be observed, which may entirely be accounted for in the apparent decreased activity in placer-mining within this Division.

As in the past, the Resident Mining Engineer will undoubtedly supply you with reports *re* actual mining development during the past year.

In lode-mining there is undoubtedly renewed activity, but without a flourish of trumpets, which would lead one to anticipate that that branch of the industry is now getting on to a more substantial and permanent basis.

Properties on the Hudson Bay mountain in the vicinity of Smithers have attracted the attention of outside capital and are now being quietly developed.

The Babine Bonanza Mining Company, under the management of James Cronin, is still continuing development-work.

The properties on Blue Grouse mountain in the vicinity of Quick, on the Grand Trunk Pacific Railway, are being steadily developed and show greater promise for the future than at any time during the past.

The *Silver Standard* mine at New Hazelton has been a steady shipper throughout the year.

The *Delta* group on the Rocher Déboulé mountain in the vicinity of Hazelton is now undergoing development operations under the able superintendence of W. G. Norrie-Lowenthal.

At Usk various properties are receiving attention and a considerable amount of capital is being spent on mining development in this vicinity.

It is with deep regret that I have to say placer-mining throughout the Mining Division has not during the past year received the share of attention that it deserves, but it is understood that it is the intention of the Kildare Mines, Limited, to resume operations on their extensive placer-mining properties in the Manson Creek country as soon as climatic conditions will permit.

## OFFICE STATISTICS—OMINECA MINING DIVISION.

Free miners' certificates issued (ordinary) .....	487
Free miners' certificates issued (company) .....	10
Mineral claims recorded and issued .....	234
Placer claims recorded and issued .....	7
Certificates of work recorded and issued .....	599
Bills of sale and mining documents .....	136
Powers of attorney recorded .....	22
Mining documents filed .....	48
Certificates of improvement recorded and issued .....	6
Crown grants of mineral claims .....	6
Applications for placer-mining leases (Peace River) .....	22
Placer-mining leases issued (Omineca, 5; Peace River, 19) .....	24

## Revenue.

Free miners' certificates .....	\$ 3,066 00
Mining receipts .....	8,948 25
Total .....	\$12,014 25

## QUESNEL MINING DIVISION.

REPORT BY R. M. MCGUSTY, MINING RECORDER.

I have the honour to submit herewith my report on mining operations in the Quesnel Mining Division of the Cariboo District for the year ending December 31st, 1919.

As the Resident Mining Engineer of this district is forwarding a report on the various properties throughout this Mining Division, I am refraining from reporting thereon.

During the past season there has been a decided improvement in the general outlook as regards mining; especially noticeable in this respect have been the number of applications for placer-mining leases, which show a decided increase over former years.

The litigation in connection with the *Bullion* claims has, I am informed, been finally disposed of, and doubtless work will start up again on these claims during the coming year.

The Pacific Great Eastern Railway has now been completed to Williams Lake; although as yet the line is not open to passenger traffic, freight is now being handled, which will remove to a large extent the severe handicap this Division suffered from in regard to high cost of freight on machinery to the mines, and the coming year should undoubtedly see great activity in the Hydraulic, Keithley, and Harpers Camp sectors.

### OFFICE STATISTICS—QUESNEL MINING DIVISION.

Free miners' certificates issued .....	109
Mineral claims recorded .....	25
Certificates of work issued .....	17
Placer-mining claims recorded .....	12
Placer-mining claims rerecorded .....	8
Conveyances, etc. ....	23

## EASTERN DISTRICT (No. 3).

REPORT BY A. G. LANGLEY, RESIDENT ENGINEER.

### INTRODUCTORY REMARKS.

Generally speaking, the production of both the metalliferous and coal mines of the district shows a slight decrease as compared with that of last year, but everything points to this only being a temporary lull, and the prospects for the coming year are most assuring.

The mining industry was somewhat handicapped by the lack of efficient labour, while the unusual dryness of the season curtailed the outputs and interfered with the development-work at some of the leading properties owing to the lack of water for power and concentration purposes.

There has undoubtedly been more activity than last year among the prospects of both East and West Kootenay, while development at some of the most important properties promises well for increased outputs during 1920.

The tonnage treated by the Trail smelter was well over 300,000 tons, and the long list of shippers, including the names of all the important mines in the Nos. 3, 4, and 5 Mineral Survey Districts, also the names of others in the northern extremities of British Columbia, in the State of Washington, and in Manitoba, demonstrates the great importance of this plant to the mining industry of this Province. During the latter part of 1918 and at the beginning of this year the smelting rates under Schedule B of the Consolidated Mining and Smelting Company were severely criticized by some of the mine-owners; hence the Associated Boards of Trade of Eastern British Columbia petitioned the Federal Government to appoint a special commission to investigate and report the fairness or otherwise of the smelting charges. The committee chosen consisted of S. S. Fowler, of Riondel; James Anderson, of Kaslo; and Ivan F. Lashmutt, of Silvertown. The investigation was started by the committee on January 21st and its report was completed at the beginning of June. As representative for the Provincial Government, I attended the sessions of the committee and was willingly given access to all data and correspondence.

The report of the committee is the result of careful study and observation of the voluminous data and statements so readily submitted by the Consolidated Mining and Smelting Company, and of the conditions with which the mine-owners of the district have to contend. It deals in a straightforward and adroit manner with the different phases of metallurgical and business matters relative to the smelting of British Columbia ores, and undoubtedly will throw light on many points which were not formerly understood or appreciated by some of the mine-owners. I would consider the report to have fully justified the investigation.

On June 24th the Consolidated Mining and Smelting Company introduced Schedule C, which shows a substantial reduction in charges amounting to an average of about \$3 a ton on Slocan ores. This reduction was made possible by the better analysis of the ore-supply and improved metallurgical recoveries.

On September 26th the company notified the mine-owners that they had decided to do away with the old pooling system of settlement for lead and advance payment of 90 per cent. of the apparent value soon after sampling, the final adjustment to be made shortly after the close of the second calendar month after sampling.

During recent years small fortunes have been acquired by mine operators in this district, and while increased activity among the mines and prospects is anticipated, there are still large areas to be prospected, and it is to be hoped that the coming year will witness far more activity in this direction than could be expected during the period of the war. In this connection I might particularly refer to the Big Bend country north of Revelstoke, and to the Golden, Windermere, and Fort Steele Divisions.

Visiting engineers, prospectors, and others seeking information will find the Resident Engineer, Gold Commissioners, and other officials of the Department of Mines always willing to give information regarding various parts of the district.

In conclusion, the writer wishes to acknowledge the courteous treatment and assistance willingly rendered to him at all times by the mining fraternity of the district.



B.C. Bureau of Mines

Gamble Mining Co.'s Sluice, Fort Steele M.D.



B.C. Bureau of Mines

Slide Mountain from Paradise Mine, E.K.

## EAST KOOTENAY DISTRICT.

## GOLDEN MINING DIVISION.

Owing to stress of work in other parts of the district, the writer did not have an opportunity of doing any field-work in this Division during the year. According to reports so far received, the mining activities show little (if any) improvement over those of last year.

The *Couverapee*, at Field, which was the leading shipper, was temporarily tied up by litigation, arising from a dispute regarding the boundary-lines of this property and those of the *Monarch* between the respective owners. According to latest reports, the *Couverapee* and *Monarch* have amalgamated, and are now being managed by Mr. Adkins, who formerly operated the *Couverapee*.

C. J. Lincke, who is interested in the *Tarheel* group of claims on the Middle fork of the Spillimacheen, is reported to be making arrangements to pack out some copper ore.

The *Rose* and *Daisy* claims, formerly known as the *I.X.L.* and *Condor*, have been bonded to Mr. Rowley, who has a small crew of men at work.

## WINDERMERE MINING DIVISION.

The activity among the prospects of this Mining Division has been more pronounced than last year, and with the prevailing high price of silver, still further activity may be expected during the coming season.

*Paradise*.—Mining and development work has been actively carried on during the year at this property, which ranks among the four most important producers of silver-lead ore in the East Kootenay District. A connection has been made from the end of the long tunnel of the No. 4 level with the upper workings, and other raises are now being driven to tap the recently developed ore-shoot below the No. 2 level. The production for the year totals about 2,000 tons, which compares favourably with that of previous years.

*Trojan*.—Active development-work has been carried on during the season by the Trojan Mining Corporation. A 9 x 8 Ingersoll-Rand compressor and a 35-horse-power gasoline-engine were installed. The principal values are in copper. The ore occurs in a quartz-filled fissure. Shipments for the year amounted to 43 tons.

*Sitting Bull*.—No mining was done at this property during the year. Thirteen tons of ore extracted during previous years was shipped to Trail.

*Burman Group*.—Situated on Slade creek, almost opposite the *Sitting Bull*. John Burman, the owner, has been occupied during the season in driving a crosscut to tap the vein, in which a high-grade shoot of ore was encountered in a drift near the surface. At the time of examination the crosscut was driven for 100 feet through a highly silicified limestone, but was not in quite far enough to reach the vein.

*Lead Queen*.—This property is situated on Frances creek. It was recently acquired by Paul Denhart, of Seattle. During the year 40 tons of silver-lead ore was shipped to Trail. Recent work has consisted of driving a crosscut to intersect the vein at a point below the ore-shoot.

*Relief Group*.—This property is near the summit of Slade mountain and at a short distance from the *Sitting Bull*. The trail was opened to the property this year, and some work done on the claims by J. C. Pitts and partner, of Invermere. The ore is high-grade silver-lead. A small shipment was made in 1917 from this property, but as the ore had to be packed out for a distance of nine miles to a wagon-road, and then hauled eight miles to the railway, the net profit after deducting transportation charges was not very encouraging, and the property was idle during 1919.

*Isaac*.—This property is situated on Frances creek at a distance of a few miles from the *Lead Queen*. For many years it has been owned and operated by H. E. Forster, of Wilmer; this year it was bought by Paul Denhart, who, it is reported, intends to operate the property during the winter.

*Nip & Tuck*.—W. D. McMillan, of Athalmer, has taken an option on this property, and had a small crew of men working this year.

The claims are situated near the headwaters of McDonald creek. It is also reported that E. Watson and others have taken a lease on the *Ptarmigan* and *Red Line* groups, that the results so far have been encouraging, and that teams are now engaged in the hauling of ore.

This property, consisting of three claims, is situated on the North fork of Toby creek at a distance of twenty-two miles from Invermere. The old wagon-road which leads past the claims needs a few repairs before it can be used for haulage. The elevation of the camp is 6,650 feet, or about 1,350 feet above the road. R. Randolph Bruce, of Invermere, is part owner and agent for the property.

The vein was discovered many years ago by an Indian and surface work was done as early as 1896, which disclosed an unusually good showing, described in the Minister of Mines' Report for 1898 as follows: "A vein of solid galena, varying from 12 to 36 inches, had been exposed in a series of open-cuts for a distance of some 150 feet." Between the years 1902 and 1905 some 150 tons of high-grade silver-lead ore was extracted from the surface and stoped from workings leading from a shallow shaft. This ore ran from 70 to 148 oz. silver and from 18 to 33 per cent. lead. Since this time the mine has been idle and the camp buildings are rapidly becoming dilapidated.

The vein, which is a well-defined quartz-filled fissure, cuts the formation of siliceous limestone at a slight angle and varies in width from 1 to 3 feet. It has been stoped along the surface for a distance of about 200 feet, and for this distance shows clean well-defined walls. The bottoms of these stopes or cuts are filled with caved material, so that at no point was the vein accessible for sampling.

At the time of examination it was not deemed advisable to tackle the old ladders without a rope, hence the underground workings were not seen; but the following is an extract from the Minister of Mines' Report for 1915, page 94: "The main working is a shaft on the vein 30 feet deep, with a drift 146 feet to the east, where an incline raise goes up to the surface 60 feet above, and a drift 70 feet to the west, and a shallow winze which was full of water at the time of examination. It is believed that other drifts have been run from this winze at a lower level."

The vein has a strike of N. 45° W. and dips into the hill at an angle of about 75 degrees. The hill slopes at an angle of 40 degrees, hence good tunnel-sites are obtainable should conditions warrant further development at a depth.

At a vertical distance of about 150 feet below the outcrop of the main vein a short crosscut reveals a small parallel vein, which has been drifted on for about 20 feet. At the face the vein shows a width of 6 inches, a sample of the ore from this point ran: Gold, trace; silver, 19.6 oz.; copper, 1.6 per cent.; lead, 21 per cent.; zinc, 4 per cent. It is a property that has possibilities, and it seems strange that no attempt has been made to further develop it during recent years.

This property, which is located on the southerly end of the *Delphine* vein, **M. T. Fraction.** belongs to R. S. Gallop, of Invermere. Here the vein has also been stoped out at the surface for a distance of 50 feet and to a depth of 20 feet. From this stope two shipments were made, and ran as follows: Net weight, 31,036 lb., containing 4.9 per cent. copper and 248.3 oz. a ton in silver; net weight, 38,000 lb., containing 5.6 per cent. copper and 220.5 oz. a ton in silver.

At a short distance in a southerly direction from this stope the vein has been drifted on for 20 feet and shows a width of 11 inches, but only slight mineralization. A sample across the face ran: Silver, 3.5 oz.; copper, 0.18 per cent.; lead, *nil*; zinc, 4 per cent. However, this drift neither gains any appreciable depth on the vein nor does it develop the vein under that portion which has been stoped at the surface.

This property is reached by following the continuation of the *Delphine* trail **Tilbury and B.C.** for a distance of about four miles towards the summit. The claims are situated on the bare mountain-side at an elevation of 9,400 feet (aneroid reading). A small stone hut affords the only shelter, and owing to its prominent situation furnishes a useful landmark. The claims are principally owned by H. E. Forster, of Wilmer.

According to past records, some five car-loads of ore has been packed out. A sample of some ore sacked for shipment during recent years ran: Gold, trace; silver, 76.5 oz.; lead, 20 per cent.; zinc, 8 per cent. There were about 100 sacks in this lot, which before being shipped would have to be resacked. Snow and ice prevented an examination of the workings. For further reference see Minister of Mines' Report, 1915, page 95, and 1909, page 100.

#### FORT STEELE MINING DIVISION.

**Sullivan.** The tonnage, amounting to 117,007 tons zinc ore, 14,890 tons lead ore, and 3,060 tons pyrite, shows an increase in zinc ore over that of last year, notwithstanding the fact that the output was seriously curtailed during the latter part of the

year on account of a strike called by the O.B.U. The following brief notes regarding this property may be of interest to those who are not familiar with the character of the deposit:—

In the early nineties the mine was first worked by a shaft and a series of shallow adits from the surface down, and the present main level of the upper workings is the tenth adit. This level is about a mile in length and cuts three distinct ore-zones. The first occurs near the portal of the tunnel, and from which, in the early history of the property, the lead was shipped and the zinc discarded. Most of the ore has been stoped out to the surface, between 50 and 60 feet above the level at this point. Passing through this ore-zone, the tunnel next cuts a pyrite-zone about 1,000 feet in width, from which the Trail smelter derives its supply of iron pyrites for the sulphuric-acid plant.

Finally we come to the north ore-zone, which has proved to be the most economically important and productive deposit so far encountered on this level. Immediately past this the vein is faulted, and the formation has been subjected to crushing and shearing movements. The strike of the fault makes a very acute angle with that of the vein. To date this fault has only been encountered on this one level of the mine. A long crosscut driven at this point to the west was successful in picking up more ore in previously unexplored ground.

In order to develop the large ore-bodies exposed in the upper workings, an adit-tunnel was started from Mark creek several years ago and is now in 8,100 feet. This tunnel runs parallel to the strike of the vein and is in the foot-wall side; the depth gained on the vein is 1,500 feet. Large ore-bodies were developed during the year at a short distance above the tunnel and in ground corresponding to the downward continuation of the first ore-zone in the upper tunnel.

The vein, which has a dip of from 20 to 25 degrees and a strike of north and south, is conformable to the enclosing quartzite formation. The ore is a very fine-grained mixture of pyrrhotite, zinc-blende, and galena.

*North Star.*—Under the management of O. C. Thompson, this property has been a steady producer during the year, and recently attained the rank of the second largest shipper in the East Kootenay. The bulk of the shipments has been made from the old dumps.

*St. Eugene.*—This famous property is still producing under the direction of the Consolidated Mining and Smelting Company. Shipments this year are double those of the previous year.

*Guindon Group.*—This property is situated almost directly opposite to the *St. Eugene*, on the other side of Moyie lake. It is being developed by Frank Guindon, an old-time miner of Moyie. A small shipment of silver-lead ore was made during the year.

*Victor.*—It is reported that G. Gundry has taken a lease and bond on this property, and intends erecting a 50-ton concentrator during the winter. The property was originally opened up by R. Abernethy, of Spokane, some ten or fifteen years ago. It is situated on Maus creek at a distance of about nine miles southerly from Fort Steele. The ore is rather a complex mixture of galena and zinc-blende, carrying good average values in silver and lead.

At Skookumchuck, on the Kootenay river, prospecting-work has been carried on during the season on a showing of copper ore. It is understood that the extent of the work done so far has not been sufficient to define the ore-body, but the results so far obtained are said to have been encouraging.

*Kootenay King.*—This property belongs to William Myers, of Fort Steele, and has been developed and prospected by him for a number of years. It is located on a tributary to Wild-horse creek at a distance of about ten miles from Fort Steele. The ore is said to run about 10 oz. in silver and 15 per cent. lead. Mr. Myers put in a season's work on the property.

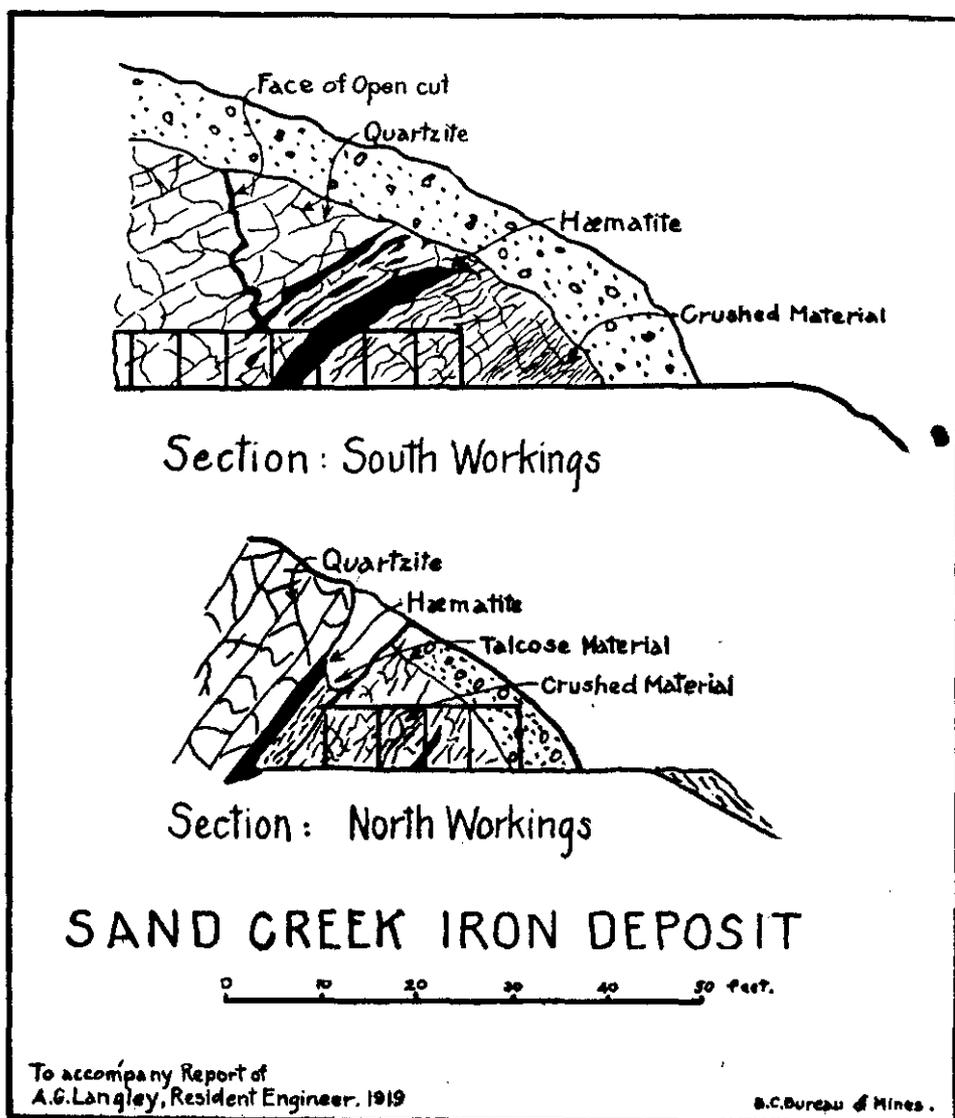
The usual amount of prospecting-work has been done in St. Mary country, and it is reported that Evans Bros., of Cranbrook, who are among the pioneer prospectors of the district, have been successful in bonding the *Achilles* group of copper claims for a substantial amount.

#### SAND CREEK IRON-DEPOSITS.

Preliminary exploration has disclosed a vein of hæmatite running in a north-westerly direction along the south side of Sand creek. Three claims have been staked along the strike of the vein and are known as the *Pearson* group, being owned and originally staked by the present owner, W. Pearson. Leaving the Fernie road at Jaffray, it is possible to drive by motor within six miles of the property. A good trail is then followed up the creek. The claims are easily accessible, and a road-grade of not exceeding 3 per cent. is obtainable from Galloway to a point on the creek immediately below the exposures, which are situated at an elevation of from 400 feet to 600 feet above.

The valley of Sand creek in this vicinity is a beautifully wooded country, the timber principally represented being white pine, hemlock, and cedar. On account of the rock in-place being covered with overburden, it is only possible to form a very limited idea of the geological structure of the formation, which apparently consists of quartzites, probably belonging to the Cambrian age, and having a dip of 50 degrees to the south-west and a strike of N. 50° W.

The ore, consisting of a massive red hæmatite, occurs as a bedded fissure-vein replacing the quartzites. The hanging-wall is well defined, but on the foot-wall side the ground is broken and crushed and in places stained with the characteristic red colour of the ore.



At the most southerly working, at an elevation of 4,000 feet, a deep open-cut crosses the strike of the vein and terminates in a short tunnel. Here the formation seems to be broken over, and the ore, which is more or less crushed, does not appear to be in-place, but to have slid over from a higher point up the hill. The ore shows a width of 3.5 feet of massive red hæmatite, a sample across which ran: Metallic iron, 52 per cent.; silica, 22.6 per cent.; phosphorus, *nil*; sulphur, *nil*.

At a slope distance of approximately 120 feet above this showing a diamond-drill hole was put down by Dr. Ings, of Calgary, some years ago, but no record of the work is available, except that the results were not encouraging. At an elevation of 4,000 feet, and at an approximate distance of 300 feet to the north-west, a short tunnel was driven on the vein and a small tonnage of hæmatite extracted. The ground here is broken near the surface and the tunnel is not of much consequence, except to show the persistency of the vein.

Continuing along the side-hill for a distance of about 300 feet, the northerly workings are reached. Here at an elevation of 4,300 feet a short crosscut shows a section of the vein to be in-place. The dip, conforming to that of the enclosing strata, is 50 degrees to the south-west and strike about N. 50° W. The hanging-wall of quartzite is well defined and there is a good selvage between it and the ore. On the foot-wall side, adjacent to the ore, there is a band of about 2 feet of soft talcose material, and general conditions would indicate that the country-rock has undergone more crushing and alteration on this side of the vein.

The ore is a well-defined band of red hæmatite lying next to the hanging-wall and having a width of 12 inches, across which a sample ran as follows: Metallic iron, 57.4 per cent.; silica, 15.6 per cent.; phosphorus, *nil*; sulphur, *nil*. Although the samples taken show the ore to run rather high in silica, it is undoubtedly of good grade, and should a good workable width be developed the mining costs for this class of ore should not exceed \$2 a ton.

The hillside sloping at an angle of 30 degrees affords a number of good tunnel-sites, and a depth of about 400 feet on the vein could be obtained by crosscutting from the surface. There is a good camp-site with plenty of timber and water, while power might be developed from Sand creek, which has a flow of about 4 second-feet during the dry season.

It is not unlikely that there may be other parallel veins in this formation, and although the vein is small the good quality of the ore and the easy accessibility of the property are strong factors in its favour, while the possibilities from a geological standpoint appear to warrant further work being done to prove the existence of a sufficient body of ore to be of economical importance.

The preliminary work should consist of trenching and open-cuts along the strike of the vein; then, if the results were favourable, a diamond-drill might be employed to advantage.

#### ST. MARY PRAIRIE.

A short trip was taken to examine a few prospects near Lone Tree butte, which, rising to height of about 500 feet above the slightly undulating prairie country, forms a conspicuous landmark at a distance of approximately three miles to the east of Marysville. There is nothing worthy of special mention to report on some of these properties, for the simple reason that there was not much to be seen on account of the old open-cuts being mostly filled and the shafts not being in condition for examination.

On this property, which is owned by the Hon. Dr. King, W. Tarrant, and  
**Yankee Girl.** J. Angus, a shallow shaft exposes a sparsely mineralized quartz vein in quartzite of the Aldridge formation, which latter at this point is apparently an inclusion in igneous rocks of the Purcell sills. The mineralization, consisting of chalcopyrite and iron pyrites, seems to be confined to small quartz veins and stringers. The vein has a width of 3 feet, a strike of N. 30° W., and dip at 65 degrees to the south-west. A sample from the best-looking ore on the dump ran: Gold, trace; copper, 0.3 per cent. Other showings exposed in a few shallow open-cuts were not significant of the possibilities of the property, which can only be established by further work.

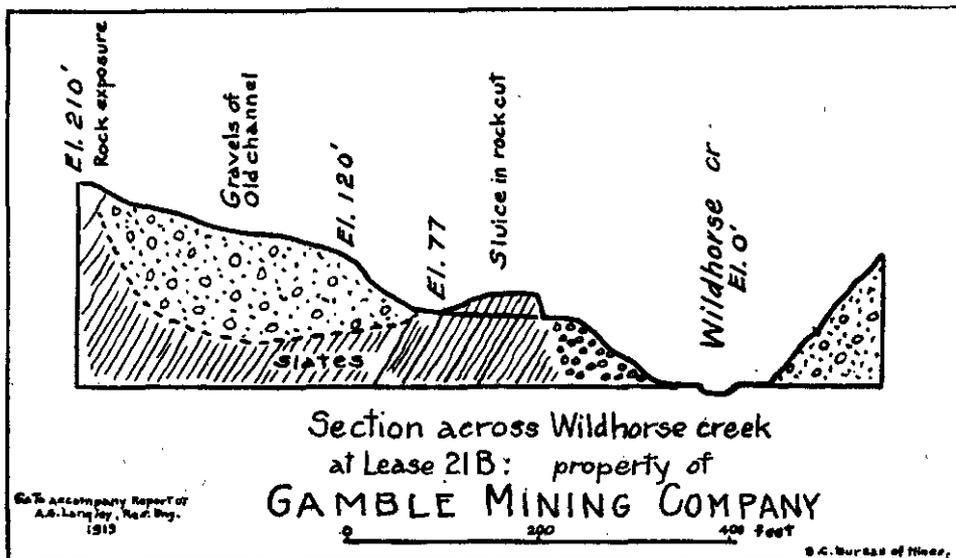
On this claim, which adjoins the *Yankee Girl* group to the north-west, a number  
**Black Hill.** of shafts have been sunk, but could not be examined, so I herewith give an extract from the Provincial Mineralogist's Report of 1898: "The formation in the immediate vicinity is composed of an igneous rock, probably diorite, cutting which is a vein 3 feet wide, having a dip of 75 degrees to the north-west and striking N. 75° E. There are three shafts on the property, sunk respectively 40, 30, and 20 feet. The 40-foot shaft has the best showing, but the others are similar in many ways, the vein-matter being calcite and quartz, seemingly in alternating layers of varying thickness. In the upper 10 feet of this shaft a fair showing of galena was exposed, but at this depth that mineral disappeared and the shaft was barren until a depth of 20 feet was attained. At this point copper pyrites appeared on the sides, continuing in small quantities through the vein to the bottom of the shaft, while in the lower few feet a little grey-copper was putting in an appearance."

**Luke Group.** This group, which is owned by J. T. Laidlaw, is situated on the rounded summit of a small spur of Lone Tree butte. Here an open-cut about 15 feet long and 8 feet deep exposes a quartz vein about 4 feet wide and side-stringers of quartz. The vein strikes S. 30° E. and dips at 80 degrees to the south-west. The bottom of the cut was filled in, and the metallic contents, consisting principally of iron and a little copper, the latter in the form of chalcopyrite, were not in sufficient quantity to be considered of economic value. A sample taken across a width of 45 inches at a depth of 3 feet below the surface gave negligible results. A sample taken from a small pile of sorted ore, possibly extracted from some seam or pocket, ran: Gold, trace; copper, 9.4 per cent.

This property is situated on the north side of Lone Tree butte and is owned by George Leask, of Cranbrook. The summit of the butte is composed of diorite sill-rock, which overlies the quartzites outcropping on the northerly side of the hill. In this formation a small but well-defined quartz vein occurs, varying in width along the outcrop from a few to about 18 inches. It has a strike of N. 45° E. and a dip into the hill of 45 degrees to the south-east. The principal work done on the vein consists of a 50-foot incline shaft. This shaft was full of water, so could not be examined, but high-grade ore in streaks and small pockets is said to have been struck. The ore is principally grey-copper. A sample taken from about 200 lb. of select ore on the shaft-dump ran: Gold, 0.50 oz.; silver, 78 oz.; copper, 2.8 per cent. It is a promising prospect, well worthy of having further development-work done on it. According to recent reports, R. E. Beattie and associates, of Cranbrook, now have a small crew of men employed at the property.

#### PLACER-MINING.

The operations of the Gamble Mining Company and the Wild Horse Dredging Company on the placer deposits of Wildhorse creek created great local interest and speculation. The former company piped water across the creek and operated a monitor on some virgin ground on the west side. Owing to the unusual dryness of the season, the shortage of water caused the cessation of operations during the latter part of the summer. However, results were sufficiently encouraging and work will be resumed next season. The sketch is taken from a survey made by W. H. Eassie.



The Wild Horse Dredging Company, which started operations early in the year, proceeded to build a boom dam across the creek, with the object of sluicing the gravel off the bottom of the main channel and recovering the gold from the bed-rock. Although they rushed the construction of this dam, high water came earlier than was expected and washed out one end which was not quite completed. It is reported that another attempt will be made next season. This company

also installed a drag-line scraper above the dam, with which they intend to remove the gravel from the main channel at this point.

On Perry creek A. J. Palmquist has been busy during the season completing a flume to conduct water to a point near the falls, where he intends to operate monitors on a high gravel-bank on the southerly side of the creek.

#### COAL-MINING.

The coal production of the East Kootenay District shows a considerable decrease as compared with that of 1918. The causes of the decrease are due to lack of demand during the earlier part of the year, followed by a close-down from May 24th until late in August. The strike which brought about the stoppage of all work arose from a dispute regarding the wages of the outside workmen in accordance with the shorter hours of labour provided by the Legislature, and finally developed into a struggle between the United Mine Workers and the O.B.U.

### WEST KOOTENAY DISTRICT.

#### AINSWORTH MINING DIVISION.

##### NEAR AINSWORTH.

**Florence.** This property, which has been operated steadily during the year, was the largest shipper in this Division. The output compares very favourably with that of last year, which reflects credit on the management, for production was somewhat handicapped by having to contend with heavy wet ground in the spring, requiring continual attention and much timbering. Efficient labour was scarce, and owing to the dryness of the season there was a shortage of water for power and milling purposes for a brief period. During five months it is reported that the average daily tonnage supplied to the mill was about 100 tons.

**Bluebell.** The production of this mine during the last two years has been to a large extent dependent upon the large deposit of lead carbonates in the surface oxidized zone above the adit level, that from the lower levels of the mine being stopped by the influx of water, which necessitated the installation of more powerful pumping machinery. It is reported that the mine will soon be unwatered and that mining on the levels below the lake-level will be resumed. The production falls short of that of the previous year.

**Highland.** This mine, which is owned and operated by the Consolidated Mining and Smelting Company, also shows a decrease in production. The concentrator was recently started after being idle for some months. New ore developments are reported. Adjacent claims were acquired, making a total number of seven claims in the group.

**Ruth.** W. A. Smith and associates work the old tailings-dump under lease. A short section of road was built and the material hauled to the upper terminal bins of the No. 1 mine. Assay values of various samples taken gave an average of about 10 oz. silver and 1 per cent. zinc. On account of the high percentage of lime a low smelting rate was obtainable.

*Tariff.*—E. Kennedy and C. Bridge, of Ainsworth, who have been working this mine under a lease, were successful in striking ore on the foot-wall of the vein at the 80-foot level. The road to the property was improved. Total shipments to Trill were 48 tons.

*No. 1.*—This property, which is owned and operated by the Consolidated Mining and Smelting Company, only shows a production of 219 tons, against about 6,000 tons last year.

**Spokane-  
Trinket.** This property has been operated successfully by J. McDougall and shows an increase in production over that of last year. The ore-bodies are small but persistent in occurrence. It is a good example of a small property which can be worked profitably by careful and intelligent management. If encumbered with unnecessary overhead expenses it would probably be doomed to failure, the fate of many prospects and mines.

Quite a little interest has been aroused over promising-looking showings discovered this summer on several properties near the *Bluebell*, and upon which a little work had been done many years ago.

A. J. Curle, of Kaslo, while looking over some ranch land, found a piece of galena float; tracing it up he found the vein in-place. Prospecting-work done on the lead this summer is said to have been encouraging, and according to recent reports more extensive exploratory work will be carried on by a syndicate composed of A. J. Curle, R. Guthrie, and W. T. Kirby, of Winnipeg. So far the results are reported to be very encouraging. Some exceptionally high-grade streaks of ore have been encountered, the values of selected specimens running as high as 2,000 oz. in silver. This is of particular interest, for the ore mined for many years at the *Bluebell* in this vicinity has not carried any spectacular silver values.

The other property, comprising the *Phyllis* and *Gwenie* claims, was staked during the summer by R. D. Hearn and B. L. Eastman. It is reported that some nice showings of galena have been uncovered near old workings which were abandoned many years ago.

#### SOUTH FORK OF KASLO CREEK.

This mine, which ranks as the largest shipper from the South fork, has only **Cork-Province.** been intermittently worked during the year by a small crew of men. An exhaustive examination of the property was made by R. H. Stewart in August. In his opinion about \$100,000 is needed to carry out a successful programme of development. Shipments for the year total 225 tons of silver-lead concentrates.

This is among the earliest locations on the creek. It was acquired three or **Gibson.** four years ago by D. K. May, of Spokane, who by an active stock-selling campaign succeeded in interesting a considerable amount of Spokane and Portland capital. During 1918 a hydro-electric plant was installed under the supervision of W. W. Elmer, the mining engineer in charge of the property. Power will be generated by a Pelton wheel and a 120-kw., 2,200-volt, 60-cycle, 3-phase generator, which equipment is lying all ready to set up in the power-house. A 12 x 12 Sullivan compressor and air-receiver have been purchased and delivered at the mine. The cost of the hydro-electric installation is said to have been about \$13,000, and it is estimated that a further expenditure of \$5,000 is necessary to complete the equipment and construction before machine-drills can be operated.

Just when conditions appeared favourable for carrying out a more progressive policy of development, the property became tied up in litigation and has been idle since the beginning of the year. There have been a lot of exaggerated statements made regarding this property, and although the possibilities of it becoming an important producer appear to be good, it is yet in the prospective stages of development, and future work alone will prove whether it will make a mine or not.

It is reported that E. J. Edwards, of Spokane, has acquired this property from **Filnt.** the owner, J. A. Carter, of Kaslo. It is proposed to form a company to carry on mining and development work during the coming year. The claims are located about two miles north of the *Cork-Province* mine, at a fairly high elevation.

This group, comprising three claims, is situated on the South fork of Kaslo **Silver Bell.** creek and is owned by R. H. Green, M.P., and S. H. Green, of Kaslo. The trail leaves the road at a point about half-way between the *Gibson* and *Index* properties and the workings are at a distance of about a mile. The ore occurs in a shear-zone, either in the granite or along the contact of the granite and sedimentaries, as far as could be ascertained from the soft, decomposed material in which they were working. The surface being covered with overburden, coupled with the fact that the workings were caved and being retimbered at the time of the writer's visit, rendered conditions unfavourable for examination and the ore in-place could not be seen. However, the ore is said to occur in streaks and bunches in the soft, crushed material which forms the filling of this sheared fissure or zone.

The principal workings consisted of an adit-tunnel driven into the hillside at an elevation of 4,800 feet; from this tunnel a few car-loads of high-grade silver ore had been extracted, but the tunnel was caved at the end and was being retimbered at the time of examination.

The ore-body apparently dips into the hill at a flat angle, and in order to further develop the property another tunnel was started during the year at a vertical distance of 100 feet below the upper workings. This tunnel was in 270 feet, and according to recent reports ore has been struck in a raise. The ore consists of carbonates, argentiferous galena, and native silver; some very fine specimens of the latter, in the form of wire silver, having been obtained. The silver values of shipments made run as high as 250 oz. to the ton.



Curle's Manganese-deposit, Kusto.



Bureau of Mines

Curle's Manganese-deposit, Kusto.

During the year a new camp-site was chosen lower down the hill and cabins erected to accommodate about 20 men. During the summer months a few cars of high-grade silver ore was shipped, and it is expected that during the winter the output will be increased. About fourteen men are employed at the property and the work is being carried on under the direction of W. E. Newton, of Kaslo.

This property, which is situated on the South fork of Kaslo creek and almost adjoining the *Silver Bell*, was worked for part of the season under option by the owners of the latter property. The vein, which has a strike of S. 43° W., occurs in a crushed zone of metamorphosed sedimentaries. Apparently the foot-wall is slate and the hanging-wall limestone. A short crosscut shows the width of ledge-matter to be about 40 feet, in which there are occasional pockets of galena and carbonate ore.

Numerous open-cuts along the strike of the vein expose highly oxidized and altered material for a distance of nearly 500 feet. Except where the work has been done, the vein is covered with a considerable depth of overburden. A grab sample of some carbonate ore sacked for shipment ran: Gold, 0.02 oz.; silver, 146.6 oz.; lead, 3 per cent.; zinc, 16 per cent. Very little underground work had been done at the time of examination and the property was still in the prospective stages of development.

**Index.** This property, which is situated on the South fork of Kaslo creek at an approximate distance of fourteen miles from Kaslo, was bonded during the year by Frank Helme (a pioneer prospector and one of the original owners) to E. J. Edwards, of Spokane. The latter, who previously was foreman at the *Gibson* mine, has taken a very active interest in this part of the country and was responsible for the incorporation of the Index Mining Company, which is now operating the *Index* property. In the past a considerable amount of underground work was accomplished by Frank Helme and occasional shipments made.

The ore has been mostly stoped out from the upper levels, and the future of the property depends largely on the development of the vein in depth. With this object in view, the present company is running a 500-foot crosscut to tap the vein at a vertical distance of 300 feet below the old workings. A 10 x 12 Ingersoll-Rand compressor and a 24-inch Pelton-wheel were installed during the summer. The Pelton wheel is operated under a head of 250 feet.

Besides driving the tunnel, a little prospecting-work was done on the surface near the portal of the upper tunnel, where a small lens of galena was uncovered. A sample of this ore ran: Gold, 0.04 oz.; silver, 44.5 oz.; lead, 62 per cent.; zinc, 7 per cent. A sample of oxidized and highly decomposed ledge-matter ran: Gold, 0.04 oz.; silver, 17 oz.; lead, *nil*; zinc, 4 per cent.

The vein is irregular in strike and dip and occurs in a highly metamorphosed zone of sedimentaries lying in close proximity to and partly included in the intrusive rocks of the Nelson granitic batholith. The shattered and contorted nature of the formation give evidence of there having been great movement, accompanied by the shearing and crushing of the country-rock; hence faults and breaks in the vein may be expected.

#### OTHER PROPERTIES.

**Whitewater.** This mine has been mostly worked under a number of leases, there being about thirty men employed. The shipments for the year will total about 900 tons of silver-lead and zinc ore. The company is now doing some work with a view to proving a supposed south branch of the *Whitewater* vein, and the indications in the crosscut are said to be very encouraging. Stringers of clean ore as wide as 6 inches occur in the slates at a point near where the vein is expected to be encountered. W. H. Burgess, of Kaslo, is the manager.

**Utica.**—T. J. Poyntz and others have been working this mine under a lease. It is reported that in the old workings a rich pocket of high-grade ore was encountered.

**Charleston Group.**—These claims, which are situated near the *Whitewater* mine, are reported to have been bonded by A. J. Harris to Winnipeg capitalists.

**St. Patrick.**—This mine, situated near Argenta and belonging to the British Alberta Mining Company, shipped 22 tons of silver-lead ore.

**Helen Group.** This group, comprising two claims—*Helen* and *Highland*—is situated at a distance of about three miles from Blaylock, on the Kaslo-Nakusp Railway, and at an elevation of 5,600 feet. The property is owned by W. English and

J. English, of Kaslo, who during the last few years have done a considerable amount of development-work. The area in the vicinity of this claim and covering what is known as Stanley basin is composed of highly metamorphosed rocks of the Slocan series, intruded by stocks and dykes of the granitic rocks of the Nelson batholith—conditions which are characteristic of the marginal regions of the batholithic intrusions. The ore, which occurs in a sheared fissure in the granite, was first discovered outcropping near the edge of a bluff.

An open-cut along the strike (S. 55° W.) of the vein at this point discloses a stringer of galena for a length of about 50 feet and also a little carbonate ore. A crosscut was started at 100 feet vertically below this showing and the vein was drifted on for about 300 feet.

This drift is in decomposed granite which forms the fissure-filling and has a width of about 3 feet. The foot-wall is well defined, but the hanging-wall is indefinite. From this level a raise connects with the surface at a point near the northerly end of the open-cut.

A nice pocket of carbonate ore was encountered in the raise, having a width of about 18 inches; the extent of same can only be proved by further work, although the possibilities of winning a small tonnage are encouraging. A sample taken across the width of 18 inches ran: Gold, 0.04 oz.; silver, 56 oz.; lead, *nil*; zinc, 12 per cent. A grab sample from 2 tons of sorted ore from the surface cut ran: Gold, 0.04 oz.; silver, 150.5 oz.; lead, 66 per cent.; zinc, 4 per cent. The upper tunnel is not driven on the vein and does not disclose any ore of importance.

**Boulder.** This claim is located at an elevation of 6,450 feet near the summit of the ridge to the south-west of the *Helen* group. The ore outcrops in the face of a bluff and along the contact between limestone and slate. Here a vertical section of a vein is exposed for a distance of about 15 feet, having a filling of oxidized gangue material, with which is mixed varying quantities of galena across a width of 12 inches. A sample across this width ran: Silver, 108.4 oz.; lead, 62 per cent.; zinc, 5 per cent.

In order to develop this ore at a depth a tunnel was started at a vertical distance of 50 feet below the outcrop. The only ore developed in this tunnel was near the portal, where a small lens was encountered. A 20-foot winze was sunk on this, which near the floor of the drift shows a width of 1 foot, but pinches to a few inches at the bottom of the winze. Another tunnel was driven at 100 feet below the upper workings. This is now caved, but is said to be in slide material and to have been abandoned before the rock in-place was reached.

The formation, consisting of slates and limestone, is in close proximity to the granite intrusions, and near the summit of the ridge is badly broken and contorted. The vein has an apparent strike of north and south and dips at an angle of 55 degrees to the east. In order to prove the continuity of the vein in a northerly direction a little shallow trenching across the strike at a lower altitude would appear to be worthy of consideration.

**Kaslo Concentrator.**—M. S. Davys has been busily engaged during the year on a series of experiments with the tailings of the old *Whitewater* mill. Although it is understood that the separation and recovery were satisfactory, the values were not sufficiently high to allow profitable operations, and the plant was closed down in November.

**Lincoln.**—J. H. Thompson, of New Denver, has had a small crew of men working at this property, and is reported to have struck a nice showing of galena.

**Mohawk Group.**—Situated near the *Utica* and owned by J. Chisholm, of Kaslo, and others. The property was worked during the year, and some 12 tons of silver-lead ore was shipped to Trail.

**Bannockburn.**—The development of this property during the year was mostly confined to driving the crosscut tunnel in order to strike the contact between the limestone and schist, along which they expect to develop ore. The claims are situated on Hall creek.

**Superior.**—Brown Bros. have been actively engaged during the season on this property; the results of the prospecting and exploratory work done have not yet come to hand. The property is situated near the *Bannockburn*.

#### NEAR POPLAR.

This property, consisting of three claims—*Comstock*, *Silver Hill*, and *Noonday* **Comstock Group.**—was originally located by P. J. Sheran, of Nelson, and recently bonded by him to the Nelson Mining and Development Company, of Spokane, and of which F. A. Starkey is president. The claims are situated on the southerly side of Cascade creek at an elevation ranging from 6,000 to 8,000 feet. Leaving the railway at a point two miles

from Poplar, the trail follows an easy grade up the creek for a distance of about six miles to the lower cabin, and then climbs steeply to the mine cabin, situated on the timbered hillside at an elevation of 6,000 feet.

The country-rock, which forms a series of more or less jagged bluffs at a short distance above the cabin, consists of schists and argillites with inclusions of aplite dyke-rock. The whole rock-mass has been subjected to much movement and the formation is broken and contorted. Evidence of uniformity of dip and strike is lacking, and judging by the contour of the hillside it would appear reasonable to come to the conclusion that the ground in this vicinity is not in-place, but has probably slid from a higher part of the mountain-side.

In this formation a quartz vein, sparsely mineralized with galena, outcrops in a few places, but is broken and lacks continuity. A sample from a small pile of sorted ore from the surface ran: Gold, trace; silver, 12 oz.; lead, 22.6 per cent.; zinc, 2 per cent. Two crosscut tunnels have been driven to tap this vein; the upper is 90 feet and has a small showing of ore near the face. A sample of sorted ore from tunnel ran: Gold, trace; silver, 11.5 oz.; lead, 11 per cent.; zinc, 3 per cent. The lower tunnel is in 170 feet, but the vein has not yet been encountered. The vertical distance between this tunnel and the upper is 158 feet.

At the time of examination the property could hardly be considered anything more than a prospect, with indications of ore, but not in commercial quantity, neither had sufficient been developed to encourage any operations on a larger scale at present.

The *Comstock* claim is located on the summit of the rounded ridge above the *Noonday* and at an elevation of 8,000 feet. The surface of the ridge is covered to the depth of a few feet with broken fragments of the country-rock, but a number of open-cuts have exposed vein-matter. At a short distance from the summit, on the easterly slope of the mountain, an open-cut discloses a well-mineralized quartz vein, which unfortunately was covered at the time of examination; the large pieces of ore piled up in the cut would indicate the width of ore to be at least 12 inches. A sample of this ran: Gold, trace; silver, 15.2 oz.; lead, 25 per cent.; zinc, 4 per cent. The formation, consisting of schists and argillites, is cut by aplite dykes, along or near the contact of which quartz veins have been formed. General conditions appear to justify further prospecting-work on this claim, with a view of proving sufficient ore on or near the surface to warrant crosscutting at a depth.

This group, comprising four claims—*Maple Leaf*, *Motherlode*, *Bonny Ann*, and *Motherlode Group* *Lucky Burke*—is owned by A. G. Johnston, of Poplar. The property is situated within two miles and a half of the railway on the east side of Poplar creek and at an elevation of 3,290 feet. The steep hillside on which the workings are located is covered with overburden and well timbered with cedar and hemlock. The work done consists of two tunnels driven into the hillside at a vertical distance of about 50 feet apart. Near the portal of the upper tunnel there is a small surface showing of galena and zinc-blende, which occurs as a replacement deposit in limestone. The tunnel has been driven for 25 feet, without encouraging results.

The lower tunnel has been driven for a distance of 100 feet, disclosing a badly broken and shattered formation. The only ore exposed in this tunnel is a small pocket of galena and oxidized material near the portal, a sample of which ran: Gold, 0.16 oz.; silver, 34.7 oz.; lead, 15 per cent.; zinc, 10 per cent. A sample of sorted ore from the surface near the portal of the upper tunnel ran: Gold, trace; silver, 32 oz.; lead, 29 per cent.; zinc, 2 per cent. Future work should be confined to following the ore where it is found to occur.

This group of three claims is situated on Poplar creek within about two miles of the railway and at an elevation of 3,150 feet. It is owned by A. Hansen, of Kaslo, who for many years has persistently carried on development-work, with the result that the underground workings are quite extensive. Work was first started on a surface showing, on which a 33-foot incline shaft was sunk; at the bottom a 40-foot drift connects with a raise from the No. 1 tunnel. In this drift the foot-wall is well defined and the fissure-filling, which was said to carry good average low-grade values at this point, was sampled across a width of 6.5 feet; the result was as follows: Gold, trace; silver, 0.4 oz.; lead, 1 per cent.; zinc, 1 per cent.

At a vertical distance of 160 feet down the hill No. 1 adit has been driven for a distance of about 400 feet. It follows the same well-defined footwall which is exposed in the upper workings and on which there is a thickness of from 1 to 2 feet of black talcose gouge. No ore

is visible in these workings, although a small shoot was said to have been struck near the raise to the surface. The No. 3 tunnel has been driven for a distance of over 100 feet and is about 125 feet below the No. 2. The conditions are similar to those in the upper workings. A sample of the talcose gouge ran 2 oz. in silver.

The formation, consisting of highly metamorphosed slate, has been subjected to much movement, as demonstrated by the slickensided surface of the foot-wall and the crushed material adjoining it; hence it is reasonable to suppose that the tunnels have followed a fissure formed along a fault-plane. It is possible that the mineralization so far encountered owes its origin to cross-veins and veinlets.

This property, comprising four claims, is situated near Poplar creek and at a short distance from the railway. The claims are owned by P. Kelly, one of the old-time miners of this part of the country. A small quartz vein carrying high gold values is principally developed by a 70-foot adit-tunnel, in which the vein is exposed for a length of about 20 feet. The formation, consisting of a dark schistose rock, probably a metamorphosed slate, appears to be in-place. The vein strikes S. 65° E. and dips to the north-east. In order to gain more depth on the vein the owner has commenced another tunnel at a vertical distance of about 80 feet below the upper. The ore is a gold quartz heavily stained with oxide of iron; the gold is in the free state and in many specimens can be seen with the naked eye. A sample of sorted ore on the dump ran: Gold, 11.3 oz.; silver, 0.5 oz. Although only a small quantity of ore has been so far developed, the values are high and conditions warrant further work being done.

*Bullock Group.*—Situated within a mile of the railway and at a short distance from Poplar. Exploratory and development work is being done by the Bullock Gold Mines, Limited. The principal values are reported to be in gold.

#### SLOCAN MINING DIVISION.

##### SANDON CAMP.

This camp has witnessed a busy season both in mining and construction work, and the future looks bright not only for the mines, but for many of the prospects, in which keener interest than usual is displayed on account of the high price now obtainable for silver.

Clarence Cunningham, whose progressive mining policy, combined with up-to-date methods, has done so much to increase production and encourage the industry, reports that at his various properties the work done during the season has been along the lines of general development. He at present has about 150 men on the pay-roll, and when running at full capacity will employ an additional 100.

No shipments were made from the Alamo mill before August; hence the tonnage is very much below the general average.

The following properties near Sandon were operated by him: *Queen Bess, Idaho-Alamo, Wonderful, Sovereign, and Silverite*. It is also reported that he recently acquired an interest in *Bluebird* and *Rawdon* claims, which adjoin the *Reco*. Aerial tramways were completed from the *Sovereign* and *Wonderful* to ore-bins near the railway.

Rosebery-Surprise Mining Company, of which J. P. MacFadden is general superintendent, has been active during the year with mining and development work at the following properties:—

*Bosun.*—Nos. 4 and 6 drifts are being extended.

*Surprise.*—The only development being done is the advancement of the No. 4 drift.

*Ivanhoe-Canadian Group.*—The Nos. 4 and 8 tunnels are being advanced.

The 4-compartment raise connecting the lower workings with the upper is worthy of special mention, it being the largest and one of the longest ever attempted in British Columbia, and its completion without any serious hitch or accident reflects credit on Paul Lincoln, the mining engineer in charge of the property. The size of the rock-cutting is 20 x 7 feet. The length of the raise is 1,000 feet. The two end compartments are used as chutes for ore and waste, while the two centre compartments are equipped with cages for men and supplies. By the development of ore on the lowest level, and also in the intermediate levels, sufficient tonnage is estimated to be available to warrant the erection of the concentrator, which is now nearing completion. This plant is designed by the General Engineering Company of Salt Lake City. The capacity is 100 tons, and the flow-sheet will include jigs, tables, and Callow pneumatic flotation-cells.

The adjoining claims of the *Rcco* group were acquired by Jas. Dunsmuir, the owner of the *Noble Five*, and will be developed from the workings of this latter property.

It is reasonable to expect that, with the recent success which has attended the development, this property will again become a steady and important producer. The large ore-shoot which was developed on the 1,000-foot level during 1918 has now been drifted on at the 800-foot level, and the result of the work establishes the fact that the same ore-body is as strong on the eighth as on the tenth level. A considerable tonnage of silver-lead and zinc concentrates was produced during the year.

The adjoining claims, *Jennie* and *Last Chance No. 4*, were recently acquired, **Rambler-Cariboo**, which gives an additional 1,700 feet of undeveloped ground on the vein, and according to W. A. Cameron, the manager, it is the intention of the company to prosecute development on the different levels in the newly acquired territory next year. Owing to the unusual dryness of the season the shortage of water seriously interfered with mining and development work.

The development of ore at low horizons, both at the *Noble Five* and *Silversmith* mines, should be an incentive for the investment of capital for the purpose of carrying on exploratory work at lower levels than was ever seriously contemplated in the earlier days of the camp. In this connection it is of interest to note that the ore at the *Noble Five* was developed at approximately 3,000 feet below the apex of the vein, while at the *Silversmith* the 1,000-foot level, on which the large shoot of ore was encountered, is the lowest horizon on which ore has been developed in the Sandon camp.

*Ruth*.—The principal work being done on this mine is the driving of the long crosscut in order to gain depth on the vein. James Anderson, of Kaslo, has charge of the property, which belongs to the Alexander interests.

*Carnation*.—A small crew of men is engaged at development-work under the management of G. Clarke.

Situated on the North fork of Carpenter creek at a distance of about three miles from Three Forks. After lying idle for a number of years, the property was acquired by A. R. Grimes early in the year and a crew of eight or ten men put to work. The operating company is called the Slocan Silver Mines, Limited. The season's work is said to have been highly satisfactory. The ore is a "dry" ore, occurring in a strong, well-defined quartz vein. The values are in silver, mostly in the form of grey-copper. Exceptionally rich pockets are occasionally encountered.

*Silver Glance*.—Situated at a short distance from Bear lake, on the Kaslo-Nakusp Railway, J. W. Power, the owner, is reported to have bonded the property to G. Huston, of Mullan, Idaho. The ore is similar in character to that of the *McAllister*.

*Panama*.—This property is now being further developed by the owner, H. Giegerich, of Kaslo. It is situated on the same mountain as the last two mentioned properties and is within easy reach of the railway.

*Washington and Silver Reef Groups*.—Situated on Payne mountain. Work was continued this year by M. C. Monahan.

*Granville Group*.—This property, which was recently acquired by a syndicate, is being developed under the direction of George Gormley.

There are a number of other properties on which work is being done in this Division, but information regarding same is lacking at present.

#### SILVERTON CAMP.

This camp has had rather a quiet season, principally on account of the curtailment of the output from the *Standard* mine, although latterly shipments have been greatly increased.

*Van Roi and Hewitt*.—During the early part of the season these properties were operated by Clarence Cunningham and a considerable tonnage was mined and milled. Latterly the *Hewitt* closed down temporarily and mining operations at the *Van Roi* were confined to development.

*Galena Farm*.—This property, which belongs to the Patrick Clark Estate, of Spokane, was worked under lease by James Casey during the early part of the season, but latterly has been closed down.

*Echo*.—This property was worked under lease by A. L. McPhee and others. About 500 tons of ore was shipped to Trail.

*Wakefield*.—This property, which is situated on 4-Mile creek and almost opposite to the *Hewitt*, was worked during part of the year by Clarence Cunningham.

#### SLOCAN CITY MINING DIVISION.

*Ottawa*.—This property, owned and previously operated by the Consolidated Mining and Smelting Company, was leased by them this year to P. McGuire and A. L. McPhee, who shipped a considerable tonnage from the old dumps.

*Republic*.—J. W. Evans, of Nelson, and associates, who have recently become interested in this property, have a small crew of men at work and expect to resume shipments shortly.

*Evening Star*.—Situated on Dayton creek near Slocan. Owned by Hugh Sutherland, of Winnipeg. William Moore, of Nelson, is in charge of the development, which will consist of crosscutting and drifting on the vein at a lower level. It is reported that a small crew of men is at work.

This group, consisting of four claims—*Anna*, *Milda H.*, *Milda H. Fraction*, and **Anna Group.** *Hamilton Fraction*—is partly owned by K. Zimmerman, of Slocan. The property is situated on Springer creek at a short distance from the *Ottawa* mine and has been operated almost entirely single-handed by the owner during the last fifteen years. The vein is principally developed by an adit-tunnel about 420 feet in length. For the first 240 feet the tunnel follows a sheared fissure in the granite, in which there are small (if any) values. At the end of this distance a 40-foot crosscut to the west encounters the vein in which the ore is found. A 140-foot drift along this vein shows the walls to be well defined and several small shoots of high-grade ore along the bottom of the drift on the hanging-wall side. The width of the ore varies from a few inches to about 1 foot. In the face of the drift the ore shows a width of 6 inches, a sample across which ran: Silver, 165.5 oz.; zinc, 3 per cent. The silver values occur principally in tetrahedrite, with which is associated a little argentite and native silver, the gangue being quartz. The strike of the vein is N. 10° E. and the dip 33 degrees to the east. A shipment of 17 tons made last year ran: Silver, 244.3 oz.; copper, 0.7 per cent.; zinc, 0.6 per cent.

Though still in the prospective stages of development, it would appear to be a property with good possibilities. E. Hyde is now working the property under lease and bond.

This group, comprising four claims—*Little Tim*, *Mammoth*, *White Heather*, and **L. T. Group.** *Purple Heather*—is situated at the head of the North fork of Springer creek. A good trail of some three miles in length connects the mine with the *Ottawa* road. The property is principally owned by D. B. O'Neill, of Slocan, who was working it single-handed during the summer. The ore, which carries high silver values, occurs in a small quartz vein in the granite, and can best be described by the following analysis of a small shipment made to Trail in June: Silver, 264.5 oz.; lead, 7.1 per cent.; silica, 57.6 per cent.; iron, 1.6 per cent. to the ton.

The principal workings consist of two tunnels driven into the granite bluff which forms the divide between the North fork of Springer creek and Enterprise creek. In the upper or No. 1 tunnel ore was first developed for a distance of about 30 feet along the foot-wall. The No. 2 tunnel was driven at a vertical distance of about 60 feet below the No. 1 and follows the vein for 60 feet, which at this point is faulted by a hornblende-mica dyke. A 32-foot crosscut to the north-west again picked up the vein, which was drifted on for about 100 feet, and for this length ore is exposed having a width of from 4 to 6 inches. From the No. 2 tunnel a raise connects with the upper workings and is in ore all the way. The vein, which has a strike of N. 65° E. and a dip of 70 degrees to the south-east, is said to be the continuation of the *Bondholder* vein, which has been worked on the other side of the summit.

This group, consisting of three claims—*Cullus*, *Ottawa*, and *Meteor*—is owned by J. C. Buchanan, who for many years has taken a very active interest in various mining enterprises in the district. The claims are located on and near the summit of the divide between the First North fork of Lemon creek and Springer creek, at an elevation ranging from 6,000 to 7,000 feet and at a distance of approximately eight miles from Slocan. From the *Lily B.* road a steep trail is followed for a distance of two miles and a half to the camp. Two cabins with accommodation for about eight men, a small superintendent's shack, and a blacksmith-shop comprise the mine buildings. The topographical features are characteristic of the mountainous area of the granite formation. The camp is situated in a

small basin, which is partly surrounded by precipitous bluffs, forming a natural barrier to the east and south-east. Until recently acquired by the present owner, the property had been worked for a number of years by leasers, during which period a considerable tonnage of high-grade silver ore was extracted.

The country-rock is granite, cut by basic and siliceous dykes. The vein is a quartz-filled fissure having a dip of 38 degrees to the north and an easterly and westerly strike. It outcrops at the summit of a bluff forming the easterly side of the basin and has been developed by series of tunnels extending from near the top to the bottom. The walls of the vein are well defined and the width is fairly persistent, although bulges and squeezes occur at intervals. The mineralization consists of native silver, argentite, and tetrahedrite, with which is associated auriferous pyrites and a very small percentage of zinc-blende. The vein has been faulted at a number of places by what seems to be a series of parallel displacement faults. This has caused no little inconvenience at times, but the ore was always picked up at the different levels.

Of the old workings, Nos. 1, 2, and 3 tunnels are caved, although access can be gained to the uppermost workings above the No. 1 tunnel from the surface at the top of the ridge. In No. 4 level, on which some 300 feet of crosscutting and drifting has been done, the ore has all been stoped out from a shoot about 30 feet long. The No. 5 level has been driven along the strike of the vein for a distance of about 250 feet. At about 52 feet from the portal the vein was first encountered, and at this point has an average width of about 8 inches, a sample across which ran: Gold, 0.04 oz.; silver, 78 oz.; zinc, 1.5 per cent. This shoot apparently extended along the northerly side of the vein for a distance of about 20 feet, and although the vein can be followed for nearly 100 feet farther, the remainder did not appear to be well mineralized. The other and most important ore-shoot was struck near the end of the level. At this point the ore is exposed along the bottom of the drift on the north side. Here the vein is well mineralized for a length of about 60 feet and has an average width of 12 inches. To show the character of the ore, a sample was taken from the material broken down by three plug-holes at 5-foot intervals, with the following result: Gold, 0.61 oz.; silver, 184 oz.; zinc, 2 per cent. In order to win this ore a 60-foot winze was sunk, and 32 tons was shipped. The gross value of the shipment is said to have been about \$22,000.

At the time of examination the winze was half-full of water and work was being confined to the driving of the No. 6 or lower crosscut to develop the vein at an additional vertical depth of 75 feet. In making a cursory examination of this property one is at once impressed with the high-grade ore and the possibilities of a small but steady production under careful and intelligent management.

This claim is located at a short distance from the *Meteor* in a south-westerly **Howard Fraction** direction. The property has been abandoned for many years. The old workings from which ore was extracted are caved, hence could not be examined. The following is a description by W. A. Carlyle, published in the Minister of Mines' Report, 1896, page 72: "The granite is traversed by many porphyry dykes, some of considerable width, and also by quartz veins carrying argentite or silver sulphide and varying values in gold. This vein, running about east and west, was dipping northerly into the mountain at a very low angle, or at a dip of 10 to 15 degrees, and an incline had been sunk about 115 feet, but not along the vein, as this was found to be faulted up 3 feet, and 15 feet farther again faulted 8 feet along the same direction of throw, while a third fault had been struck. The vein was 12 to 20 inches wide, of honeycombed quartz, with argentite disseminated through it in crystalline form, and considerable ore had been stoped, hand-sorted, and shipped to the smelters, which returned high values in silver and good gold values, as 7 tons shipped to Pilot Bay smelter in 1895 gave 163 oz. silver and \$16 in gold to the ton, and 12 tons more recently, 206 oz. in silver and \$26 in gold to the ton."

Since this report was written a quartz vein was traced along the ridge by stripping and numerous open-cuts, and to intersect this at depth a crosscut some 1,300 feet in length was driven, gaining from 300 to 500 feet below the outcrops. The results obtained evidently did not come up to expectations. A sample taken of the oxidized and honeycombed quartz on the dump of the old incline shaft ran: Gold, 0.08 oz.; silver, 15.90 oz.

This property, comprising four claims—*Slocan Prince*, *Black Prince Fraction*, **Black Prince**, *Montreal*, and *Moonraker*—is situated at a distance of nine miles from Slocan and at an approximate elevation of 6,000 feet. The hillside on which the

workings are located is heavily wooded and slopes at an angle of 25 degrees towards the headwaters of the Second North fork of Lemon creek. The camp buildings, consisting of two cabins with accommodation for eight men, blacksmith-shop, and ore-sorting shed, are in a good state of repair, except the latter, which is somewhat dilapidated. The old workings are quite extensive and, generally speaking, in good condition, most parts of the mine being easily accessible. For the last three or four years J. T. Tipping, of Slocan, working the property under lease and bond, has met with encouraging results, although mining has necessarily been carried on by more or less hand-to-mouth methods owing to lack of working capital.

The formation is of the typical granite of the Slocan City area, and in the vicinity of the workings is cut by acidic and basic dykes. The ore occurs in lenticular-shaped shoots, sometimes along the foot and sometimes along the hanging wall of a wide, sheared fissure in the granite. Although high-grade streaks carrying native silver and grey-copper are frequently encountered, the general run of the ore may be described as a fine-grained mixture of galena, zinc-blende, and iron pyrites, with which is associated a little grey-copper and native silver in a quartz gangue. Six car-loads shipped by J. T. Tipping ran as follows: Silver, 140 to 184 oz.; lead, about 5 per cent.; zinc, 4 to 39 per cent. The width of the lead varies from 20 to 40 feet, has a strike of S. 22° W., and dips into the hill at an angle of 60 degrees.

Briefly the workings are as follows: No. 1 level, 129-foot crosscut to vein and 400 feet of drifting. No. 2 level is about 100 feet below No. 1 and consists of a 419-foot crosscut to the vein and 400 feet of drifting. No. 3 level, 125 feet below No. 2: This tunnel has been driven along the vein from a point near the surface for a distance of nearly 1,300 feet. No. 4 level: A tunnel has been driven along the vein for 125 feet. The main ore-shoot was developed between the No. 2 and No. 3 levels. This shoot was 150 feet long and from 12 to 20 inches wide.

There is probably a considerable tonnage of mill-feed left between the different levels, but this can only be ascertained by extensive and systematic sampling. Recent work disclosed ore under the timbers of an old raise connecting the No. 1 and No. 2 levels. From the No. 3 level ore was stoped from the north-east end, and there are still several small showings of good-grade ore in this part of the workings. The No. 4 level is in good-looking ground, but the ore so far encountered carries a high percentage of zinc. Owing to the character of the ore careful sorting has to be resorted to, that high in zinc being discarded. The development-work done in the past consists principally of drifts along the lead, and it would seem apparent from the nature of the deposit that not sufficient crosscutting across the shear-zone has been done.

This property is situated on Enterprise creek at a distance of eight miles from

**Westmount.** Slocan lake and has produced a considerable tonnage of high-grade silver ore.

It was worked continuously from 1905 to 1914. In the early nineties work was first started by F. Griffiths, the original owner. At this time the hillside was well covered by overburden supporting a heavy growth of timber and underbrush, and the vein only outcropped at one place near the portal of the No. 1 tunnel. Here the indications could not have been very encouraging, for the small showing of ore near the surface, consisting of an intimate mixture of iron pyrites, zinc-blende, and a little galena, was not of commercial value, and it was only after drifting for over 100 feet that the pay-streak of high-grade ore was encountered.

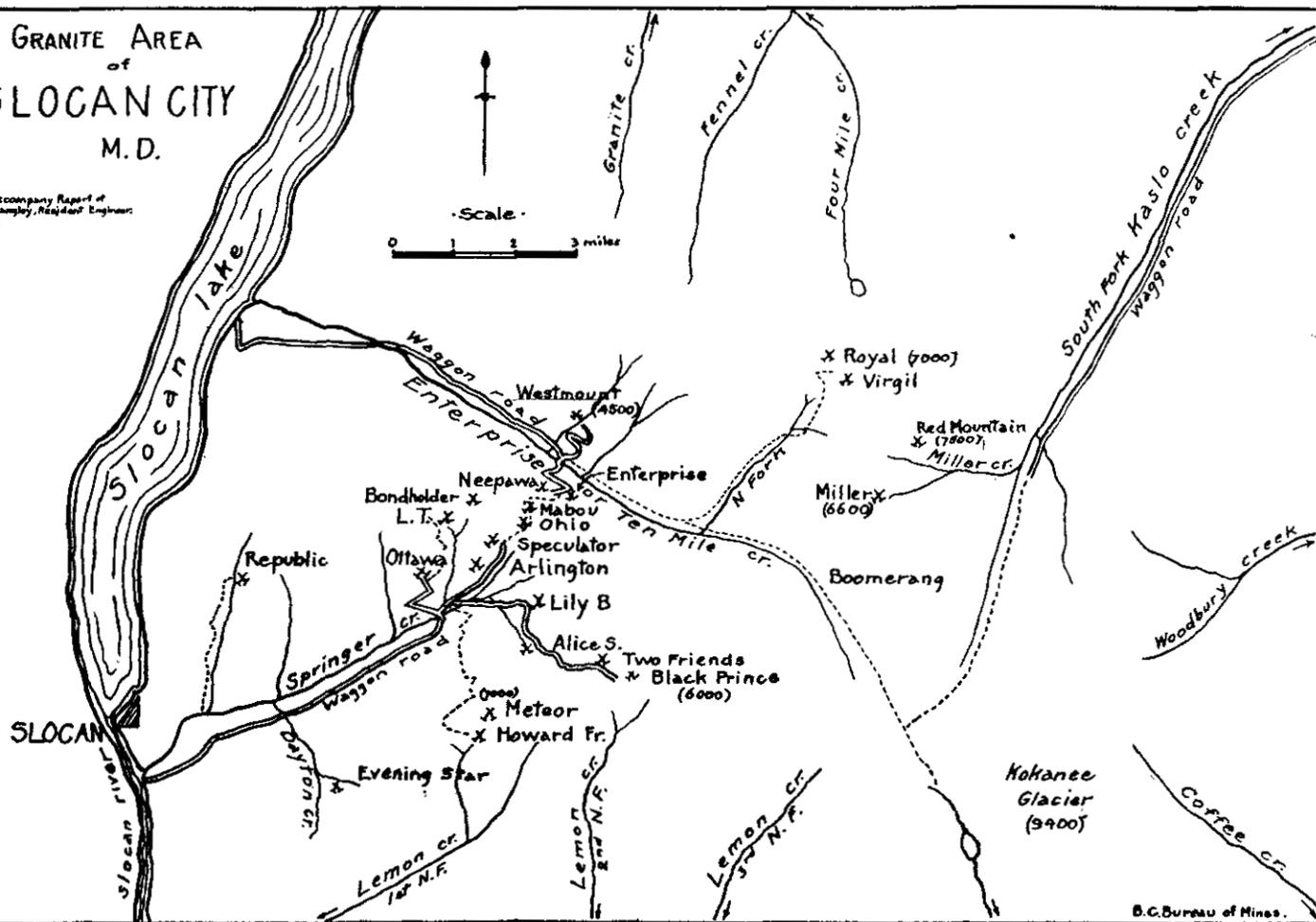
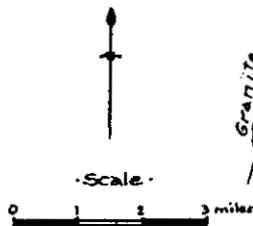
This drift is worthy of special mention, for one seldom sees such a good example of timbering in prospect-tunnels. The timbers and track, which were put in twenty-three years ago, are in good condition and in perfect alignment to-day. To give an idea of the values obtained the following may be of interest: The average value of fifty-two car-loads ran: Gold, 0.049 oz.; silver, 169.82 oz.; lead, 9.39 per cent.; zinc, about 20 per cent. Some of the shipments made went as high as: Silver, 438 oz.; lead, 12.9 per cent.; zinc, 20.5 per cent.

The main vein is from 3 to 6 feet wide; the filling consists principally of decomposed granite, with quartz varying from a few inches to 2 feet in thickness. The ore is invariably found to be associated with the quartz-filling. The character of the ore varies in different parts of the vein; in places the high silver values are associated with galena, in the form of tetrahedrite, and ruby-silver, while in others the predominant minerals are tetrahedrite associated with zinc-blende and native silver. Except in the high-grade streaks, the ore is an intimate mixture of iron pyrites, zinc-blende, and a little galena.

The formation is of granite, similar in character to that found in the region surrounding Springer and Enterprise creeks; it is easily recognizable by large phenocrysts of feldspar. From observations in the field, the dark basic dykes which intrude this granite area in many cases

# GRANITE AREA of SLOCAN CITY M.D.

To accompany Report of  
A.G. Lamley, Resident Engineer  
1919



B.C. Bureau of Mines.

apparently are responsible for the faulting of the vein system, the throw usually being in a northerly direction.

The mine is developed by four adit-tunnels. The richest ore was extracted from the small cross-veins near their intersection with the main vein on the No. 2 and No. 3 levels. The largest ore-body was mined between the second and third levels. Not much ore has been developed on the No. 4 level. The No. 2 level has been extended some 300 feet beyond where the ore was encountered, but did not prove any further ore-body in this direction. The hanging-wall on this level is not well defined and in places is composed of crushed and decomposed granite, with small feeders of quartz, seams of calcite and talcose material, conditions which would appear to warrant more crosscutting on this side of the vein. At some 200 feet from the end of the drift a basic dyke crosses the vein, and at this point the drift follows the dyke for a short distance and then continues in the direction of the strike of the vein in barren ground. The reasons for doing this latter work are difficult to understand.

The present work, which is being done by H. D. Lea and associates, who have a lease on the property, consists of stoping between the third and fourth levels. During the year three car-loads of ore was shipped to Trail. The ore occurrence and the geological conditions at this property are certainly of great interest and the best part of a week could be spent on the ground to advantage.

This group, comprising five claims—*Trio*, *Boisevan*, *Neepawa*, *Edith*, and *Mervin Fraction*—is situated at a distance of eight miles from Slocan lake, on Neepawa. Enterprise creek, and at an elevation of 4,500 feet. According to old records, the mine has been intermittently operated, principally by leasers, since the early nineties, during which period some \$50,000 worth of ore has been extracted. The property was acquired this year by the Della Mines, Limited, of which J. S. Lamb, of Vancouver, is president and E. F. Roche manager and secretary-treasurer. During the year only two or three men were employed at mining and cleaning out the old workings. According to the manager, plans have been formulated for development on a large scale, including the ultimate erection of a 200-ton concentrator, tramway, power plant, etc. The large bunk-house of the adjoining property—namely, the *Enterprise*—has been bought by the company.

The property was visited on the writer's return from the headwaters of the North fork and the time at his disposal only allowed a somewhat hasty examination. The *Neepawa* vein occurs in a sheared fissure in the granite, dipping at an angle of about 60 degrees to the east and having a northerly and southerly strike. This shear-zone, which apparently terminates at Enterprise creek, can be traced in a southerly direction to the *Arlington* mine, at which place it is wider and more pronounced. The ore, occurring in quartz veins and stringers—in the crushed and decomposed granite-filling of the fissure, is apparently a finely crystalline mixture of sulphantimonates of silver, with which is associated zinc-blende and galena. Good silver values are often obtainable in vein-matter which to the eye resembles lean or barren material; hence, in walking through the underground workings, it is impossible to form an idea of the possible values without taking numerous samples.

The mine has been developed by four adit levels driven into the steep hillside and the underground workings are quite extensive. The best shoot of ore is said to be between the third and fourth levels. In an intermediate between these levels the ore is exposed for a short distance in the roof of the drift, and in order to get some idea of the character and value of the ore at this point a sample was milled across a width of 30 inches, which gave the following results: Silver, 17.5 oz.; lead, 2.5 per cent.; zinc, 12.5 per cent.; gold, trace.

To form any definite idea of the available tonnage suitable for mill-feed the property would have to be carefully surveyed and an assay plan prepared. The amount of ore which is recognizable in various places, upon taking a trip through the mine, does not convince one that a sufficient tonnage has been developed to warrant a large expenditure on mill-construction, power plant, etc. However, the management is evidently satisfied on this point, and if operations are successful it will do a lot to help this part of the district. Considering the present high price of silver, it would appear to be a property which, under careful and competent management, might be made a profitable producer without it being necessary to take any undue risk in making a large capital expenditure.

This property, comprising four claims—*Mabou, Ohio, Empress Fraction*, and *Mabou and Ohio Summit Fraction*—is owned by R. Kirkwood and associates and is situated on Enterprise creek, adjoining and to the south of the *Neepawa*. R. Kirkwood, who is one of the pioneer prospectors of the Kootenays, became interested in this part of the district as early as 1894, when he located the *Enterprise* mine, and from which a large tonnage was shipped in the early nineties. Prospecting-work has been intelligently and systematically carried out on the *Mabou* vein, but unfortunately the workings, which have been idle for about ten years, are nearly all caved in, and hence are of little assistance in helping to form an idea of the possibilities of the property. The workings commence at an altitude of approximately 5,800 feet, or 1,800 feet above the road on Enterprise creek, and extend up the steep slope of the hillside towards the summit of the ridge.

Besides a number of open-cuts along the strike of the vein, there are three adit levels, of 75, 50, and 15 feet in length respectively. The formation and ore occurrence is similar to that of the *Neepawa*, and apparently the vein lies in the same zone of shearing. A grab sample from a 2- to 3-ton pile of ore at the portal of the No. 3 tunnel, which is 75 feet in length, ran as follows: Gold, trace; silver, 22.5 oz.; zinc, 7.5 per cent.

At a short distance above the cabin the trail to the summit passes the portal of a 75-foot tunnel driven on the extension of the *Enterprise* vein, which has a strike of S. 55° W. and a dip of from 70 to 80 degrees to the south-east. The ore here is of a distinctly different character to that of the *Mabou* vein, and consists of a fairly coarse-grained galena, with which is mixed varying quantities of zinc-blende. A sample of the cleanest-looking ore from a pile of 3 or 4 tons at the portal of the tunnel ran as follows: Gold, trace; silver, 266.2 oz.; lead, 18.5 per cent.; zinc, 17 per cent.

Both the *Enterprise* and *Mabou* veins are said to be traceable to the *Ohio* claim, which adjoins the *Mabou* to the south. On this latter claim a considerable amount of work was done many years ago, but here again the most important workings are caved. It is difficult to form an opinion of the property without knowing the record of the work done and the results obtained, but it would appear to be good prospecting-ground. It seems a pity that in so many cases where conditions seem favourable for further exploitation the workings are allowed to cave and open-cuts to become filled up. In many cases this not only makes it more difficult for an examining engineer to form an opinion of the property than if nothing had been done, but also militates against the possibilities of interesting capital.

This group, comprising four claims—*Alameda, Riverside, Autumn, and Lailey Riverside Group. Fraction*—is owned by R. Kirkwood and is situated on the summit of the ridge on the southerly side of Enterprise creek and at a distance of about two miles beyond the end of the wagon-road. At present there is no direct trail from the creek, but the property is easily accessible from the main trail between the creek and the Arlington road. A small quartz vein occurs in a sheared fissure in the granite which has been traced down the steep hillside towards the creek, and at vertical intervals of 200 feet has been prospected by means of three adit levels. The quartz vein, having a south-westerly strike and a dip of 70 degrees to the south-east, is small and its continuity is not well defined, but in places contains small pockets of fairly high-grade silver ore.

The upper or No. 1 tunnel has been driven for a distance of 120 feet along the strike of the vein. A sample taken from a pile of about 2 tons extracted from this tunnel ran: Gold, trace; silver, 87.5 oz.; zinc, 7.5 per cent. The No. 2 tunnel has been driven for a distance of 200 feet and the No. 3, or lowest, for a distance of about 40 feet. The ore is a "dry ore," the principal values being in silver, which is associated with zinc-blende, iron pyrites, and in places a little galena.

*Boomerang*.—Situated on Enterprise creek at a distance of about two miles beyond the confluence of the North fork. There is reported to be a nice showing of high-grade silver ore at the bottom of a shallow shaft. Further work is being done by Franz Bros. to prove the continuity of the ore by crosscutting.

#### THE NORTH FORK OF ENTERPRISE (10-MILE) CREEK.

The topography of the region at the head of this creek is typical of that of many creeks which form the drainage system of the granite areas. The basin in which the creek has its source, at one time probably the resting-place of a glacier, is park-like in appearance, the

greater area being grassy meadow land, through which the creek meanders, forming small ponds at intervals. The surrounding scenery is both rugged and picturesque. Granite bluffs rising abruptly to about 1,000 feet form the sides of the basin, presenting a fairly even sky-line, only broken by an occasional bare and precipitous peak rising for 2,000 or 3,000 feet above the timber-line.

The particularly interesting feature regarding the geology of this area is that narrow bands of steeply tilted sedimentary rocks made their appearance as inclusions in the granite batholith on the east side of the basin, forming several low passes to that section of country surrounding the headwaters of the South fork of Kaslo Creek. These bands, which become more pronounced as the creek-valley is approached, consist of pyritized slates, schists, and limestone. The original iron sulphides, having been oxidized, have imparted a red hæmatite colouring to the schists which can be distinctly seen for miles. A little prospecting has been done at various places in these sedimentary rocks near the granite-contact and mineral has been found, but not enough work has been done at any one place to prove sufficient ore to be considered of commercial importance. Nevertheless, it is an area worthy of careful investigation by the prospector.

This group, comprising two claims, is situated at the head of the North fork, **Royal Group.** at a distance of seven miles by trail from the end of the wagon-road on Enterprise creek. The elevation of the cabin is about 7,000 feet. The metallic contents of the ore are principally in grey-copper, with which is associated a little ruby-silver and some argentite. The mineralization has taken place in a small quartz vein, is pockety in occurrence, and nowhere greatly exceeding 6 inches in thickness. The quartz vein, varying from a few inches to about 1 foot in width, has been formed along a sheared fissure in the granite and has a strike of N. 10° W. The vein is persistent and well defined.

An adit driven along the strike is in about 250 feet, and if continued for a few feet farther would strike daylight on the other side of the ridge. A 60-foot raise has been driven 156 feet from the portal. From these workings some 17 tons of ore has been extracted; of this, 7 tons was shipped in 1904. A sample taken across a width of 4 inches at the face of the tunnel ran: Gold, 0.08 oz.; silver, 18.5 oz.; zinc, 1.5 per cent. A sample across a width of 4 inches in a small stope near the end of the tunnel ran: Gold, 0.02 oz.; silver, 58.5 oz.; zinc, 1.5 per cent. A grab sample from a 10-ton pile of sorted ore for shipment ran: Gold, 0.02 oz.; silver, 118.5 oz.; zinc, 4 per cent. The steep pitch of the hillside down which the vein can be traced affords good tunnel-sites for development at greater depth, and conditions would appear to warrant further prospecting being done in this direction.

These claims were staked many years ago by Mike Murphy, of Kaslo, who built **Virgil and Christina.** a cabin and did a considerable amount of prospecting-work, but latterly little has been done and the workings are not in very good shape for examination. The claims are located on the granite ridge which forms the divide between the North fork and 4-Mile creek at an elevation of approximately 7,500 feet. The vein, having a north-westerly strike, is a fissure in the granite and similar in character to that of the *Royal* group. It can be traced up the face of the granite bluff to the summit of the ridge. Good silver values are said to be obtainable at intervals over a length of 1,000 feet along the strike of the vein, but this could not be confirmed at the time, neither were the old tunnels driven into the face of the bluff for 12 and 30 feet respectively in condition for examination. M. Murphy, who was at the property, stated that he expected to do further work this year.

Leaving the basin of the North fork of Enterprise creek and proceeding in an **Red Mountain** easterly direction over the divide, one arrives at the headwaters of Miller **Group.** creek, which flows into the South fork of Kaslo creek at a distance of about sixteen miles from Kaslo. On the north side of Miller creek the pyritized sedimentaries, which come in close contact with, and occur partly as inclusions in, the granite, form a zone some 300 feet in width; a distinct red colour due to oxidation is noticeable. Near the summit of the ridge on this zone two claims have been staked—*Red Mountain* and *Red Mount*—at an altitude of 7,550 feet. On the surface there are little (if any) indications of vein-matter, but no doubt sufficient were found to lead to the staking of the claims and the location of the present diggings. In an open-cut resembling a series of steps in the steep hillside a small quartz vein has been uncovered, lying conformably with the dip and strike of the formation.

At a few feet below the surface a small pocket of highly enriched oxidized ore was encountered. This ore is of a black earthy character, commonly known as "black sulphurets," although it is probable that the high silver values are in the form of silver chloride. A sample across a width of 6 inches of this ore ran: Gold, 0.04 oz.; silver, 514 oz. A sample of reddish oxidized material ran: Gold, 0.04 oz.; silver, 40.5 oz.; zinc, 6 per cent. Below this pocket the vein is nothing more than a quartz stringer; only a small section of it has been so far exposed.

The concentration of high silver values at this one place is evidently due to enrichment by surface waters. Conditions do not at present warrant any extensive outlay of capital, but more surface work might be done to advantage in an effort to trace the origin of the ore. The property is owned by R. Ainslie and D. McCuaig, of New Denver.

**Profit-Miller Group.** Situated at the head of Miller creek at a distance of two miles from the South fork of Kaslo creek. The property is owned by R. Ainslie and D. McCuaig. Very little work has been done on the property. The general geological conditions are complex, due to faulting, shearing, and contacts between the sedimentaries and the granitic rocks. At this particular place there is a shear-zone on the hanging-wall side of which there is a 2-foot streak of talc gouge; on the foot-wall side 6 or 8 inches of ore is exposed in places in a quartz vein. A sample of this ore ran: Gold, 0.08 oz.; silver, 15.9 oz.; lead, 18 per cent.; zinc, 21 per cent. Before spending any large sum of money it would be advisable to prove the existence of ore in sufficient quantity to be of economical importance by the means of surface work or the continuation of the present tunnel.

#### NELSON MINING DIVISION.

**Eureka.** This property, which is situated on Eagle creek at a short distance from Nelson, was acquired by the Inland Mining Company, of Walla Walla, in August, 1918. The *Granite-Poorman* mill was leased, and development at the mine was continued by advancing the main drift in a southerly direction, where a considerable tonnage was developed. Latterly the company took over the *Granite-Poorman* mine and mill. The long crosscut is now being continued at the *Eureka* to tap the vein below the present workings. The mill, which is equipped with 20 stamps and designed for the *Granite-Poorman* gold ore, is being remodelled with a view of making it adaptable for treating the ores of both the *Eureka* and *Granite-Poorman*.

A progressive programme of mining and development work has been planned, and will be carried out under the supervision of J. Clarke Johnstone, the mining engineer in charge. The operating company is called the Vincent Development Company.

**Yankee Girl.** Situated at Ymir. Under the management of W. T. McDowell this mine was one of the largest producers in the Division during 1918, but ceased production during the present year, probably owing to the fact that the values are not high enough to allow mining to be carried on under present economic conditions. Presumably it is only a matter of time for financial arrangements to be made for the erection of a concentrator, which is necessary for the future success of this property. There is reported to be ample tonnage available to warrant this additional expenditure. The principal values are in gold, and the production of this mine last year was responsible for an increase in the gold production of this Division.

A great deal of interest has been taken in the exploratory work being done on Sheep creek, the success of which means so much to this camp in particular, and to the gold production of the district in general.

**Emerald.**—A small concentrator is being erected at this mine. Steam-power will be used. The mine, which in recent years has been the only silver-lead producer in the Sheep Creek district, is one of the pioneer properties, and has shipped in the past about 50,000 tons of crude ore. The ore carries a high percentage of lead, low silver, and zinc values varying from about 6 per cent. upwards.

**Second Relief.**—Situated near Erie. The mill and mine buildings were completely wiped out by bush fires during the summer months. Efforts are now being made by A. D. Westby, the manager, to reorganize the company with a view of acquiring sufficient capital to rebuild the plant. The values are in gold.

**Spokane Group.**—Situated on Canyon creek, in what is known as the Bayonne district. Laib Bros. have been actively engaged in developing the property during the season, and

according to reports have built a small arrastra. The values are in gold and silver, the gold predominating.

*Molly Gibson*.—Situated at the head of Kokanee creek in the granite area to the north of the West arm of Kootenay lake. This mine is one of the steadiest producers in this Division and for the year was the largest shipper. The property is owned and operated by the Consolidated Mining and Smelting Company.

This mine, originally owned by W. H. Moore, of Nelson, was acquired in 1916 on a bond by the California Mining Company, with registered office at Nelson. The officers of the company are: J. R. Cassin, of Spokane, president; W. R. Orndorff, secretary-treasurer; and W. H. Turner, manager. The property consists of five claims—*California, Union, Deadwood, Cliff, and Gold Ring*—situated on Toad mountain at a distance of three miles south of Nelson. During the last four years the development-work has been systematically carried on under the superintendence of W. H. Turner, with the object of blocking out sufficient ore to warrant the operation of a concentrator. In order to facilitate the work the compressor at the *Athabasca* was leased and 4,000 feet of pipe-line laid to the mine.

The vein is a quartz-filled fissure occurring in a band of schists near a granite-contact. It shows persistence in strike and dip, and by means of underground and surface work is found to be continuous for some 1,000 feet along the strike. It has a distinct banded structure and has been formed along a line of shearing, as evidenced by the slickensided rock surfaces. The dip of the vein is 52 degrees to the south and the strike S. 80° W. The width varies from 5 to 10 feet. The ore occurs in long narrow shoots. The principal values are in gold, the associated minerals being iron pyrites, zinc-blende, and a little galena. The highest gold values are generally found to be associated with the zinc-blende. The gangue is quartz.

The vein is developed by three adit levels. The No. 1 level is a drift along the vein, from which ore has been stoped to the surface. This level is now caved. The No. 2 level has been driven 106 feet vertically below No. 1. The length of the level is approximately 627 feet. Here the vein has been drifted on for 206 feet; five car-loads of ore shipped from this level are said to have carried values of from \$17 to \$26 in gold, about 30 per cent. of which was in the free state. There is a considerable quantity of ore available for milling in this level. The No. 3 level gains a vertical depth of 170 feet on the No. 2. This level has been driven by the company, and followed a barren vein for 1,200 feet, when it intersected the *California* vein. This latter was drifted on for about 300 feet, showing a width of from 3 to 5 feet. Across this width the average of numerous samples taken by the manager indicate favourable possibilities of winning a considerable tonnage of \$17 ore from between this level and the No. 2.

During the year arrangements were completed for the leasing of the *Athabasca* mill, and one mile of road was built connecting the two properties. The mill is being remodelled, and it is anticipated that the mine will enter the list of producers in the near future. The systematic and conservative manner in which the development of the mine has been carried out reflects credit on the management.

The old prospect-tunnels and shaft on this property, which are situated in close proximity to the well-equipped mill and camp of the Baskin-Steadman Lumber Company, are now engaging the attention of M. H. Baskin, who proposes to systematically explore the ground with a view of finding out the why and wherefore of the old workings. At present there is not very much to go on, except the favourable location and indications of ore in good-looking ground. There are four claims in the group, which are staked along the probable extension of the *Hardscrabble* vein. The elevation of the present workings is approximately 3,550 feet and the distance from the railway is about two miles.

The old prospect-tunnel is driven in a direction of S. 20° W. for 115 feet, gaining little backs in this distance. At a short distance from the portal a body of crushed material high in silica and stained with oxide of iron was cut by the tunnel. In places the crushed quartz is stained with copper, but no ore of economic value is disclosed. Beyond this point the tunnel is in barren unaltered country-rock composed of diorite grading into a highly siliceous granite. At a distance of about 500 feet to the south-east an old shaft has been sunk on a quartz vein. A grab sample from a small pile of ore, consisting of quartz mineralized with chalcopyrite and iron pyrites, ran: Gold, 0.04 oz.; silver, 1 oz.; copper, 2.8 per cent. The shaft was partly filled with water, hence could not be examined.

This property, comprising a group of eight claims, is situated on the northerly side of Sheep creek at a distance by road of eleven miles from Salmo. The claims were first located by Thos. Bennett and H. M. Billings, both pioneer prospectors of the Sheep Creek district, and to whom belongs the credit of many valuable locations in this district. Mr. McMartin, of Cobalt, was responsible for the progressive development of the property. After doing a certain amount of preliminary development at the mine a 100-ton concentrator was erected below on Sheep creek. This plant, embodying the very latest in mill design, was completed in 1912. Briefly, the equipment consisted of a battery of 10 stamps, tube-mill, amalgamation-plates, and complete Merrill cyanide plant. Water-power for the mill and mine was derived from Sheep creek, and is capable of developing about 400 horse-power. The savings are said to represent 95 to 98 per cent. of the values. The plant, with the accompanying buildings for the employees, at once gives the impression that it was laid out and built under the supervision and design of an experienced and competent engineer. A Leschen tramway 3,600 feet in length connects the mill with the mine-workings, which are situated on the mountain-side at an elevation of 2,098 feet above the mill.

A total of about \$279,000 was spent on the erection and equipment of the buildings and plant at the mine and the mill, exclusive of large expenditures for the purchase of property and development-work. The operations covered a period of about four years—namely 1912 to 1915—during which, up to the end of August, 1914, the operating profits amounted to \$168,617.30.

During 1918 the Nugget Gold Mines, Limited, formed an amalgamation between the *Motherlode* and the adjoining property of the *Nugget* group, the principal object being to develop the *Nugget* vein by means of a long crosscut from the lower workings of the *Motherlode*, which would not only allow economical working of the *Nugget*, but would also allow the use of the *Motherlode* mill on Sheep creek. The crosscut, which will have a length of about 1,200 feet, was started from the No. 5 level of the *Motherlode* and is now nearing its objective, although a shortage of water during the season seriously impeded the progress. This crosscut should tap the *Nugget* vein about 640 feet below the workings. The work is being done under the supervision of R. H. Stewart, consulting engineer. Harold Lakes is in charge at the mine.

The main vein of the *Motherlode* is characteristic of the veins of the Sheep Creek district, which are quartz-filled fissures cutting the enclosing schist and quartzite formation. The experience has been that where they traverse the quartzite gold values are obtainable, but in the schist the values are negligible. This is true in the case of the *Motherlode*, all the ore being developed where the vein traversed the quartzite formation. In this connection it is of interest to note that the most westerly ore-shoot in the *Motherlode* occurred in a band of quartzite which can be traced to cut the *Nugget* vein at one of its most productive points. The most easterly band of quartzite in the *Motherlode*, from which ore was developed, has not yet been explored in the *Nugget* workings.

The general strike of the veins is westerly and cuts that of the enclosing formation at an oblique angle. The dip varies from 70 to 80 degrees. The general strike of the formation is N. 20° E. and dip 67 degrees to the south-east. The vein, which has been developed by a series of crosscuts from the surface, has had its values stoped out to the fifth level, below which conditions did not appear to warrant the driving of another long crosscut in order to gain additional depth on the vein. The ore is a gold-bearing quartz, rusty in colour, and more or less decomposed. The original iron sulphides, having been oxidized, have left the gold mostly in the free state.

This group, comprising seven claims, was originally staked and operated by **Nugget Group.** W. B. Poole. The property adjoins the *Motherlode* to the north and has been developed from the opposite side of the ridge. The mine-workings are at present reached by a trail, which, following the valley of Fawn creek for about three miles, connects with the Salmo road. During a period extending from September, 1908, to September, 1911, some 14,000 tons of ore was milled, from which was recovered about \$220,000 in gold. The tailings loss was from \$3.50 to \$5.50 per ton, hence the gross value of the ore was about \$20 a ton.

The amount of underground development-work done up to the end of 1911 was 5,800 feet. All underground work was done by hand and the ore was treated in a 4-stamp mill, which was largely dependent on steam-power for operation. The timber in the vicinity of the mill is small,

so it was not long before the fuel-supply became scarce and the length of haul prohibitive for successful operation.

There are five known veins on the *Nugget* ground; the principal one, on which most of the work has been done, is the *Nugget* vein. This vein, having a dip of about 80 degrees to the south and a strike of N. 70° E., varies greatly in width, but shows an average of about 5 feet. It has been developed by four adit levels to a depth of 450 feet below the apex, at which depth oxidized ore carrying free gold has been proved. The veins and formation are similar in character to those at the *Motherlode*. Based on the assumption that the values in the *Nugget* will continue with depth, and that considerable ore can be won from the upper workings, the proposition is an attractive and legitimate mining enterprise.

Unfortunately, the work done by A. W. McCune at the *Queen* mine did not come up to expectations and the project has been abandoned. A tunnel was driven for approximately 1,600 feet; at 700 feet from the portal the *Yellowstone* vein is said to have been cut. This was drifted on for about 200 feet, but little values were found. Although this tunnel does not develop ore, neither does it condemn the property, in the opinion of those thoroughly familiar with the ground.

This property, consisting of sixteen claims, is located at the head of Fawn **Reno-Donnybrook** creek at a distance of about one mile to the north of the *Nugget*. W. B. Poole, **Group.** who is one of the principal owners, put in a season's work at prospecting a new lead, which runs parallel and at a short distance from the *Reno* vein. The formation belongs to the same geological series as that of the Sheep Creek area, in which gold quartz has been mined at the *Motherlode*, *Queen*, and other properties, but there is greater evidence of intrusive igneous rocks.

The elevation of the claims ranges from about 6,000 to 7,000 feet. The surface of the hillside is well covered with a depth of about 2 feet of overburden, necessitating the digging of numerous open-cuts and trenches to expose the veins. This work has been systematically done, enabling the veins to be traced for well over 1,000 feet towards the summit of the ridge.

The veins are quartz-filled fissures similar in character to those of the Sheep Creek camp. Enriched pockets occur, but the values seem to be fairly persistent along the length of the vein, the best being found where the vein loses in width, which is particularly applicable to highest portion of the vein. At the lower levels the vein is wider, but carries less values. The ore is rusty-coloured and more or less honeycombed quartz. The values are in free gold, and an average of a number of samples would indicate the ore to run about \$20 a ton. Native gold is visible to the eye in many of the picked specimens.

It would appear to be a property which has good possibilities, worthy of careful investigation with a view of bringing it to that stage of development where the requirements would amply justify the necessary expenditure for mill-construction and accessory equipment.

This property comprises three claims owned by Mrs. Bertha Cameron, of **Bunker Hill** Victoria, and is located at a distance of seven miles from the Erie road at **Group.** Green City. One day was allowed for the trip, which time might have been sufficient had the writer been accompanied by any one who was thoroughly familiar with the ground; as it was, we found all the old trails long since obliterated, and the old camp-site presented nothing more than a wilderness of underbrush. Near where at one time there was evidently a cabin a few open-cuts had been made to explore the ground under a thin capping of oxidized material, but there was not much to be seen, as they were partly filled with dirt and nothing resembling ore had been extracted.

At a short distance from these diggings an open-cut had been made at the side of a small creek. Here the country-rock has been mineralized with iron sulphides in the form of pyrrhotite across a width of 30 inches. A sample across this width gave no values in gold or silver. From the bottom of this cut a shallow shaft had been sunk and a few tons of pyrrhotite extracted. At the time of the visit this shaft was full of water. The formation consists of igneous rocks of the Rossland volcanic series. There are said to be other showings on the property worthy of examination; hence another trip will be arranged during the coming season if possible.

This property, consisting of seven Crown-granted claims, is situated on Cultus **Iva Fern Group.** creek at an approximate distance of seven miles from Kootenay lake. There is a good trail from the lake-shore to the mine, and the camp can be reached

comfortably either on foot or horseback in about three hours. The claims are staked in a northerly direction along the strike of the veins from the valley of Cultus creek to the summit of the rounded ridge lying between the North and South forks of the creek. J. Mulholland, the original owner, bonded the property to the Consolidated Mining and Smelting Company in 1918, under which bond he accepted a contract to drive a crosscut tunnel and altogether do some 700 or 800 feet of underground work. The mine cabins consist of a bunk-house and cook-house with accommodation for about eight men; there is also a small blacksmith-shop at the tunnel and another cabin on the creek at the foot of the mountain trail which is used as a storehouse.

The surface of the mountain in the vicinity of the workings is covered with a depth of from 3 to 6 feet of overburden and few rock-exposures are visible. The formation in which the ore has been found, consisting of steeply tilted and highly metamorphosed rocks of sedimentary origin, has been intruded in the vicinity of the veins by a basic lamprophyre dyke, which may be genetically connected with the ore-deposits.

The surface work has so far been confined to an area near the summit of the ridge, and although the vein is said to have been traced down the hill, little work has been done at lower altitudes. Long shallow trenches dug across the strike of the formation disclose the rock in-place, which near the surface has been subjected to highly oxidizing agencies; the dyke-rock is decomposed and there are wide zones of broken material stained with oxide of iron. Besides oxidized and decomposed ledge material, small quartz stringers carrying ore are the only indications of the vein or veins in these trenches.

Near the summit of the ridge, at an elevation of about 6,300 feet, a 10-foot shaft has been sunk on the No. 2 vein. At this point there is a wide exposure of oxidized and decomposed material in which ore occurs in streaks and bunches. On the foot-wall side at the bottom of the shaft the ore shows a width of 2 feet, but the shattered condition of the enclosing rocks is not convincing as to its continuity. The vein conforms to the stratification of the formation, the dip being almost vertical and strike north and south. From this shaft 3 or 4 tons of ore has been extracted, a grab sample of which ran: Gold, 0.04 oz.; silver, 4.2 oz.; copper, 3.5 per cent.; lead, 26 per cent.; zinc, 9 per cent.

Farther down the hill and in an easterly direction from the No. 2 vein a 20-foot shaft has been sunk on what is known as the No. 1 vein. At the top of this shaft the vein shows a width of about 6 feet, but the fact that the shaft was caved and partly filled prevented an examination of the bottom. A grab sample of a few tons of ore extracted from this shaft ran: Gold, 0.02 oz.; silver, 5.2 oz.; lead, 35 per cent.; zinc, 4 per cent.

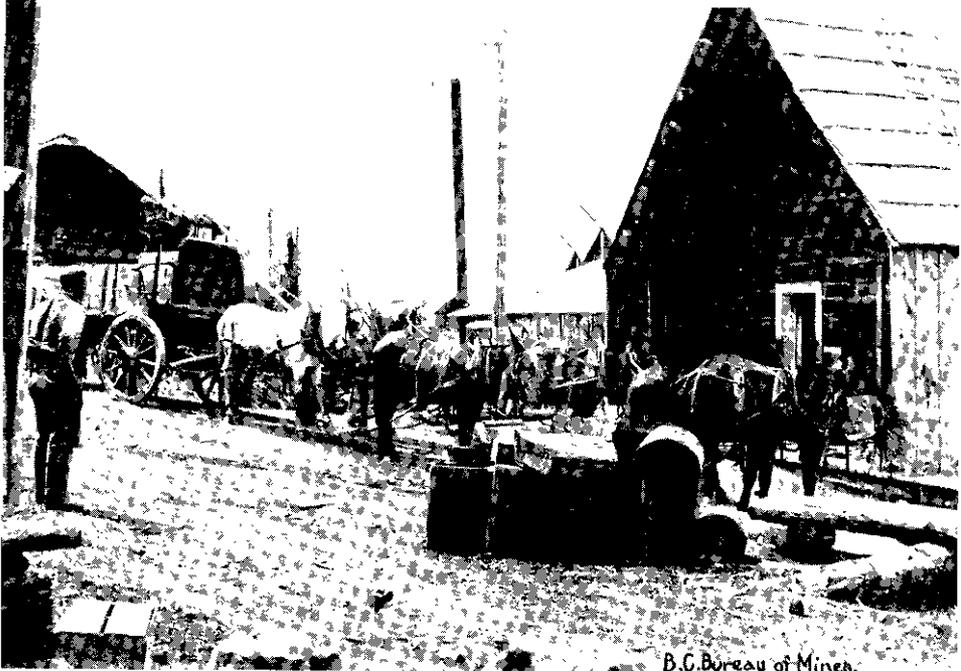
It is interesting to note the difference between the ore from these two veins. That from the No. 2 vein consists of a fairly coarse-grained galena, with which is associated chalcopyrite and zinc-blende. The ore from the No. 1 vein is a steel-grain galena and carries no copper. The gangue material in both cases is composed of lime and silica.

The crosscut tunnel which is being driven by the Consolidated Mining and Smelting Company to intersect these veins is now in 252 feet, and will gain a depth of about 200 feet on the No. 2 and 125 feet on the No. 1 vein. At a distance of 200 feet from the portal two quartz stringers carrying galena were cut. The wall-rocks at this point are hard, massive slate. The last 50 feet of the tunnel is in the same material, but, judging by surface indications, softer ground will be encountered as the No. 2 vein is approached.

The No. 2 vein is the strongest and is of particular interest on account of its copper content, which possibly owes its origin to pneumatolytic processes created during the intrusions of the hornblende dyke-rock. More surface prospecting might be done to advantage on this vein, while the continuation of the crosscut tunnel will demonstrate the possibilities at depth.

The property is still a prospect and its future depends upon the development of sufficient ore to warrant the erection of a concentrator. The indications for finding ore are favourable, but at present the probabilities of its becoming an important producer are still problematical.

This property, comprising three claims, is situated on Corn creek at a distance of three miles from Kootenay flats, from whence a good trail of easy grade leads to the mine cabin. The creek-valley and adjoining hillsides are heavily timbered with cedar, hemlock, and pine. The surface of the claims is covered with overburden and no rock-exposures were visible, except in the creek-bottom, where the outcrop of the vein was discovered. The apparent direction of the vein is south-west, with a dip of 25 degrees to



B.C. Bureau of Mines.

Emerald Mine Ore Tunnels at Town of Salmo.



B.C. Bureau of Mines

Alamo Concentrator, near Three Forks, W.K.

the south-east. A crosscut tunnel 130 feet in length was driven to tap the vein below the outcrop in the creek-bed. Ten feet from the end of this tunnel vein-matter was encountered, and a 20-foot drift to the north-east discloses some greenish calcareous rock, probably dolomite, sparsely mineralized with chalcopyrite and iron pyrites, but evidence of any well-defined vein is lacking. The tunnel only gains about 20 feet of backs below the outcrop.

At a distance of about 40 feet to the west of the outcrop a prospect-tunnel driven at right angles to the vein struck a pocket near the surface, from which about 2 tons of ore was extracted. A sample of the sorted ore from this tunnel ran: Gold, trace; silver, 4 oz.; copper, 3.5 per cent.

The ore is chalcopyrite, with which is associated iron pyrites, zinc-blende, and a little galena. The gangue is principally quartz. The formation consists of slates and schists, probably of Pre-Cambrian age. The development-work done so far is not sufficient to allow much importance to be attached to the deposit.

During 1919 this group, consisting of a long string of about forty claims, was **Great War Group**, staked by G. A. M. Young, of Creston, on behalf of the British Columbia Iron Company, Limited. They extend for about a distance of three miles in a northerly and southerly direction on either side of the Canadian Pacific Railway at a point three miles west of Kitchener. The area is composed of the Pre-Cambrian rocks of the Aldridge formation, which come under the general classification of dark-grey argillaceous quartzites, weathering to a rusty-brown colour. Igneous rocks, described as the Purcell sills, and varying in composition from hypersthene gabbro to a very acid granite, have been injected between the horizontal strata of the Purcell series and are of common occurrence in the Aldridge formation. Contemporaneous to the sill-rocks there were flows of lava composed of highly altered amygdaloidal basalt. In a belt of rocks extending in a northerly direction from the summit of the Moyle range for a distance of six or seven miles up Goat river to the Kitchener iron-deposits, indications of iron ore have been discovered at various places.

Superficial prospecting-work was done on the Kitchener deposits some years ago, with the result that five beds of hæmatite were said to be uncovered, having widths of 8, 12, 18, 15, and 6 feet respectively. The average assays of a number of samples taken is reported to have given 50 per cent. metallic iron, with negligible quantities of sulphur and phosphorus. Although there is said to be a large tonnage, it is understood that not sufficient work has been done to allow an estimate being made of the amount available.

It is further reported that the ore occurs in quartzite, running north and south throughout the length of the mountain alongside a greenstone dyke. (See Minister of Mines' Report, 1901.) At the southern extremity of this mineralized belt, near the summit of the Moyle range, the present discoveries on the *Great War* group have been recently made.

Prospecting-work carried out under the direction of G. A. M. Young consists of stripping the surface free from the heavy overburden of detritus. The principal and probably the most important work has been done near the point of discovery. These workings are situated at a distance of three miles from the railway-track and at an elevation of 6,000 feet. With the exception of the one place at which the ore was discovered, no exposures of the ledge were formerly visible, for the rock in-place is heavily covered with overburden, making prospecting slow and costly.

The workings are as follows: The No. 1 cut, which is the most southerly, consists of a deep trench 50 feet long across the apparent strike of the ore-body. The rock surfaces are exposed, but no ore was encountered. At the No. 2 cut, which was driven in the same direction and at a distance of about 100 feet north of the No. 1 cut, similar conditions prevail. The rock exposed along the bottom of the cut is a diorite superficially stained with iron oxide. Black hæmatite float has been found near these workings, indicating the presence of a vein farther up the hillside. At a short distance to the north of No. 2 another cut has been made; this runs in a northerly and southerly direction, exposing a face about 52 feet long and 10 feet high. The longitudinal section of this from the southerly end exposes a band of soft black hæmatite 4 feet wide and 12 feet long, gradually passing into a hard black crystalline ore and becoming disseminated through a tough, fine-grained light-green rock carrying a certain percentage of iron pyrites.

Two samples were taken, one along the 12 feet of soft ore and the other was chipped from the surface of the remainder of the face for a length of 38.5 feet. The sample of the soft ore ran: Metallic iron, 52 per cent.; sulphur, trace; phosphorus, trace. The other sample ran:

Metallic iron, 42 per cent.; sulphur, 2.63 per cent.; phosphorus, 0.04 per cent. The silica content was not determined, but judging from the character of the ore, it would be high in the latter sample.

Continuing down the hill for a distance of about 200 feet, a shallow trench uncovers a width of about 15 feet of siliceous black hæmatite, in a "tight" formation. Farther down the hill a similar exposure has been made.

"As yet, not sufficient work has been done to enable an estimate to be made of the available tonnage or even the relation between structural and stratigraphical features of the deposit to be determined. The greenstone apparently bears an important relation to the concentration of the ore, although its origin may be traceable to other sources.

From other analyses taken by the owners, the general characteristics of the ore are as follows: Black crystalline hæmatite, carrying 50 to 60 per cent. metallic iron, 20 to 30 per cent. silica, from 0.02 to 0.03 per cent. phosphorus, and about 1 per cent. sulphur. The ore is magnetic owing to its composition containing about 23 per cent. of magnetite; hence its most appropriate designation would be "magnetic-hæmatite." The ore apparently lies between diorite and quartzite, and, assuming that it is genetically connected with the igneous intrusive rock, its occurrence will probably be somewhat freakish.

Before doing any extensive development-work or diamond-drilling it would be advisable for the owners to have a magnetic survey and thorough geological exploration made of the area. The magnetic and highly silicated phases of the formation should be eliminated, and an effort made to discover areas where the formation has been loosened up and in which conditions lend themselves to ore-concentration by processes of weathering.

This property, comprising seven claims, is situated at a distance of two miles **Sullivan Group.** and a half from Kitchener and within half a mile of the railway. It is principally owned by J. A. Sullivan, of Kitchener. The workings are located on the hillside to the south of the track and at an elevation of about 600 feet above it. The main vein, which is a quartz-filled fissure in a hornblende diorite, has been prospected by a few open-cuts, and at a point where it was found to be most heavily mineralized a 6-foot shaft has been sunk. Across the bottom of this shaft there is a width of 3 feet of ore, composed of chalcopyrite associated with iron pyrites in a quartz gangue. A sample across 34 inches ran: Gold, trace; silver, 1 oz.; copper, 6 per cent.

The strike of the vein is east and west and roughly parallels the contour of the hillside; the dip is almost vertical. The hillside slopes at an angle of 40 degrees; hence good depth in proportion to the length of drive can be obtained by adit levels. The vein is again exposed in a trench at a distance of about 100 feet west of the shaft. Here it shows a width of 4 feet, containing an ore-streak of about 12 inches. All things considered, it appears to be a prospect upon which further work is fully warranted.

#### ARROW LAKE MINING DIVISION.

*Millie Mack.*—Situated near Burton. This property has been operated for a number of years by the owner, H. E. Forster, of Wilmer. This year there was a small crew of men working, but no information regarding the result of the season's work has yet come to hand.

*Chieftain.*—This property has been lying idle for some years, but as a result of an examination made by engineers it is understood that the mine will be opened up early next spring. It is situated on Cariboo creek at a distance of about twelve miles from Burton.

#### TRAIL CREEK MINING DIVISION.

Steady production was maintained by the Consolidated Mining and Smelting Company's mines and the *Le Roi No. 2*, the total output being about the same as that of last year.

The principal source of gold and copper in the district is derived from the mines of Rossland, and although the copper production of this camp only amounted to a little over 1,500,000 lb., that of gold was approximately 30 per cent. of the total of the Province.

The official announcement that the Consolidated Mining and Smelting Company intends erecting a large concentrator for the treatment of the low-grade Rossland ores predicts greater activity for this camp than has been experienced for some years.

In spite of the ever-increasing cost of labour and supplies—conditions which are not favourable for the economic mining of low-grade gold ore—the production for the year will compare favourably with that of last year.

At Trail many improvements have been made at the smelter, and the successful experiments made on the magnetic separation of the *Sullivan* ores have gradually led to extensive additions being made to the experimental magnetic separator plant, which now has a daily capacity of about 300 tons.

On June 24th the Consolidated Mining and Smelting Company issued Schedule C, which shows a substantial reduction in smelting charges, amounting to an average of about \$3 a ton on Slocan ores.

On September 26th the company notified the mine-owners that they had decided to change their method of lead settlement by cancelling the old pooling system. The new method of settlement applied to all shipments received at the smelter on and after October 1st.

The following is Schedule C and amended terms of payment:—

“ SCHEDULE C—PAYMENTS.

“ *Gold*.—Pay for 95 per cent. of the assay at \$20 per ounce. No pay for gold unless 0.05 oz. per dry ton or over.

“ *Silver and Lead*.—Payments for silver and lead will be based upon the zinc contents of the ore on the following schedule:—

	Silver Payment.	Lead Payment.
	95 per cent.	90 per cent.
10 per cent. zinc or under .....	95	90
Over 10 per cent. and including 11 per cent...	94½	89
“ 11 “ “ 12 “ ..	94	88
“ 12 “ “ 13 “ ..	93½	87
“ 13 “ “ 14 “ ..	93	86
“ 14 “ “ 15 “ ..	92½	85
“ 15 “ “ 16 “ ..	92	84
“ 16 “ “ 17 “ ..	91½	83
“ 17 “ “ 18 “ ..	91	82
“ 18 “ “ 19 “ ..	90½	81
“ 19 “ “ 20 “ ..	90	80
“ 20 “ “ 21 “ ..	89½	79
“ 21 “ “ 22 “ ..	89	78
“ 22 “ “ 23 “ ..	88½	77
“ 23 “ “ 24 “ ..	88	76
“ 24 “ “ 25 “ ..	87½	75

“ No ore containing more than 25 per cent. zinc will be accepted under this schedule.

“ *Silver*.—Will be paid for to the extent shown by the above schedule on the fire assay at the average of the *Engineering and Mining Journal*, New York, quotations for the second calendar month succeeding the date of sampling at Tadanac, B.C. In no case will the deduction from the silver assay be less than 0.5 oz. per ton.

“ *Lead*.—The lead contents will be determined by the wet method of analysis, deducting 1½ units to arrive at the dry-lead assay. Lead will be accounted for on the dry-lead assay to the extent shown by the above schedule; provided, however, that in no case will the deduction from the said dry-lead assay be less than 1 unit or 20 lb. per dry ton of ore.

“ The price of lead to be used in settlement will be our average sales price delivered at destination in Canada for the second calendar month succeeding the date of sampling or the A. S. & R. Co.'s New York average quotation for the said second calendar month, whichever is the greater, less a deduction in either case of 1½ cents per pound for refining and marketing.

“ There will be deducted also from the settlement price \$2.30 per ton on sales at Toronto and common points, and \$4.50 per ton on sales at Montreal and common points, and similar differentials to other points. This freight adjustment is to cover actual increases in freights; e.g., should sales in any month be 2,000 tons and, say, 1,200 tons for delivery at Toronto and 800 tons at Montreal, the freight adjustment would be three-fifths at \$2.30 and two-fifths at \$4.50, or \$3.18 per ton of lead.

“ Paragraphs (a), (b), and (c) on page 4 under the heading ‘Settlement’ are cancelled, and the following substituted:—

“ *Settlement*.—(a.) Shortly after sampling an advance payment of 90 per cent. of the apparent value will be made. The prices used in estimating the apparent value will be the New York price for silver of the date of sampling and the previous month's sales price for lead.

“(b.) Shortly after the close of the second calendar month after sampling, when the data is available, the final value will be computed and any adjustment necessary will be made between the smelter and the mine.”

Situated near Renata, on Lower Arrow lake. Development, consisting of **Mountain Chief.** sinking and drifting, has been steadily carried on under the supervision of J. W. Evans, the manager. A 2-bucket tram was erected early in the year, and latterly a 2-drill compressor was installed at the mine. Shipments were recently resumed to Trail. According to recent reports, present indications at the mine have fulfilled the most sanguine expectations.

#### REVELSTOKE AND LARDEAU MINING DIVISIONS.

Situated at Laurie, on the main line of the Canadian Pacific Railway. **Lanark.** Development-work has been actively carried on under the direction of W. Dornberg. The winze on the No. 4 level has been dewatered. It is reported that conditions are favourable for steady operation during the coming year and that a considerable increase in output is expected.

After lying idle during recent years, the *Beatrice* was opened up again and the mine-workings put in shape for further mining and development work, which, it is understood, will be carried out under the supervision of Mr. Bodine, who is familiar with the property. Four men have been working since the middle of August. The property is held under bond by a company which was recently incorporated and called the New Era Mines, Limited.

*Burniere Group.*—Situated near Cambourne and owned by C. Menhinick. This property is reported to have been bonded this year and that mining operations will be carried on during next year.

As early as 1896 a considerable amount of prospecting-work was done on these claims by a company called the Gold Fields of British Columbia, Limited. **Waverley-Tangier Group.** To give access to the property a wagon-road was built for a distance of about twenty-eight miles up the North fork of the Illicillewaet river from Albert Canyon, on the main line of the Canadian Pacific Railway. Work was abandoned many years ago, the old wagon-road became obliterated in numerous places, and it was not until last year that work was resumed by a small crew of men. The property was acquired by G. H. Walters, of Spokane, from T. Graham and O. Sandberg, of Albert Canyon. There is reported to be possibilities of opening up a considerable body of low-grade silver-lead ore. The mine is situated in the heart of a vast undeveloped country and its progress will be watched with interest, for if successful it should certainly lead to more mining activity north of the Canadian Pacific Railway line.

Since an examination and report were made on this property last year few **Woolsey Group.** new developments have taken place. A tunnel-site was chosen at an elevation of 5,100 feet on the west side of the creek and work was started in the fall of 1918. The tunnel has been driven along the foot-wall and parallel to the strike of the vein, which is N. 50° W., the dip being 45 degrees to the north-east. At a distance of 74 feet from the portal a crosscut has been driven, showing the vein to have a width of 23 feet. On the foot-wall side the mineralization is slight, but increases towards the hanging-wall. A moiled sample of 30 lb. taken across a width of 9.5 feet adjacent to the hanging-wall ran: Silver, 6.6 oz.; lead, 6 per cent.; zinc, 6 per cent. The gangue is quartz. At a distance of 120 feet from the portal another crosscut has been started and was just getting into the foot-wall side of the vein at the time of examination.

According to recent reports from the miners, the vein holds its width at this point and is more heavily mineralized with galena. A grab sample of a small pile of cobbled ore from the tunnel ran: Silver, 69.5 oz.; lead, 48 per cent.; zinc, 4 per cent. The formation, consisting of carbonaceous slate, is uniform in dip and strike, with the result that the vein, which conforms to the bedding-planes, has exceptionally well-defined and uninterrupted walls. So far neither on the surface nor in the underground workings is there any evidence of disturbance or igneous intrusions. The vein is a quartz-filled fissure, which is remarkable for its persistence in width and continuity. Cutting the hillside at an oblique angle, it can be easily traced for thousands of feet from near the summit on the west side of the creek to that on the east side.

Immediately above the tunnel galena outcrops on the surface, and at an elevation of 5,375 feet an old drift has been driven for a distance of 90 feet, but discloses nothing of importance. The vein here is exposed in a series of jagged bluffs and can be seen continuing towards the summit. At an elevation of 5,900 feet the vein shows a width of about 9 feet along the face of a bluff, at which point A. B. Clabon, president of Vancouver Chamber of Mines, lost his life last year. Here several shallow diggings on the foot-wall side of the vein expose some nice showings of galena, a sample across 10 inches of which ran: Silver, 49.4 oz.; lead, 58 per cent.; zinc, 4 per cent. Whether these last showings are on the *Alice* claim of the *Woolsey* group or on the claim staked by O. Sandberg and Gus Hedstrom can best be ascertained by a survey.

Proceeding from the new tunnel down the hill, the East fork of Silver creek is crossed at an elevation of about 4,300 feet, and a good trail is followed to the showing on the east side of the creek, where at an elevation of 4,650 feet the vein has been uncovered from overburden and an open-cut exposes a width of 9.5 feet. The vein-filling of massive quartz is mineralized with galena in streaks and bunches, and with which is associated iron pyrites and zinc-blende. While small quantities of ore can be extracted, concentration would be necessary for profitable mining. Whether the average values obtainable at this point are sufficiently high for mill-feed at the present stage of development is questionable, and no definite opinion can be formed until the continuity and character of the deposit is proved by further work. A sample of the best grade of sorted ore from this cut ran: Silver, 49.4 oz.; lead, 46 per cent.; zinc, 6 per cent.

From the above brief description it will be seen that the vein is mineralized in a number of places over a wide area. The ore occurs in lenses and barren spots are bound to be more or less frequent. The future of the property depends on the development of a large tonnage and the ultimate erection of a concentrator. While the indications are favourable, careful judgment will have to be exercised as to where the work should be done to obtain the best results.

This group, consisting of four claims and owned by A. Kitson and others, of **Iron Cap Group**, Revelstoke, is situated on the summit of the divide between the headwaters of 15-Mile and LaForme creeks. Leaving the Big Bend road at 15-Mile creek, a slashed trail is followed for about four miles, from the end of which it is necessary to scramble through the brush until the open country of the summit is reached. In a total distance of about six miles an elevation of 5,200 feet has to be climbed. However, the grand scenery alone when near the summit is ample reward for the somewhat lengthy and arduous trip. A park-like country with grassy slopes and beautiful little lakes meets the eye when once out of the timber, and strikes very pleasing contrast with the bold and rugged peaks rising from and far above the ridge of the summit of the divide. The ridge, which is rounded on the westerly side, falls off abruptly to the east or towards LaForme creek.

The area, composed of granitic rocks cut by siliceous dykes, exhibits the various stages of transition from the highly siliceous rocks to the more basic variety. In a dark-green basic rock, probably an augite diorite, copper values have been found, the mineralization consisting of chalcopyrite and iron pyrites. On the surface the iron-stain due to oxidation is visible in a number of isolated places, but not sufficient work has been done at any one place to enable an opinion to be advanced on the possibilities.

Across a width of about 50 feet the face of a bluff on the east side of the summit shows the stain of iron oxide, which forms a thin film on the rock-surface, and under which the sulphides of iron are encountered, but there is little evidence of copper. At a short distance above this showing and on the summit of the ridge, at an elevation of 7,000 feet, several shallow diggings show the rock at a few feet below the surface to be disseminated with chalcopyrite. A sample of the best grade of ore from one of these cuts ran: Silver, 1 oz.; copper, 0.8 per cent. Samples of select ore have been obtained by the owners which ran as high as: Silver, 2.2 oz.; copper, 3 per cent.

A little more work done by the owners at the most favourable showings will demonstrate whether or not the property is worthy of more progressive development. At present it is a mere prospect with doubtful possibilities, but has been mentioned at some length in an endeavour to give at least a slight idea of this part of the country, about which little is known.

This property, consisting of a group of six claims, has been staked along the north-westerly spur of Goat mountain, and is principally owned by George **Scout Group**. Goldsmith, the original locator, and one of the pioneer prospectors of the district. A fairly good, though steep, trail leads from the valley of the Incomappleux river,

or what is generally known as Fish creek, to the property, which is situated at an elevation of 3,500 feet above the foot of the mountain. The trail, which is built up a narrow timbered ridge, gains this elevation by a great number of short switchbacks. The distance from Beaton to the trail turning is twelve miles by wagon-road and the trip can be comfortably made in a day.

The cabin, built on the face of the steep hillside, has a most pronounced list to starboard or down the hill, and has only been saved from its downward flight by means of many props and braces. However, when once inside, it offers good shelter and accommodation for three men. The hillside in the vicinity of and above the cabin presents a bare and steep rock-surface, consisting of a massive and compact formation of schists and alternating bands of limestone.

Running across the surface at an oblique angle there is a band of highly pyritized and silicified limestone, having a width of from 10 to 15 feet, conforming to the stratification of the enclosing rocks. The pyrite on the surface has been altered to a reddish variety of siderite. At the upper end of this mineralized band a tunnel has been driven for a distance of 185 feet along its strike. For the entire length of the tunnel the ground is soft, decomposed ledge-matter heavily stained with oxide of iron, in which occur at intervals streaks and small pockets of galena and some little carbonates and black sulphurets. A sample of the galena ran: Gold, 0.1 oz.; silver, 58.4 oz.; lead, 56.5 per cent.; zinc, 2 per cent. A sample of black sulphurets ran: Gold, 0.18 oz.; silver, 45.2 oz.; lead, 35.1 per cent. zinc, 2 per cent.

Several open-cuts expose the vein at lower altitudes, but except for showing its persistency along the strike are of little importance, as not enough work has been done. The vein is said to be traceable down the hillside to an approximate elevation of 3,000 feet below the tunnel, where water coming from the supposed *Scout* lead forms a falls some 20 feet in height.

There is still another showing on the *Scout* group towards the south-easterly end of the property and within sight of the *Mammoth* mine. Here an open-cut along the strike of a small quartz vein in the limestone exposes a few pockets and stringers of galena, but no ore-body of commercial importance. An assay of the galena from this showing ran: Gold, 0.06 oz.; silver, 43.2 oz.; lead, 31.2 per cent.; zinc, 4 per cent.

At the present time, although the property has good possibilities, there is hardly enough ore developed or work done on the lead for an examining engineer to commit himself in making definite statements regarding the probabilities of a large tonnage being available, on which the future of the property depends. The conditions warrant further work being done by the advancement of the present tunnel, with short crosscuts at intervals from wall to wall. It is not of much satisfaction to the engineer to know that the vein can be traced to the bottom of the mountain, or, for that matter, across several divides, unless it is mineralized. Of course, in all veins the ore occurs in shoots, and one cannot expect to find mineral along the whole length of the vein. If this vein can be traced to the bottom of the hill, or if there is some other vein exposed at this point, then it would also be advisable to do further prospecting in an effort to find ore and at a lower altitude.

Both the *Scout* group and the adjoining claims of the *Big Showing* group were examined by a number of engineers during the season, and were reported on by Newton Emmens for the Minister of Mines in 1914. Upon request of the owners another examination was made by the writer; hence it has been necessary to repeat much of the information contained in the 1914 Report.

#### Big Showing Group.

This property, comprising five claims, is located to the east of the *Scout* and on the same spur of Goat mountain. It is owned by John Leask and associates, of Cranbrook. Leaving the *Scout* trail at a short distance below the cabin, a descent of about 600 feet is made around the northern end of the spur to the gulch, the source of a small mountain torrent called Goldsmith creek, and also forms an excellent channel for snowslides, which have scoured its precipitous sides clean, leaving along the easterly side a precipitous and bare rock-exposure many hundred feet in height. On the westerly side of the gulch the slope is rugged, and the strata, dipping at a steep angle to the north-east, form a series of small benches or shoulders which can be climbed without much difficulty. This formation, consisting of schists, slate, and limestone, has a strike of N. 30° W.

The vein outcrops on the west side of the creek and is somewhat similar in character to that of the *Scout*, except that the sulphides are exposed on the surface, due to the action of erosion at this point keeping pace with that of oxidation. It conforms to the stratification of the enclosing rocks and can be traced for many thousands of feet. The surface exposure at the

outcrop is rightly called a "big showing," the width of the mineralized ledge being about 50 feet, in which a considerable quantity of galena occurs in patches and disseminations in a quartz gangue. The intervening bands of barren material are stained in places with oxide of iron. At this point the line of the surface cuts the vein at an angle which is not normal to the dip; hence the true width is not represented and is about 20 feet.

Ore can be traced for some distance up the hill until the vein becomes covered. It is reported that ore has been found in a precipitous bluff near the summit. A sample of the galena from the surface ran: Gold, trace; silver, 1.6 oz.; lead, 25.3 per cent.; zinc, 1.5 per cent. A sample of the iron-stained ledge-matter ran: Gold, trace; silver, trace; lead, *nil*; zinc, 4 per cent.

At an elevation of about 5,000 feet and at a vertical distance of 300 feet below the surface showing a tunnel has been driven for 171 feet, the first 66 feet of which follows a course of S. 20° E., and the next 105 feet due south. In driving this tunnel they did not allow for the dip of the vein, and it is therefore in the foot-wall side. When this was recognized a crosscut was started at a point 126 feet from the portal and was driven in a direction of N. 80° E. for 42 feet; it was abandoned when within about 20 feet of the vein. For prospecting purposes this tunnel-site is well chosen, but for operating the property on a large scale a more favourable site might be obtainable at a lower altitude and in a more accessible place. Good water-power and timber are within easy reach of the property.

From the tunnel a climb of 3,000 feet was made to the summit of the ridge, where there is an excellent view of the peaks of Goat mountain, on the slopes of which can be seen the many tunnels of the *Mammoth* mine. There are said to be some good showings of carbonate ore on the claims of the *Big Showing* group, some 2,000 feet below the saddle of the divide on which the old *Mammoth* cabin stands, but time did not allow an examination.

The *Big Showing* might be considered a good prospect, with possibilities of a large tonnage of low-grade ore. The amount of work done neither condemns the property nor proves the existence of a large tonnage. Further work should be done at the tunnel and on the surface. In order to trace the vein and closely study the geological conditions a week might be spent on the ground to advantage, but even then a man might not be very much the wiser as to the economic value of the property. Ore is what is needed, and it generally takes some powder and hard work to prove its existence in quantity. Hence the owners would be well advised to either do more prospecting themselves, or endeavour to interest capital by offering sufficiently attractive terms with a view of having further work done. A season's work by a small crew of men would do a lot to show up the possibilities of the property.

#### TROUT LAKE MINING DIVISION.

There has been less actual mining activity in this Division than usual, although there has been keen outside interest taken in many of the leading properties, as evidenced by the number of inquiries and the numerous examinations made by visiting engineers, which it is hoped will result in renewed activity during the coming year, for it is certainly a district which has great possibilities.

**Old Gold.** This property is situated at a distance of about thirteen miles from Ferguson and a short distance over the summit, which forms the dividing line between the Trout Lake and Ainsworth Divisions. A small crew of men was working this year, but so far no record of any shipment being made has come to hand. The ore is high-grade silver-lead, and in spite of extremely adverse conditions a considerable tonnage has been packed out from this property.

**Crescent.**—Situated near the headwaters of 8-Mile creek on the northerly side of Trout lake. Prospecting and development work were continued this year under the management of M. Leahy.

**Triune.** This property is easily reached from Ferguson, it being situated at a short distance beyond the end of the wagon-road up the South fork of Lardeau creek. The elevation of the mine-workings range from 7,500 to about 8,000 feet. Some 1,000 feet above the small basin at the head of Triune creek the mine cabin can be seen perched on the precipitous face of a bare rocky ridge of Triune mountain. About 600 feet above the cabin a small glacier rests among the rugged peaks of the summit, at the edge of which ore was first discovered, and from these original workings a considerable tonnage carrying high silver and gold values was extracted.

The development-work principally consists of four adit-tunnels. The No. 4 tunnel is driven in a slate formation for over 600 feet, but no ore has so far been developed, although conditions at the face look promising. Access to the portal of No. 3 is gained by the aid of a rope. This latter tunnel is connected with the No. 2 by a raise, but unfortunately a cave-in prevented the examination of this level, and incidentally the use of the raise, by means of which the upper workings are reached. An effort was made to scale the bluff, but without the aid of a rope it was decided that "the game was not worth the candle," so the upper workings were not examined. (Refer, Robertson, W. F., Annual Report of Minister of Mines, 1903, page 122.)

The band of dark slates in which the *Triune* vein occurs rests conformably on a foot-wall of yellow-weathering greenish-grey schists. The strike of the formation is N. 70° W. and dip 75 degrees to the north-east. The ore is galena, with which is associated iron pyrites and zinc-blende. The gangue is quartz. The average values of the last eighteen cars shipped ran: Silver, 182 oz.; lead, 34 per cent.; gold, 0.5 oz.; zinc, 6 to 9 per cent.

During recent years the mine has been operated under the management of R. H. Battey for the Minnesota Gold and Silver Mining and Manufacturing Company. No work was done on the property this year. Recent improvements include the installation of a 2-bucket tramway system to convey the ore down the mountain to the basin immediately below the cabin. The future of the property depends largely on the development of ore at a depth, and the present conditions appear to fully warrant the advancement of the No. 4 tunnel, although before doing this it would be advisable to have a proper survey of the mine made.

This group comprises four claims—*Gold Bug*, *Rambler*, *Silver Star*, and *Silver Spoon*. The property, which is owned by J. W. Livingstone, of Ferguson, is situated on the South fork of Lardeau creek, near the confluence of 7-Mile creek, and at a distance of seven miles from Trout lake. The location is ideal for mining operations, there being ample timber and water-power available, while there is an excellent wagon-road within a few hundred feet of the tunnel-site. The development-work, which was started many years ago, has been done single-handed by the owner.

On the surface of the *Gold Bug* claim there are few indications of mineral in-place, except along the northerly side of the creek, where some of the joint planes of the slate formation are filled with quartz carrying small quantities of galena. In the near-by *Silver Cup* property similar seams were found to invariably lead to ore, and as this group is located in the mineralized zone extending from the latter property to the *Nettie L.*, Livingstone decided to follow one of these seams with a crosscut tunnel. After driving through a massive slate formation for 190 feet a quartz vein was encountered, having an apparent strike of north-west. The quartz shows evidence of crushing and to be more or less mixed with crushed slate, and in places mineralized with galena, zinc-blende, and iron pyrites. Instead of crosscutting the main body of quartz at the place where it was first encountered, the drift meanders around the south side and finally ends at a point only a short distance from the face of the original crosscut. At this point, which is at the southerly end of the workings, the face of the drift shows a crushed mass of quartz and graphitic slates; on the southerly side there occur pockets of high-grade galena, a sample across 6 inches of which ran: Gold, 0.02 oz.; silver, 72 oz.; lead, 57.5 per cent.; zinc, 8 per cent. Another sample taken near the bottom of the drift across 12 inches ran: Gold, 0.02 oz.; silver, 12 oz.; lead, 6 per cent.; zinc, 36 per cent.

At the time of examination there was not any ore-body of commercial importance developed, but the general geological conditions appeared favourable for the deposition of ore, and the prospect might be considered one which has good possibilities.

At a distance of about 2,000 feet in an easterly direction a little surface work has been done on a showing of low-grade ore on the *Rambler* claim. Here a band of quartzite crosses the creek and is said to be a continuation of what is locally known as the *Nettie L.* dyke. There are several showings of quartz carrying small quantities of galena, zinc-blende, iron pyrites, and a little chalcopyrite, but there is no well-defined vein so far exposed, and the possibilities of this deposit are difficult to arrive at without further work being done, as the formation at this point does not appear to be in-place.

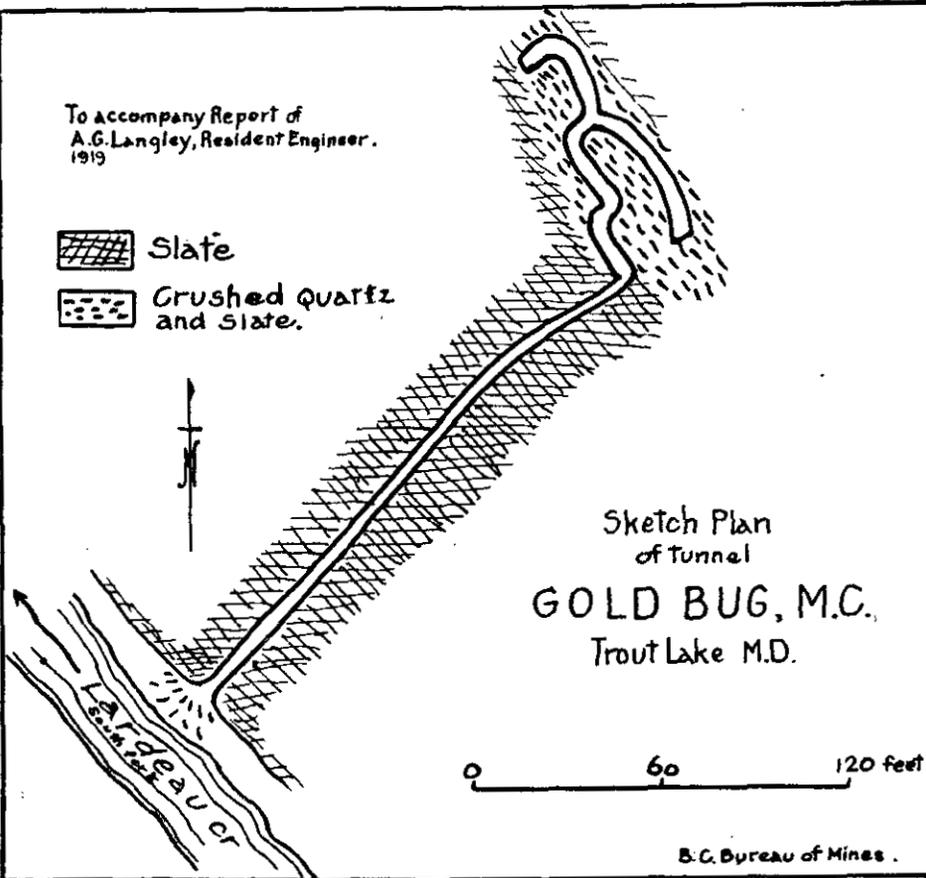
To accompany Report of  
A.G. Langley, Resident Engineer.  
1919



Slate



Crushed quartz  
and slate.



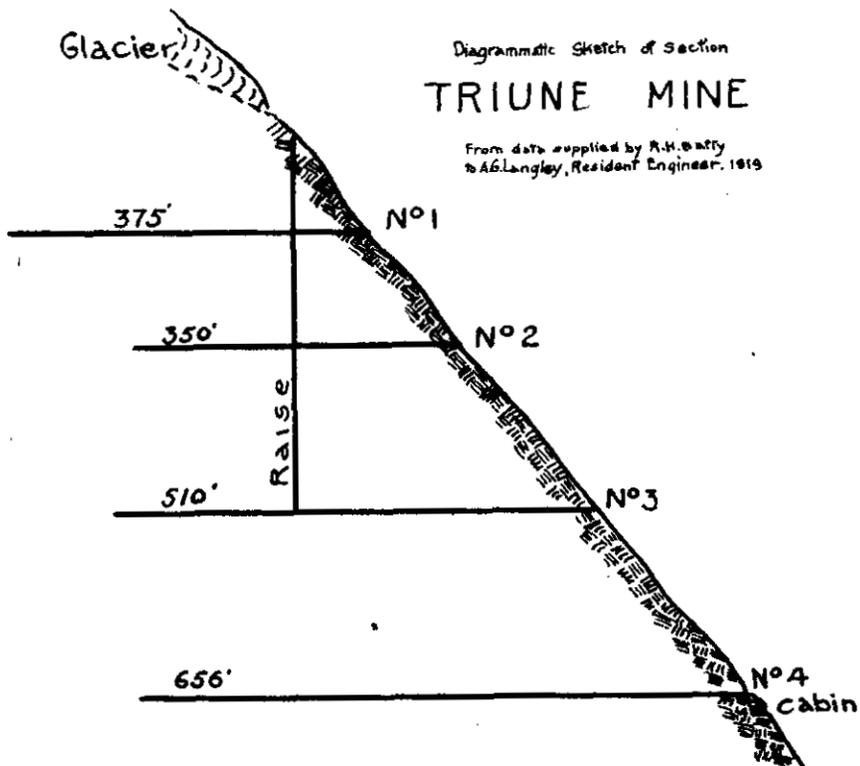
Sketch Plan  
of tunnel  
GOLD BUG, M.C.  
Trout Lake M.D.

B.C. Bureau of Mines.

Glacier

Diagrammatic Sketch of Section  
TRIUNE MINE

From data supplied by R.H. Dally  
to A.G. Langley, Resident Engineer, 1919



B.C. Bureau of Mines

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## NORTH-EAST KOOTENAY DISTRICT.

### GOLDEN MINING DIVISION.

REPORT BY JOHN BULMAN, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report of the Golden Mining Division of the North-east Kootenay District.

Mining operations in this Division are at a standstill and nothing but the necessary assessment-work, in order to keep the recorded claims alive, has been done by way of development.

*Monarch and Coverapee*.—Situating on Mount Stephen, Field. These claims adjoin each other and in 1918 considerable shipments were made, but nothing has been done for the year 1919.

The *Giant* mine at Spillimacheen, a low-grade proposition with lots of ore in sight, has been idle all the year. Captain Armstrong, one of the owners, having been overseas, has now returned and we may expect operations to commence in the near future.

#### OFFICE STATISTICS—GOLDEN MINING DIVISION.

Mineral claims recorded .....	40
Certificates of work issued .....	25
Free miners' certificates (ordinary) .....	125
Free miners' certificates (company) .....	1
Free miners' certificates (special) .....	3

#### *Revenue.*

Free miners' certificates .....	\$ 979 50
General mining receipts .....	345 00
Tax on Crown-granted claims .....	972 50
Tax on mines and minerals .....	2,122 10

Total .....	\$4,419 10
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### WINDERMERE MINING DIVISION.

REPORT BY E. M. SANDILANDS, MINING RECORDER.

I have the honour to submit my mining report for the year 1919 on operations in the Windermere Mining Division.

I am glad to be able to report that the amount of claims staked, certificates of work issued, and free miners' certificates sold exceed those of last year, and the general revenue of the office exceeded that of 1918 by some \$1,500. Quite a little new interest has been taken in some of the old claims, and several deals are now pending which will mean the opening-up of several new groups in the spring. At time of writing the lack of snow is rather retarding the shipping of ore. During the coming summer quite a good deal of activity is expected, chiefly on account of the very high price of silver.

*Paradise*. This property has worked continuously during the year and is one of the oldest and steadiest shippers in the Province. It is owned by R. R. Bruce, of Invermere, and Robt. McDonald is the mine superintendent. It is situated on Spring creek, a tributary of Toby creek, and is distant about eighteen miles from Invermere, to which point the ore is hauled by wagons or sleighs for shipment. The average number of men worked at the mine is about twenty-five, besides the ore-haulers. About 2,000 tons of ore has been shipped during 1919. The ore is a sand-carbonate with some galena. The new "Cut-off" road on the south side of Toby creek has been improved this summer and a new phone system to the mine installed.

This property is situated on McDonald creek and was formerly owned by **Nip and Tuck and Silver Tip**. W. Haupt. It has been sold to W. D. McMillan, of Seattle, Wash., and work was carried on during the summer. Some new rich surface showings were uncovered and about a car of high-grade ore sacked. The ore has not been shipped to date owing to the distance and, at that time, bad state of the road. Further development will be carried on in the spring.

This property is situated above McDonald creek and adjoins the *Nip and Tuck Ptarmigan Mines* group. It consists of a group of Crown-granted claims known as the *Red Line* group, and upon which a large amount of work was done and money expended in the early days by New York capital. The property is now under bond to E. W. Watson. Considerable prospecting on the surface was done during the summer and some new rich surface showings discovered; these were laid open by the receding of the glacier, which is claimed to have receded some 1,000 feet. Some 50 tons of rich ore has been sacked from the above-mentioned showings. At time of writing some 150 tons of dump-ore has been shipped to the smelter which was mined in the early days. This ore is now made profitable by the high price of silver; it goes about 40 oz. in silver and about \$15 in gold; there is no lead in it. Possibly 1,000 tons of this ore will be shipped this winter which was intended for mill-feed by the old owners. The rich ore will be taken out later. Development on an extensive scale is looked for in the summer and possibly a mill installed.

These properties are situated on Boulder creek, a tributary of Horse Thief creek, and have been worked continuously by W. W. Wonn, of Seattle, Wash., and associates. At the time of writing the property is closed down. What future developments are ahead I have no information. The wagon-road branching off Horse Thief road has been further improved and widened.

This property was formerly owned by Thos. Brown and partners and has since been sold to P. Denhart, Morris Thompson, and others, of Seattle, Wash. Considerable work was done on the property during the past year and about 80 tons of galena ore shipped. During the summer a crosscut tunnel was run to crosscut the vein some 250 feet; work was slow and expensive on account of the bad ground. About 90 feet more has to be driven. At time of writing the property is temporarily shut down, as it does not pay to operate again until spring on account of the expense of keeping the trail open, there being no ore ready yet for shipment. When the crosscut is finished it will cut down the hauling distance and in many ways make operating easier. P. Denhart, who is in charge of the property, intends to open up again in the spring and resume shipments. The property is on Frances creek and ships to Brisco, on the Kootenay Central Railway.

This property is on Frances creek and about three miles from the *Lead Queen*. It was formerly owned by H. E. Forster, who has now bonded it to W. D. McMillan and associates. About 80 tons of ore is now being shipped to Brisco and a small crew working under the management of P. Denhart. Work on a more extensive scale will be carried on next summer. There is a good showing of fairly good-grade galena ore.

This group of claims is situated on Jumbo creek, a tributary of Toby creek, and is owned by J. E. Stoddart and others. During the summer considerable work was done and a surface crosscut was run which uncovered a width of 85 feet of good milling-ore. The property is now under option and extensive work will be done in the spring. In all probability a mill will be built.

This property is near the *Paradise* mine, but on the Boulder creek slope of the mountain. J. Burman and others own the group and two men have worked continuously. A crosscut tunnel has been driven some 200 feet. Some rich ore is exposed on the surface. The ledge is expected to be tapped very shortly now.

OFFICE STATISTICS—WINDERMERE MINING DIVISION.

Certificates of work recorded .....	89
Bills of sale, agreements, etc. ....	21
Claims recorded (quartz) .....	67
Claims recorded (placer) .....	1
Free miners' certificates sold (ordinary) .....	98
Free miners' certificates sold (special) .....	1

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<i>Revenue.</i>	
Free miners' certificates .....	\$ 508 75
Mining receipts .....	701 95
Trade licences .....	222 50
Motor revenue .....	272 00
Gun licences .....	885 00
Water revenue .....	68 20
Poll-tax .....	110 00
Marriage .....	5 00
Law-stamps .....	2 45
General receipts .....	676 10
<b>Total</b> .....	<b>\$3,451 95</b>

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## SOUTH-EAST KOOTENAY DISTRICT.

## FORT STEELE MINING DIVISION.

REPORT BY N. A. WALLINGER, GOLD COMMISSIONER.

I have the honour to submit a report on the progress of mining in the Fort Steele Mining Division for the year 1919.

It can hardly be said that the mining season of 1919 has fulfilled all the prospects of 1918, as many of the proposed examinations did not take place, due to the unsettled conditions of labour and finance and high cost of everything connected with mining, and in one or two instances the want of transportation; and, finally, the unfortunate position in which gold is, the demand outstripping the supply, and the supply killed by the inability of the metal to take its place amongst the other metals in the race for high prices. This practically prohibits the exploration of low-grade free-milling gold quartz.

The placer operations have not turned out as well as expected on Wildhorse creek; the work of the Wild Horse Placer Mining Company was completely upset by the sudden spring floods causing the partial wreck of the boom-gate, and the subsequent work by the drag-line bucket system cannot demonstrate its value until sufficient depth is attained. The Gamble Placer Mining Company on Wildhorse did fairly well, the results paying a considerable sum after all expenses were deducted. Other placer operations on Weaver creek and Moyle river are still progressing and a great deal of work has been done; the prospecting being stated as very favourable. On Perry creek, where an ambitious scheme of hydraulicking is being followed, no actual washing took place, but considerable work was done in completing the flume and reinforcing and making vents in the big siphon. It is expected that the water will be turned on early in spring.

The result of quartz-mining has been more satisfactory, although actual ore shipments are not as big as they should be on account of the miners' strike, which is still in force.

The shipments from the *Sullivan* and *St. Eugene* mines, the properties of the Consolidated Mining and Smelting Company of Canada, Limited, are as follows:—

From the *Sullivan* mine: 14,890 tons of lead ore, yielding 126,446 oz. of silver and 8,453,344 lb. of lead; 117,007 tons of zinc ore, yielding 45,633,008 lb. of zinc and 3,060 tons of iron pyrites. The development-work has been kept up and improvements at the mine consist of a new modern dry-house, fully equipped with shower-baths, lavatories, etc., at the lower workings and new ore-bins and first-aid station at the upper workings.

From the *St. Eugene* mine: 776 tons of lead ore, yielding 13,383 oz. of silver; 565,004 lb. of lead; 2,179 tons of zinc ore, returning 827,695 lb. of zinc. All the above ore was sent to Trail.

The *North Star* shipped 7,121 tons, mostly lead carbonates taken from the mine chiefly, the dump supplying a small part; this amount would probably be much larger but for the fact of the disastrous forest fire in July, which burnt out a part of the tram-line and sixteen buildings, and subsequently a miners' strike that tied up the work for a while. Development has been carried on and fair supply of ore exposed.

The *Victor* group has sprung into life again, a bonding lease having been given; new development-work has already been started and a small concentrator is being installed, so that shipping and development may go together.

The *Guindon* group at Moyle broke into the shipping column with a small consignment of 5 tons of solid galena, from which a handsome return was obtained.

Great satisfaction has been felt over the bonding of the *Evans* group of claims on Whitefish creek to a Calgary syndicate, which is evidently making preparations for extensive development. This group contains a very large body of low-grade copper ore and its exploration will be followed with great interest; the problem of concentration is made somewhat easier by the vicinity of the waterfalls at the foot of the mountain. It is hoped that this will lead to more interest being taken in the St. Mary district, where so many excellent outcrops of copper are reported.

The hæmatite-deposits on Bull river and Sand creek have been examined and good reports issued, and as iron is in demand it is hoped that development may follow.

The discovery of a large iron-capped ledge carrying native copper has caused some stir; it is only a quarter of a mile from the railway crossing at Skookumchuck; the property was bonded at once and development is being pushed actively.

The reorganization of the company holding the *Park* group on Luke creek is welcome news, and the fact that a considerable sum has been set aside to sink the main shaft much deeper will cause the results to be watched with interest, as confidence in this locality needs reinforcing.

The low-grade free-milling gold quartz on Perry creek came in for examination, and as the work done during the year has been successful it is confidently expected that permanent development will be undertaken and a mill installed; its success would have far-reaching results, as the extent of this class of ore is very large. The outlook for a bonus on gold is causing a stronger interest in this class of ore.

The mining outlook for 1920 is bright, and would be brighter if the mineral resources of this district were more generally known; this, of course, will come as properties are opened up and demonstrated as being commercially profitable.

OFFICE STATISTICS—FORT STEELE MINING DIVISION.

Mineral claims recorded (Form B) .....	108
Certificates of work (Form E) .....	157
Conveyances and other documents of title .....	65
Partnership agreements .....	1
Gold Commissioner's permits .....	16
Documents filed .....	36
Affidavits filed .....	210
Mining leases issued .....	16
Free miners' certificates (ordinary) .....	267
Free miners' certificates (company) .....	6

*Revenue.*

Free miners' certificates .....	\$1,565 25
Mining receipts .....	3,090 85

## NORTH-WEST KOOTENAY DISTRICT.

### REVELSTOKE AND LARDEAU MINING DIVISIONS.

REPORT BY ARTHUR JOHNSTON, GOLD COMMISSIONER.

I have the honour to submit herewith a report on the mining conditions within the Revelstoke and Lardeau Mining Divisions for the year ending December 31st, 1919.

#### REVELSTOKE MINING DIVISION.

##### BIG BEND DISTRICT.

There is nothing of importance to report in regard to lode-mining during the year. It is reported, however, on good authority that late in the fall a bond was taken on the copper properties formerly owned by the Prince Mining and Development Company, who operated extensively in Standard basin, forty miles north of Revelstoke, some twenty years ago. Many eminent mining engineers have reported favourably on this property, but the high cost of transportation is a serious drawback to the successful financial operation of same. If this bond is exercised during the coming season it will no doubt attract a great deal of attention to the mining possibilities of this district.

There is very little to report with regard to placer-mining activities during the year. Mr. Remillard and associates, who for the past two seasons have been constructing a flume from the headwaters of French creek to their properties lying in an old channel of this creek, completed same in the fall, and it is expected that active mining operations will be commenced this year. This property lies seventy-five miles to the north of Revelstoke. On 11-Mile and Keystone creeks Peterson Bros. are operating leases. The extent of their operations last year was chiefly in prospecting the ground, and the results of same were found to be most satisfactory. It is expected that work on this property will be prosecuted this year.

##### ALBERT CANYON AND ILLICILLEWAET DISTRICTS.

The *Woolsey* group was bonded to a company represented by C. V. Brennan, of Victoria, and the work already carried out on this property gives hopeful prospects that same will eventually be a large producer. This property is situated on Silver creek, about seven miles from Albert Canyon, and there is a good trail.

The *Lanark* mine, situated at Laurie, on the main line of the Canadian Pacific Railway, underwent development-work during the season, and it is expected that extensive mining operations will be in force this year.

The *Waverley-Tangier* property, situated twenty-five miles north-west of the main line of the Canadian Pacific Railway Company at Albert Canyon, was bonded to G. H. Walters, of the Walters Investment Company, of Spokane, Wash., two years ago, but has now been transferred to a company of wealthy capitalists of the State of Washington. During the season four men were actively engaged on this property in opening up the old workings and general exploration-work. The company proposes to put a large crew of men at work at the beginning of the season and to equip the property with the latest mining machinery, so as to ensure its success as a shipping concern. Some twenty-two years ago a wagon-road was built from Albert Canyon to these mines, but owing to disuse this road is in bad repair at the present moment. It is the intention of the company to open up this road, so as to facilitate the transportation of supplies and the shipment of ores.

No other mining activity worthy of mention occurred in the other parts of these districts.

#### OFFICE STATISTICS—REVELSTOKE MINING DIVISION.

(John Lee, Mining Recorder.)

Free miners' certificates .....	151
Free miners' certificates (company) .....	2
Certificates of work .....	64

Mineral claims recorded .....	63
Bills of sale recorded .....	11
Powers of attorney .....	2
Transfers .....	2
Memorandums of agreement .....	1
Payments in lieu of work .....	2
Groupings recorded .....	11
Placer leases recorded .....	5

LARDEAU MINING DIVISION.

There was a good deal of mining activity in the Camborne district of this Division. The *Beatrice* mines have been lying idle for about fifteen years, but were again opened up and the mine-workings put in shape for further development. This property is now owned by the New Era Mines, Limited, under bond from the original owners. It is reported that some fine lenses of ore have been exposed in the workings this fall and winter, which has proved most encouraging, not only to the new owners, but to the mining men of the district.

The *Multiplex* mines, of which O. T. Bibb is the present general manager, were idle during the season. It is understood that sufficient capital is now available for the continuation of development-work of this well-known property, upon which in 1917 and 1918 upwards of \$25,000 was expended.

The *Berniere* group, owned by Cory Menhenick, was bonded last summer to J. A. Darragh, representing Indiana capitalists. Nearly the entire purchase price, as covered by the bond, has been paid by this company. It is the intention of the new company as soon as snow disappears to commence development operations on a large scale, and it is intimated that a stamp-mill will probably be erected during this summer.

It is likely that the *Eva* and *Oyster-Criterion* groups will be in operation this year after standing idle for many years.

The outlook for this year in regard to this camp is most encouraging, and, generally speaking, a very optimistic spirit is prevalent among the mining men of these Divisions.

OFFICE STATISTICS—LARDEAU MINING DIVISION.

(Mrs. F. I. Fraser, Mining Recorder.)

Free miners' certificates .....	32
Free miners' certificates (company) .....	1
Locations recorded .....	15
Certificates of work recorded .....	70
Bills of sale recorded .....	8
Transfers recorded .....	1
Payments in lieu of work .....	2
Groupings recorded .....	20

32 - 6 - 5

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 175.  
 20.  
 2.50  
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 697.50

## SLOCAN DISTRICT.

## AINSWORTH MINING DIVISION.

REPORT BY R. J. STENSON, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on mining developments in the Ainsworth Mining Division for the year ending December 31st, 1919.

I regret to say the tonnage shipped during the year was less than half of that for the previous year, due, partially, to the shortage of water-supply for power purposes.

There was considerable activity on the South fork of Kaslo creek. The bond on the *Index* was taken up and James Carter, of Kaslo, sold the *Flint* and *Bulis* claims to E. J. Edwards and associates on October 16th for \$22,000 cash.

The *Flint* worked continuously during the year and 20 tons of high-grade ore was taken out before the property was sold.

The *Marten*, owned by Power & Carter, was developed by 32 feet of upraise and 50 feet of drifts on the lead; ore averaging 10 inches was uncovered, assaying 84 oz. silver and 62 per cent. lead.

The *Manganese*, situated on Kaslo creek, shipped two cars of manganese ore to Trail.

The *Kirby* group of four claims, situated about half a mile north-east of the **Kirby Group.** *Bluebell* and a quarter of a mile from Kootenay lake, was located by A. J.

Curle, of Kaslo, in the spring of 1919. Four inches of clean galena and 18 inches of zinc ore outcropped on the surface; the ledge consists of schist and lime. Development-work was commenced in October, crosscutting the ledge 50 feet, with more or less mineralization of iron sulphide, zinc, and galena for the entire distance.

Tunnel No. 1 was drifted on the vein for a distance of 40 feet, the pay-streak widening from 3 to 15 inches, consisting of clean galena and zinc; beautiful ruby-silver occurs in the clean galena and assays have been obtained running from 63 to 1,978 oz. silver and 64 to 80 per cent. lead.

Tunnel No. 2 was driven about 8 feet, crosscutting the vein from the hanging-wall; the first shot uncovered 3 inches of clean galena which widened out to 6 inches zinc and spathic iron; the galena assaying 250 oz. silver and 64 per cent. lead, the zinc ore carrying from 15 to 29 per cent. zinc and 15 oz. silver.

This is an interesting discovery, as showing the possibilities to be obtained from prospecting old camps.

Situated on South fork of Kaslo creek. This property is under bond to **Silver Bear.** F. Helme, Kaslo, on which two payments have been made. The ledge is 55 feet wide, composed of lime, talc, and calcite, with an average of 18 inches of carbonate ore assaying 168 oz. silver and 9 inches of lead ore running 187 oz. silver and 70 per cent. lead. The development-work was one crosscut 70 feet long with a drift on the vein of 65 feet, and one 165 feet long with drift on the vein of 55 feet, and 40 feet of open-cut. A bunk-house, 18 x 23 feet, was erected and 23 tons of ore shipped.

Work on the *Helen* group and *Boulder*, situated in Stanley basin and owned by English Bros., of Kaslo, consisted of 100 feet of raise, 80 feet of drifting, and 40 feet of open-cuts, making a total of 1,200 feet of tunnel and 300 feet of upraise.

Work on the *Boulder* consisted of 30 feet of open-cuts and 10 feet of shaft, in which they have from 2 to 14 inches of lead ore.

The *Spokane*, in Ainsworth camp, under the management of J. McDougal, employed six men throughout the year; 400 feet of drifts and raises were accomplished and over 400 tons of ore shipped.

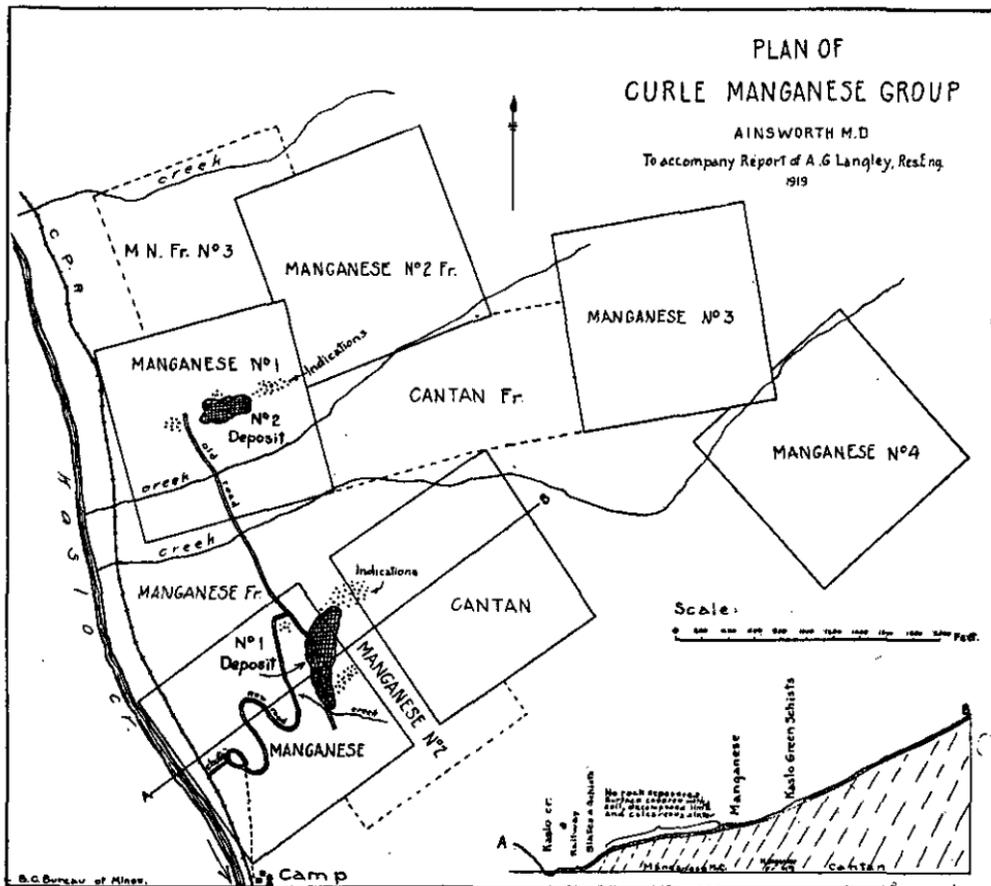
The *Ruth*, under lease to E. D. Smith and associates, worked for four months, shipping 500 tons of mill tailings.

The *Maestro*, under lease to T. Hawes and G. McPherson, worked for six months and shipped 60 tons of ore. The work consisted of 150 feet of drifts.

# PLAN OF CURLE MANGANESE GROUP

AINSWORTH M.D.

To accompany Report of A. G. Langley, Res. Eng.  
1919



The *Eden-Crescent*, worked by three men, improved the ore-showing considerably; about 100 feet of development-work was done.

On the *Grant* two men were employed for part of the year crosscutting and raising some 50 feet; some fine ore was encountered and 1 ton for sampling purposes.

The *Tariff*, under lease to F. Kennedy and A. Bridge, worked for nine months and shipped 48 tons of ore, drifting and crosscutting 90 feet during operation.

The *Skyline* was operated under lease by O. Nelson and two men; work on drifts and raises to the extent of 130 feet was done and 130 tons of ore shipped.

The *Little Phil* was worked the greater part of the year by E. Peterson and W. Trainor under lease, sinking shaft 30 feet, 80 feet of drift, and 20 feet of crosscut, and shipped 20 tons of ore.

Work on the *United* consisted of 70 feet of drifting, which was carried on by two men for about six months; 29 tons of ore was shipped.

*Gallagher*.—Six tons of ore was shipped by H. McVicar.

**Bluebell.** Situated at *Riondel*. The work of the year was directed to further development of the upper levels; unwatering the lower levels, which had been submerged since March, 1918; reconstruction of the rock-house; and alterations of headworks to permit improvement of the quality of oxidized ore, of which important but indefinite tonnage remains. Although the mine had been unwatered at the end of the year, excepting the lowest level, and resumption of operation at depth was expected during January, this has been prevented by the extreme shortage of water-power. Conditions affecting water-supply seem to preclude resumption before early spring of 1920.

During the year there was shipped from the mine 1,192 tons of oxidized ore and 35 tons of concentrate. The average number of persons employed during the year was nineteen.

*Silver Bell*.—Situated on the South fork of Kaslo creek and owned by Green Bros., of Kaslo. Development-work consisted of 210 feet of drifting, 360 feet of crosscutting, and 157 feet of raise. A new camp was built to accommodate twenty men. Ore shipped for the year, 93 tons.

The *Utica* was worked for about three months, employing an average of twelve men, and shipped 155 tons of ore, which produced 17,360 oz. silver and 26 tons of lead. The work consisted of raises and drift.

On the *No. 1* mine, operated by the Consolidated Mining and Smelting Company, development consisted of 398 feet of drifting and crosscutting, together with 1,274 feet of diamond-drilling; 169 tons of ore shipped; nine men were employed.

The *Highland*, operated by the above company, employed an average of thirty-three men and shipped 127 tons of crude ore and 308 tons of concentrates. Development consisted of 998 feet of drifting, crosscutting, and raising, together with 3,276 feet of diamond-drilling.

The *Cork-Province* mines, under the management of W. E. Zwicky, operated from May to September 30th, one shift, when water for power purposes gave out. Produced 200 tons of silver-lead concentrates and some zinc concentrates, one car of which was shipped. Management is making arrangements to install a generator, which should provide sufficient power to run mine and mill by electric power the year round.

*Washington*.—Located above the *Rambler* mine at Rambler. Under the management of W. H. Burgess. A lease of the *Carbonate King* was given to Monaghan & McKiernan, who worked the ground until snowfall. An examination was made of the *Washington* by R. H. Stewart, M.E., for the owners.

*Deep*.—Located at Retallack. Under the management of W. H. Burgess. A fire destroyed the cook-house, dining and dry rooms during the early spring. Some men were employed cleaning up for the mine, and an examination was made by R. H. Stewart, M.E., for the owners. It is understood that some more development-work may be undertaken next year.

*Whitewater*.—Located at Retallack. Under the management of W. H. Burgess. Worked in the main by leasers, of which there were thirty on the job at the end of the year. Some very good results were obtained; 619 tons of silver-lead ore and 202 tons of silver-zinc ore was shipped, partly to Trail and partly to Midvale, Utah. The company has lately undertaken some development-work and the results to date are said to be encouraging.

The *Ten Day Man*, owned by R. Hughes and J. Chisholm, worked part of the year and shipped 16 tons of ore, valued at \$4,000.

The *Beaver* was worked for about three months by the owners, J. McDonald, J. M. Allen, and A. Jardine, extending the tunnel 35 feet, with encouraging improvement of the ore-showing.

OFFICE STATISTICS—AINSWORTH MINING DIVISION.

Free miners' certificates .....	186
Mineral claims recorded .....	31
Assessments .....	185
Transfers .....	42
Mineral claim leases .....	11
Certificates of improvements .....	2

SLOCAN MINING DIVISION.

REPORT BY ANGUS McINNES, MINING RECORDER.

I have the honour to submit herewith the annual report on the mining operations in the Slocan Mining Division for the year ending December 31st, 1919.

The year just closed has been a very prosperous one for the mine-owners of this district. Sandon for the present is the busy camp of the district, there being eleven properties operating in that vicinity—namely, *Ivanhoe*, *Reco*, *Silversmith*, *Hope and Ruth*, *Noble Five*, *Wonderful*, *Surprise*, *Richmond-Eureka*, *Sovereign*, *Minnehaha*, and *Mercury* groups.

The *Silversmith*, formerly the *Slocan Star*, has more ore in sight and blocked out than at any time in its history.

The *Noble Five* management has a fine new concentrator about ready to start operations. It is the second largest plant in the Province of that kind, the Cunningham mill at Alamo being the first.

The *Ivanhoe* and *Surprise* groups are owned and operated by the Rosebery-Surprise Mining Company, with headquarters at Chicago. There are two concentrating plants, one at Sandon and one at Rosebery. P. J. McFadden is manager.

The *Wonderful* and *Sovereign* are operated by Clarence Cunningham. The ore from these properties is taken by railroad to Alamo, where it is concentrated and shipped from there.

The *Minnehaha* is owned and operated by Alexander Mann, railroad contractor, of Vancouver. George Clark is in charge.

The *Mercury* has recently been bonded to Seattle people, who have a small gang doing development-work.

At the Alamo camp the following properties are working: *Idaho-Alamo*, *Queen Bess*, *Rambler*, *Soho*, *McAllister*, and *Granville* groups. The *Idaho-Alamo* and *Queen Bess* groups are owned and operated by Clarence Cunningham. The ores from all his properties are treated at his plant at Alamo.

At the New Denver camp the following properties are working: *Bosun*, *Mollie Hughes*, *Mowitch*, *Marion*, and *Capella* groups.

The *Bosun* group is owned and operated by the Rosebery-Surprise Mining Company. The ore from this property is taken by water to Rosebery, where it is treated at the company's mill. Fred. J. Murphy is the mining engineer in charge, assisted by Stanley Moore at the mine. The other properties in this camp mostly worked under lease to miners who are making them pay well.

At the Silverton camp the following properties are working: *Standard* and *Van-Roi* groups. The *Standard* has worked constantly for fourteen years and paid several million dollars in dividends. The *Van-Roi* is working a small crew at present doing development-work.

In the early part of the year labour was hard to get and work on most of the mines was somewhat curtailed.

Mr. Langley, the Government Mining Engineer, has been a great help to many prospectors as well as to mine-owners during the year.

OFFICE STATISTICS—SLOCAN MINING DIVISION.

Free miners' certificates issued .....	214
Mineral claims recorded .....	41
Assessments recorded .....	154
Transfers and other documents .....	10
Revenue collected .....	\$5,374 09

## SLOCAN CITY MINING DIVISION.

REPORT BY T. McNEISH, MINING RECORDER.

I have the honour to submit my report for the Slocan City Mining Division for the year ending December 31st, 1919.

In so far as mining development on any large scale is concerned, the situation is practically unchanged from last year. There has been considerable work done on some of the properties, which has given very encouraging results, and I beg to submit herewith a memorandum of such work done.

The *Black Prince*, which is under lease to J. T. Tipping, shipped 32 tons of very high-grade ore which was taken out in development-work.

The *Meteor* group, owned by J. C. Buchanan, has done considerable development and is at present driving a long crosscut tunnel to tap the lead at depth. During the year 92 tons of high-grade silver ore was shipped.

The *Eastmont*, which was under lease to H. D. Lea and associates, shipped 102 tons of ore. It is believed that with extensive development this property could be made a heavy shipper.

The *Anna* group is under lease and bond to Earl Hyde and is doing extensive development-work; a good streak of very rich ore has been struck.

The *Arlington*, which was under lease to M. S. Davys, shipped 509 tons of dump.

The *Republic*, which is under lease to J. W. Evans and J. N. Nelson, is doing extensive development-work and has shipped 23 tons taken out in such work, and another car is ready for shipment.

The *Ottawa* group, which is under lease to A. L. McPhee, shipped 377 tons of ore, and according to reports the property is looking better than ever before.

The *Little Tim*, owned by D. B. O'Neal and A. S. McAuley, has been doing development-work, and 5 tons of ore is ready for shipment.

The *Evening Star*, owned by Hugh Sutherland, of Winnipeg, Man., has had a crew erecting buildings, ore-sheds, etc., to replace those burnt last year, and is now driving a long crosscut to cut the vein at depth. Big things are looked for from this mine if the ore-body continues at depth.

The *Neepawa* group on Enterprise creek has done considerable development-work and is going to build a plant in the spring to treat the low-grade ore, and it looks as if in the near future this property will be a big shipper.

## OFFICE STATISTICS—SLOCAN CITY MINING DIVISION.

Free miners' certificates issued .....	67
Certificates of work issued .....	75
Locations recorded .....	55
Transfers recorded .....	8
Notices to group .....	15
Poll-tax receipts issued .....	28
Firearms licences issued .....	38
Marriage licences issued .....	2
Total revenue collected .....	\$1,041 00

## TROUT LAKE MINING DIVISION.

REPORT BY OSCAR JACOBSON, MINING RECORDER.

I have the honour to submit herewith my report of the progress of the mining industry in the Trout Lake Division for the year 1919.

During the season of 1919 the mining industry did not do as well as was expected at the beginning, as no property was turned over to any company for development; but still the yearly assessment-work on all of the promising claims was kept up, showing that the owners still have faith in their properties. The new locations of claims during the year were well up to the number of last year's.

OFFICE STATISTICS—TROUT LAKE MINING DIVISION.

Free miners' certificates issued (ordinary) .....	52
Free miners' certificates issued (company) .....	1
Locations recorded .....	26
Certificates of work .....	127
Payment in lieu of work .....	1
Notices to group (filed) .....	28
Transfers recorded .....	4
Agreements recorded .....	2
Leases and options .....	1
Traders licences issued .....	13
Game licences issued .....	29
Poll-tax collected .....	6

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 28  
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 6

## NELSON DISTRICT.

## NELSON MINING DIVISION.

REPORT BY J. CARTMEL, GOLD COMMISSIONER.

I have the honour to submit the annual report on the Nelson Mining Division for the year ending December 31st, 1919.

Judging from the increased amount of development-work and general interest in the mining industry throughout this district during the past year and the promising showings on a number of the newer properties, the outlook for the immediate future is certainly more encouraging than for quite a few years past, and justifies the optimistic feeling displayed in mining circles.

## NELSON CAMP.

*Silver King*.—Two men were stationed at this property till the end of October, engaged entirely in unwatering the mine. No ore was mined or shipped and the only development done was diamond-drilling totalling 305 feet.

This property has been developed during the past two years and a half by  
**California.** J. R. Cassin and associates, of Spokane, Wash., who have it under bond.

The *Athabasca* mill has been acquired and reconstructed ready to treat the ore from the *California* and also the *Eachequer* mine, which the same parties have acquired. Several tunnels have been run and ore blocked out at considerable depth. From six to ten men have been employed in development, and it is understood that a force of from forty to fifty will soon be at work. A test shipment of 93 tons of ore was sent to the Trail smelter. A wagon-road about a mile in length has been constructed from the *California* to the mill, over which the ore, which carries a good percentage of free gold, will be hauled by an auto-truck.

This group, comprising seven claims, is under lease and bond to the Vincent  
**Eureka Group.** Development Company, of Walla Walla, Wash., who has also acquired the well-known *Granite-Poorman* property. Flotation equipment is being installed in the mill at the latter mine to treat the *Eureka* ore, which carries copper-silver-gold values. A considerable amount of development has been done on the *Eureka* during the past year, with encouraging results, and at the present time a crosscut is being driven to develop the known ore-bodies at 200 feet greater depth. It is expected that this property will be one of the large producers of the district with completion of the mill this coming fall. Two hundred and forty-eight tons of ore was shipped to the Trail smelter during the season.

*Perrier Group*.—Very little development has been done on this property during the past year, outside of surface-slucing, for which the necessary equipment is available.

The *Monarch* group, consisting of seven claims, situated near Hall Siding, has been steadily developed by Jas. Fisher and associates, and I am informed that a diamond-drill is being installed to explore the vein, which has a width of 50 feet and carries copper and silver.

Situated at the head of 9-Mile or Sictum creek, which flows into the West arm  
**Noonday Group.** of Kootenay lake on the north side, owned by Ratcliffe & Johnson, of Nelson, is under bond to a Spokane syndicate who are developing same and have erected a small Gibson mill on the property. It is stated that the ore from this property has given some splendid assays, one being over \$1,400 in gold.

This group of claims, situated on Eagle creek a few miles west of Nelson, has  
**Jack Pot Group.** been acquired by Baskin & Stedman, of Nelson, who have had a small force of men employed opening up and extending old workings. A large vein carrying copper-silver-gold of probable mill value has been developed. A rather promising find of copper ore has been made on McPhail's ranch on this creek, and Mr. McPhail intends doing some development on same during the coming season.

Joseph Baxter, owner of *Ophir* and *Black Rock* claims on Bird creek, in the same vicinity, has done considerable development, resulting, I am informed, in finding some high-grade gold ore on the *Ophir* and copper-gold on the *Black Rock*.

The *Beasley-Monarch* group, situated near Beasley Siding, is under bond to the Fall Creek Mining Company. Carl M. Mohr is manager. Considerable development, chiefly surface work, has been done and some promising copper ore found.

The *Wonderful* group, in the vicinity of Hall Siding, is being developed by the Terzian Bros., who are driving a crosscut tunnel to strike the vein, which carries silver-lead, at depth. They are very hopeful of their expectations being realized.

The *Morning Star* group, also near Hall Siding, is being worked by the same parties and a good-looking vein of copper-gold ore has been struck, giving very encouraging assays.

The *Gold Plate* and *Gold Note* on Eagle creek, owned by Jeff Steele and Alex. Long, respectively, and the *Gold Hill* on 49-creek, owned by Alex. McDonald, have all been under development, with promising results, I believe.

*Apex*.—Jeff Swanson and partners have worked on this claim, which is situated in the vicinity of Apex Station, throughout the season, and have struck a vein of gold ore said to carry values.

This well-known mine, operated by the Consolidated Mining and Smelting Company, has been worked throughout the season, an average of thirty men having been employed, over \$37,000 being spent in wages. Some 665 feet of drifting was done and 76 feet of raise driven; 2,442 tons of ore was mined, of which 561 was crude and 1,881 mill-feed; 816 tons of ore was milled, producing 100 tons of concentrates. \*No additions to the plant have been made.

#### YMB CAMP.

The Hobson Silver Lead Company has not made any shipments from this mine owing to the relatively low price of gold coupled with the high cost of production, but steady development has been carried on, resulting in the encountering of a new vein which it is expected will be found to join with the parent vein at depth. It is rumoured that one of the large Canadian mining corporations is negotiating for the purchase of the *Yankee Girl*, *Dundee*, and other properties in this vicinity.

The *Commodore*, owned by Grobe & Pollan, has been developed throughout the season.

*Porto Rico*.—A few tons of ore was shipped from this mine to the Trail smelter.

#### ERIE CAMP.

The plant at this mine unfortunately was wiped out by forest fires last summer, and consequently operations were suspended for the time being. However, A. D. Westby, the manager, reports that financial arrangements are being made with a view to again placing the mine on a producing basis.

This group, consisting of six claims, is situated on Granite creek, a tributary of the North fork of Salmon River, and is owned by August Armbruster and E. E. McArthur. The ore is complex, the chief values being in gold, and as the showing is promising the owners are sanguine that the property will make good when economic conditions become more nearly normal.

This group consists of four claims on Keystone mountain, Whisky creek, near Erie. Joseph Barnard and W. H. Rhomberg are the owners. Seventy-five feet of drift was run during the season and the tunnel is now in 165 feet, exposing a small high-grade silver-gold showing in a 6-foot vein, which is steadily improving with development.

#### SHEEP CREEK CAMP.

This well-known property, together with the *Kootenay Belle* and *Vancouver* groups, are under bond to A. W. McCune, of Salt Lake City, Utah, who has a force of men engaged in driving a crosscut tunnel from the *Queen* to tap the known bodies on the *Vancouver*, but the work was discontinued at a point about 800 feet short of the objective after some 1,700 feet of the tunnel had been run, apparently expected values not having been encountered on the way. The formation through which the tunnel was run is schistose, and as the values thereabouts are carried in the quartzite it was doubtless not considered justifiable to continue further with this work.

**Motherlode-Nugget.** These properties have been amalgamated under the ownership of the Nugget Gold Mines, Limited, and last March work was commenced on a tunnel from the lowest workings of the *Motherlode* with the object of intersecting the main *Nugget* vein at 625 feet below the No. 4 level of the latter mine. The new tunnel has been driven a distance of 1,165 feet, the time consumed on the work having been lengthened out somewhat owing to various vexatious delays caused by shortage of water in the fall, encountering very hard rock, etc.; but at the time of writing I am pleased to learn that the objective has been gained, the vein having been crosscut, showing a width of 12 feet and exposing an ore-body. No further particulars are available as yet, but as this is in all probability the same ore-body as exposed in the upper workings of the *Nugget*, it doubtless means a new lease of life for the property, with consequent benefit to the district and all concerned. An average of fifteen men has been employed on the work. Harold Lakes is the manager.

**Ore Hill and Summit.** These properties, which are situated on the south side of Wolf creek, a tributary of Sheep creek, have been steadily developed during the season by W. B. Poole and associates, as also the *Reno-Donnybrook* group. The development consists mainly of surface work, and as the showings are exceptionally good, these promise to be good properties.

**Emerald.** This well-known lead-silver property is situated on the divide between Sheep and Lost creeks and is owned by the Iron Mountain, Limited. John Waldbeser is manager. Steady development has been carried on during the past year, and a test-mill has been erected which it is expected will be in operation this spring when water is available. One hundred and seventy-seven tons of ore was shipped to the smelter at Trill, and 42 from the *Jersey* in the same vicinity.

*Southern Belle.*—This is also a lead-silver property of promise, on which some development-work was done. Some dispute as to title apparently has held up more active operation.

*Nevada Group.*—Situated on Nevada mountain between Lost and Sheep creeks. An interesting showing in gold was disclosed last fall which justifies the belief that the property may become of importance with development.

The *Dodge* group consists of four claims on Little Sheep creek. Only surface development has been done to date, exposing a small, persistent lead-silver vein for several hundred feet. Mazrall & Rhomberg are the owners.

The *Bonanza* group on Wolf creek (Geo. Bell, of Salmo, owner), carrying principally values in gold, has been under development, and about 20 tons of ore from the surface workings was put through the *Ore Hill* mill.

**Spokane Group.** Laib Bros. have developed this property, which is situated in the Bayonne section, to the extent of 300 feet by three tunnels and have some ore blocked out with a view to shipping. A car-load was hauled out and shipped to the Trail smelter this fall, but owing to difficulties of transportation to the railway this was found to be too costly, although the shipment gave good returns. An arrastra has been constructed to test the ore locally with a view to making high-grade concentrate for shipping.

**Iva Fern Group.** This group, situated on Cultus creek, is under development bond to the Consolidated Mining and Smelting Company, Limited, and consists of fifteen claims, seven of which have been Crown-granted. A comprehensive plan of development has been initiated, but owing to the scarcity of miners the contemplated long crosscut tunnel, started to cut all veins, was only driven 225 feet, and work was closed down during the winter, the intention being to install machinery as soon as weather conditions permit in the spring. Several hundred feet of surface-trenching was done, disclosing a series of parallel veins of economic width and value, and from all indications the property promises to be a large producer. The values are in lead-silver-copper-gold. J. W. Mulholland, the locator and owner, has been retained as manager.

This is an extension of the *Iva-Fern* and is owned by a Nelson syndicate. **Dull Pick Group.** Only surface development was done during the past year, but a vein was disclosed which appears to be a continuation to the south of the mineralized zone opened on the *Iva-Fern*, and is said to carry good values in copper and silver.

Several promising strikes are reported to have been made at the head of Cultus creek last summer, but no details of same are to hand; and from the Bayonne section generally good

reports have come in, but owing to the lack of roads and the poor condition of the few trails the development of this promising region is necessarily retarded.

#### OTHER PROPERTIES.

*La France Creek.*—The La France Creek Mining Company's properties have had very little development done other than the usual assessment. Work was closed down last April, but I understand negotiations were under way during the summer with a view to raising the necessary capital to place the mine on a producing basis. There are several levels aggregating 1,100 feet of tunnel, and the ore, which is silver-lead-zinc, has been tapped at 600 feet depth. Difficulties of transportation from the mine to Kootenay lake constitute a great handicap. I am told that \$60,000 has already been spent on the property.

*Lockhart Creek.*—Thos. Wall and Robert Yull's properties on this creek are stated to have shown up a promising vein of silver-lead ore with a small amount of development-work.

The *Sullivan* group, in the vicinity of Kitchener, has been under development, consisting chiefly of surface work, with fairly promising results, a vein carrying copper-silver-gold being exposed.

#### PLACER.

Placer-mining has been dormant during the past season, only four claims having been recorded, from the owners of which no reports have been received.

#### OFFICE STATISTICS—NELSON MINING DIVISION.

Free miners' certificates (individual) .....	468
Free miners' certificates (company) .....	7
Free miners' certificates (special) .....	4
Claims recorded (mineral) .....	220
Claims recorded (placer) .....	4
Certificates of work recorded .....	426
Agreements, transfers, etc. ....	110

#### ARROW LAKE MINING DIVISION.

WALTER SCOTT, MINING RECORDER (OFFICE AT NAKUSP).

I have the honour to submit the annual report of the Arrow Lake Mining Division for the year ending December 31st, 1919.

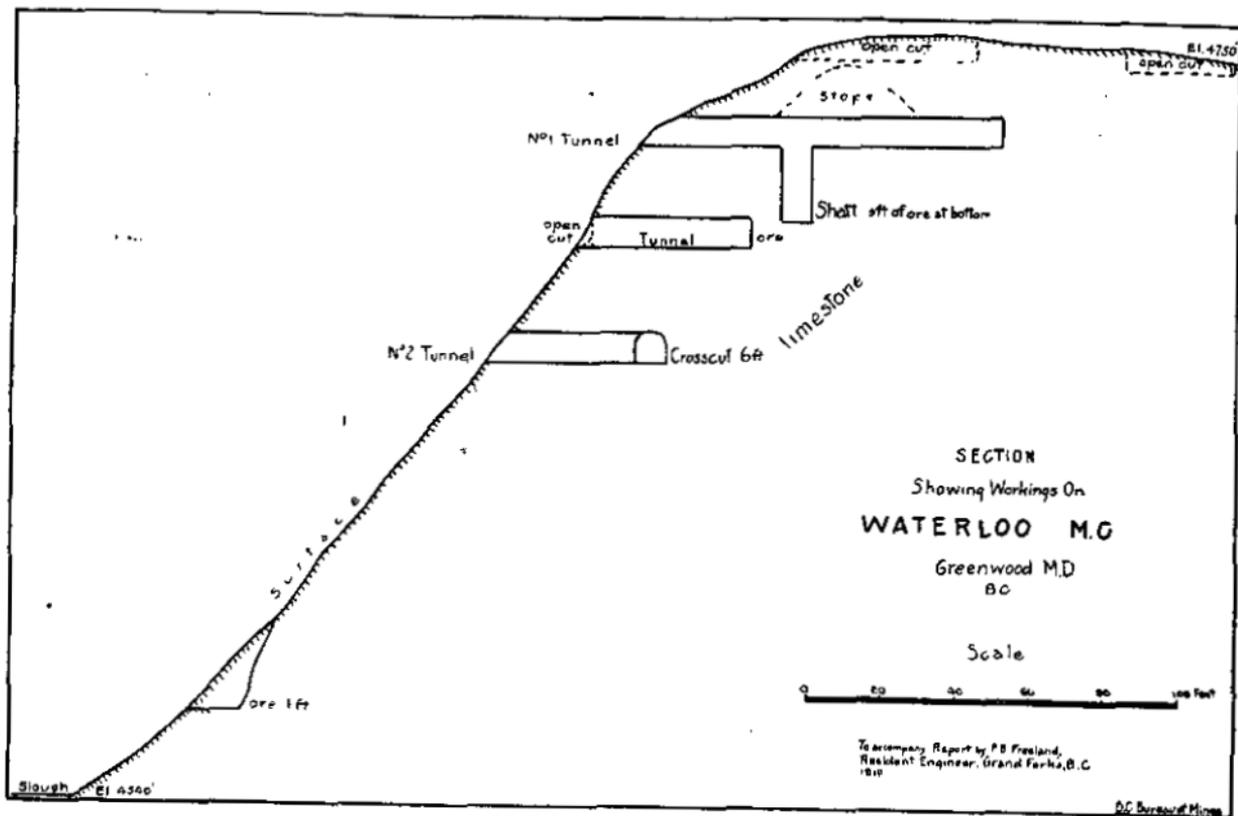
*Mulle Mack.*—This mine belongs to H. E. Forster, of Wilmer. A force of men has been working all summer and 25 tons of high-grade galena ore has been shipped to Trail smelter.

*Tillicum Group.*—This group is owned by J. G. Reveler and Lawrence Robson, of Burton, who have run a tunnel over 20 feet on the vein and have a good showing of galena and iron pyrites carrying gold. The vein-wall is in-place and looks good.

#### OFFICE STATISTICS—ARROW LAKE MINING DIVISION.

Free miners' certificates issued .....	55
Certificates of work recorded .....	14
Mineral claims recorded .....	21

275  
35  
52.50  
362.50





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 ROSSLAND DISTRICT.
 

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## TRAIL CREEK MINING DIVISION.

REPORT BY H. R. TOWNSEND, GOLD COMMISSIONER.

No development worth speaking of has been made in this Division during the year 1919. A few claims have been staked and a few reverted claims leased.

The mines of the Consolidated Mining and Smelting Company of Canada, Limited, and the *Le Roi No. 2* have been operated to a limited extent, but the number of men employed has been very small in comparison with former years.

## OFFICE STATISTICS—TRAIL CREEK MINING DIVISION.

Free miners' certificates (individual) .....	124
Free miners' certificates (company) .....	6
Mineral claims located .....	23
Certificates of work recorded .....	59
Bills of sale, agreements, etc. ....	7
Certificates of improvements .....	2
Leases of reverted mineral claims .....	1

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## SOUTHERN DISTRICT (No. 4).

REPORT BY PHILIP B. FREELAND, RESIDENT ENGINEER.

## INTRODUCTORY.

The above district includes four Mining Divisions—Grand Forks, Greenwood, Osoyoos, and Similkameen. The mineral production of this district is considerably below the average, chiefly owing to the closing-down of the Granby mines at Phoenix in June, 1919, on account of a shortage in coke for the smelter; a decrease in the bodies of possible payable ore added to the high cost of production.

In 1918 Granby produced 443,134 tons of ore, as against 143,086 tons in 1919, a difference of 300,048 tons.

The cessation of mining at Phoenix has reduced the output of copper to practically *nil*, and also materially cut down the production of gold and silver.

There have been no new discoveries of any particular importance in the district other than a few fissures of high-grade silver ore on Wallace mountain, Beaverdell. The scarcity of prospectors and capital, also the fact that large areas are Crown-granted on which no development has been carried on for many years, is the probable cause.

A great many of the Crown-granted areas are well mineralized, and though the ores are somewhat complex, the present facilities for power, transportation, and new methods of concentration and separation might make them attractive to capital, providing a large enough area for operation could be acquired at a reasonable figure.

A preliminary note is essential to the understanding of the "Taxation Act Amendment Act, 1916." As the law had stood, a Crown-granted mineral claim on which taxes were in arrears for a number of years was offered for sale by the Government at a regular *tax sale*, with arrears of taxes plus interest and charges and Crown-grant fee as an upset price. If no sale was made the property remained in the hands of the Assessor until desired by some one, when it could only be purchased by tender. It was not open to location under the "Mineral Act" and a prospector had no protection, and to relieve the situation this Act was passed.

Under the 1916 Act such reverted Crown-granted mineral claim may be obtained by any person under a lease for one year upon payment of \$25, and a renewal of such lease may be granted for a further period of one year, but no longer. During the period of such lease the lessee has the right to enter, prospect, and mine on such Crown-granted mineral claim, and during such time the lessee has the option to purchase such Crown-granted mineral claim upon payment of all taxes, costs, and interest which remained due and unpaid on such claim on the date of its forfeiture to the Crown, together with all taxes and interest from the date of the lease to the date of application to purchase the Crown grant.

A person may only obtain a lease, or any interest in a lease, of two such claims in the same Mining Division.

Such leases are not transferable and are subject to the rights any person may already hold to any portion of the surface of such Crown-granted mineral claim.

One of the largest developed copper-mines, the *Copper Mountain* group at Princeton, having approximately 12,000,000 tons of low-grade ore, has not as yet begun operations. When this property begins to produce, the copper-output of the district will once more assume normal proportions.

The South Kootenay Power Company is constructing a high-power electric line from Greenwood to Princeton to supply the *Copper Mountain* mines and mill. It experienced a considerable amount of trouble during the early part of the year on account of a strike amongst the linemen employed. All the camps were closed down for several months. At the present time construction is proceeding. The route followed by this line is described in the British Columbia Annual Report, 1918.

The *Rock Candy* mine (the fluorite-deposit) is being developed steadily and the ore treated at the company's mill near Lynch creek. A good many problems in regard to concentration of fluorite by decrepitation have been overcome by the Company's chemists and the results are

satisfactory. The market for fluorite has fallen off considerably since the war ceased, and the long haulage to the different steel centres in the East cuts down the margin of profit to a minimum.

## TOTAL TONNAGE AND CONTENT FROM DISTRICT.

Mining Division.	Ore.	Gold.	Silver.	Copper.	Lead.
	Tons.	Oz.	Oz.	Lb.	Lb.
Greenwood .....	144,075	8,077	180,136	2,783,629	41,407
Grand Forks.....	43,934	573	11,241	483,846	1,793
Osoyoos.....	64,097	24,224	31,303	6,180	.....
Totals .....	252,106	32,874	222,680	3,273,655	43,200

## GRAND FORKS MINING DIVISION.

On the receipt of some very good samples of highly altered limestones, carrying chalcopyrite and malachite, and reports from some prospectors who had visited Mount Faith, that there were possibilities of a fairly large body of low-grade copper, a visit was paid by the writer between September 2nd and September 9th.

Mount Faith lies approximately twenty miles in a northerly direction from the head of Christina lake and is reached by boat and trail. The country-rock exposed on the trail and for a distance of half a mile on each side was a coarse-grained muscovite granite varying in colour from grey to pink. In places there are highly siliceous bands carrying minute pyritohedrons of pyrite, but containing no other values.

Near the summit of Mount Faith (elevation 7,775 feet barometric) a small area of limestones was observed, most of which was unaltered. On the north-eastern slope, approximately half a mile from the summit, there is a small area of altered limestone capped with pyrrhotite and containing chalcopyrite, pyrite, and carbonate of copper. A hole 8 feet deep had been sunk in this and there were no apparent increases in values. Most of the chalcopyrite lay in the fractures of the limestone and in small inclusions close to the fractures.

The whole mineralized zone was only about 50 feet square. It is possible that further development might uncover larger ore-bodies, which would be essential to successful operation, considering the distance from transportation.

*Lightning Peak and Extension (Equinox Group).*—This property, situated approximately one mile east of Lightning Peak, was worked by W. A. Calder, assisted by two men. Development-work consists of the following: Shafts, 97 feet; tunnels, 150 feet; crosscuts, 37 feet; open-cuts, 50 feet. Ten tons of silver-lead ore was shipped to Trill smelter.

Situated south of Lightning Peak and owned by T. Cortiana. Development-work consists of 75 feet of open-cut and tunnel. The lead, which varies from a stringer to 18 inches, strikes north and south and dips approximately 70 degrees to the east, and carries silver, gold, lead, and zinc. The country-rock, which is mainly remnants of the sedimentaries, is cut by tongues of granite and considerably crushed and faulted, making development-work difficult. The gangue is quartz.

*Fife Lime-quarries.*—Situated on Christina lake and owned by the Consolidated Mining and Smelting Company, Trail. The limestone is used as a flux in the Trail smelter and about 17,000 tons was shipped in 1919.

**Yankee Boy.** This property, situated on Hardy mountain near Grand Forks, is under lease to J. Bailey, of Eholt, J. R. Nichol, *et al.* A considerable amount of development-work was done and some ore taken out, but not shipped. The ore is galena, argentite, with a small amount of tetrahedrite in a quartz gangue.

**Union.** This mine has been worked during the latter part of the year by the owners, Louis Johnson, Pat McGinnis, and J. McDonald, of Grand Forks. Eighty-one tons of ore was shipped to Trill, having an approximate content of 0.28 oz. in gold and 31 oz. in silver to the ton. An analysis of the ore shipped is as follows: Gold, 0.28 oz.; silver, 31 oz.; copper, 0.05 per cent.; zinc, 0.15 per cent.; sulphur, 1.6 per cent.; silica, 74.8 per cent.; iron, 4.40 per cent.; lime, 5.90 per cent. Development-work now being

carried on consists of a crosscut driven north from No. 2 tunnel, which exposed 22 feet of ore averaging about \$20 in gold and silver, and a drift on the lead of about 20 feet.

**Emma.** Owned by the Consolidated Mining and Smelting Company, Trail. Strikes in the coal-mines were directly responsible for the closing-down of this mine during a part of the year. Resumption of work commenced in the autumn and 21,273 tons of low-grade copper ore was shipped to Trail, having a content of 524 oz. in gold, 730.2 oz. in silver, and 473,729 lb. of copper.

**Berlin.** Situated at Paulson and owned by the Inland Mining Company, Walla Walla, Wash. This mine has been closed down for a greater part of the year. About 6.5 tons of gold and silver ore was shipped to Trail, having a total content of 26 oz. in gold, 83 oz. in silver, and 117 lb. of copper. The ore consists of galena, chalcopryrite, and pyrite in a gangue of quartz. The ore occurs in fissures in an alkali syenite. Several hundred feet of development-work done.

**Molly Gibson.** This mine was developed spasmodically by contract throughout the year, some difficulty being experienced in getting men who would work by hand on the hard rock that was encountered in the crosscut tunnel. This tunnel, driven 265 feet, mostly through jasperoid, and approximately 60 feet below the old inclined shaft, struck some small stringers of ore, but not in commercial amounts. Work during the latter part of the year was confined to cleaning out the old inclined shaft and a short drift driven on the ore to ascertain, if possible, its strike and dip, which will facilitate further development in the crosscut. Assays from some samples taken from the bottom of the shaft gave \$80 a ton in gold and silver.

*Bertha Consolidated Gold Mining Co. and Pathfinder Mining Co.*—The *Little Bertha* and *Pathfinder* mines are situated approximately sixteen miles north of Grand Forks on the east side of the North fork of the Kettle river. Both these mines were worked some years ago, chiefly by local capital, and a small quantity of ore shipped to the smelter.

The *Little Bertha* ore values are in gold and silver, associated with pyrite in a quartz gangue. The deposit is of the fissure type, varying in width from a fraction of an inch to 4 feet.

The *Pathfinder* ores are chiefly copper associated with pyrrhotite in a highly siliceous gangue. The deposit is a replacement in the sedimentaries, and badly disturbed by the intrusion of alkali-syenite dykes. The ore-bodies, as far as development has proved, are in small segregations and are uncommercial unless concentrated.

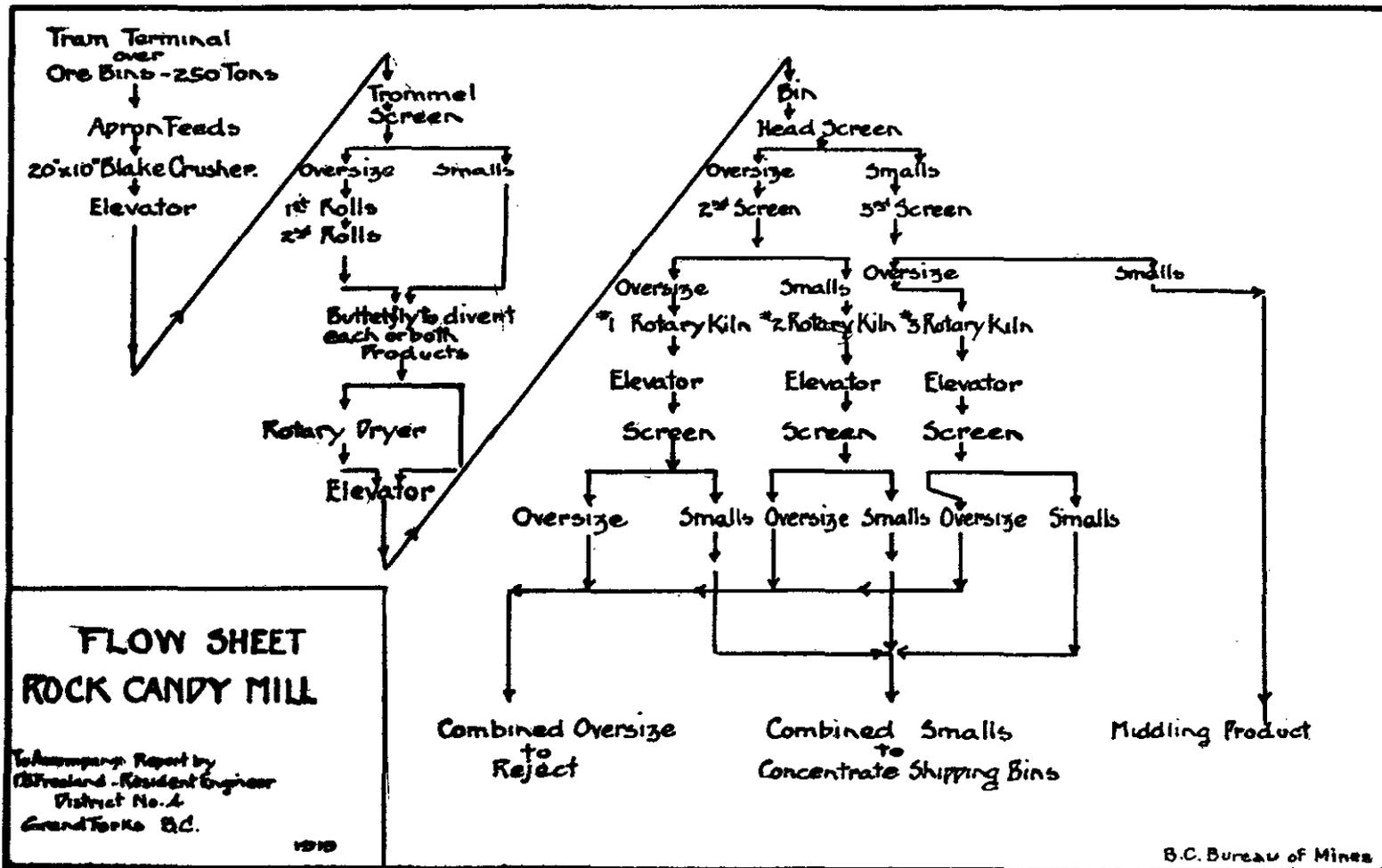
The former owners of both companies have entered into an agreement with Mr. Hayes *et al.*, of Spokane, Wash., with the result that a contract has been let to A. Savage, of Grand Forks, to drive a tunnel under the old workings of the *Little Bertha*.

*Granby Smelter, Grand Forks.*—Operations at this plant ceased in June owing to the shortage of coke caused by strikes in the coal-mines.

**Rock Candy Group.** Situated on Kennedy creek, a tributary of the North fork of the Kettle river. This group consists of the *Rock Candy*, *Tadanac*, *Rabbit*, *Portal No. 1*, *Portal No. 2*, *Fluorspar Fraction*, and *Decimal Fraction*, and contains 267.8 acres. The Consolidated Mining and Smelting Company, of Trail, which owns the property, has done a considerable amount of development-work, as shown on the accompanying map. During the early part of the year an aerial tram-line, two miles long from the mine to the mill, was completed; also bunkers, log bunk-houses, kitchen, and offices constructed at the mine.

The first development-work consisted of diamond-drilling, which was not entirely successful owing to the difficulty of saving the disintegrated ledge-matter in the core-barrels. A crosscut was then started 35 feet above Kennedy creek and driven 100 feet before the ledge material was struck. This crosscut was continued through the deposit for a considerable distance. The deposit, approximately 140 feet wide, on this level was considerably crushed and contained stringers of chert, kaolin, barite, and quartz, with only two commercial bodies of fluorite, varying from 3 to 7 feet. In this lead-matter occurred inclusions of chalcopryrite, limonite, galena, chalcocite, pyrite, and covellite, with large tabular crystals of barite in the cavities. The limonite, chalcocite, and covellite are secondary minerals.

The deposit formed near the surface, under low temperature conditions, may not be expected to persist in depth. The rocks lying to the east of the deposit are phases of alkali syenite (see Brock's report), whilst those to the west, with coarse phenocrysts of feldspar, evidently belong to the group referred to as alkali syenite porphyry, and are of late Tertiary age.

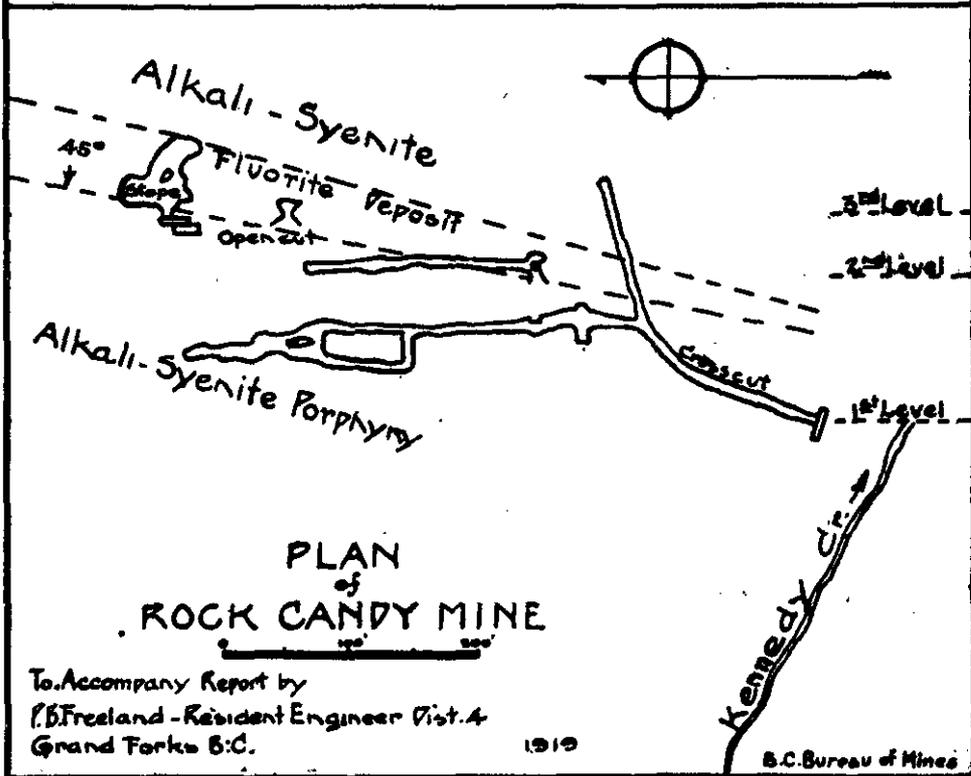
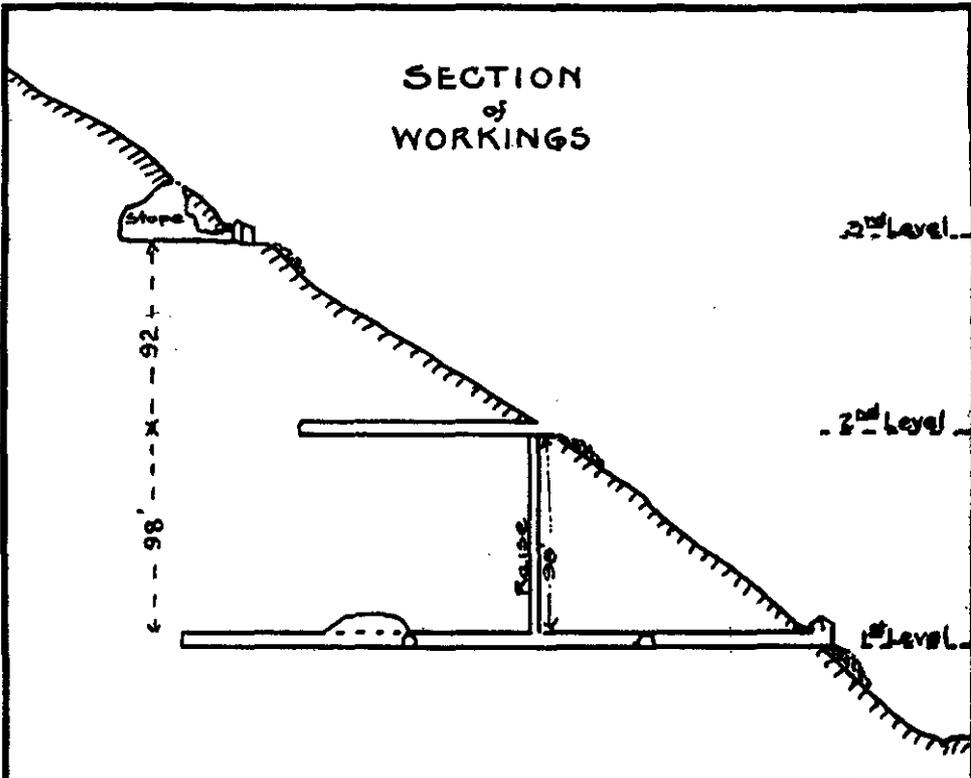


**FLOW SHEET  
ROCK CANDY MILL**

Interim Report by  
 W. F. Ireland - Resident Engineer  
 District No. 4  
 Grand Forks B.C.

1910

# SECTION of WORKINGS



To Accompany Report by  
 P. B. Freeland - Resident Engineer Dist. 4  
 Grand Forks B.C.

1919

B.C. Bureau of Mines

A drift was started from No. 1 crosscut and continued for a considerable distance, following the commercial fluorite-deposit in the foot-wall; then another crosscut was driven east from the tunnel and a deposit on the hanging-wall encountered and drifted in, as shown on the map. An upraise has been put in between No. 1 and No. 2 to facilitate the handling of the ore from above; No. 2 will be driven under No. 3 and the ore from the stope taken out through No. 2 and No. 1. The deposit at No. 3 level is about 50 feet wide and contains a good grade of fluorite. The colour of the fluorite varies from a deep purple to a green and white. This colour does not seem to influence the percentage of  $\text{CaF}_2$  in the rock.

The occurrences of iron and copper sulphides, which fortunately are only in small segregations, are very detrimental to the commercial value of the fluorite, and a good deal of otherwise high-grade ore has to be discarded on this account. No profitable means, at present, have been found to eliminate the sulphides. That there is a certain amount of redeposition going on is apparent in the lower tunnel, where a fresh break on the rock is in a few days covered by a thin film of fluorescent hue. Tons mined, 5,442; men employed, 26.

*Rock Candy Mill.*—The building of this 100-ton capacity mill by the Consolidated Mining and Smelting Company, of Trail, was more or less of an experiment in the first place, which has been added to and changed according to necessity. The results obtained to date are satisfactory from a concentration standpoint and reflect credit upon those who have worked upon its solution.

The fluorite is brought approximately two miles from the mine to the mill over an aerial tram, and then dumped in bins of 250 tons capacity. From thence it is distributed by apron feeds through a 20- x 10-inch Blake crusher and elevated to a trommel screen of  $\frac{1}{4}$ -inch mesh, the oversize passing through two sets of rolls set to  $\frac{3}{8}$  inch and  $\frac{1}{4}$  inch respectively. All products then pass through a rotary dryer 14 feet long and 3 feet 2 inches in diameter, which is heated by the waste gases from the kilns. This product is again elevated and passed over three sets of impact screens, the feed for No. 1 kiln being plus  $\frac{1}{4}$  inch, No. 2 kiln being minus  $\frac{1}{4}$  inch or plus No. 8, and No. 3 kiln being minus No. 8 or plus No. 15.

The minus No. 15 makes up the middling product. The smalls from No. 2 screen give the best results for decrepitation, making a product containing about 2 per cent. silica. The rotary kilns are 14 feet long and 3 feet 2 inches wide and make 3 revolutions a minute. About 1,200° Fahr. is the necessary temperature for decrepitation. The middling product contains about 5 per cent. silica and is used locally for making acid, and also for adjusting the concentrates to meet specifications. After decrepitation takes place the product is slowly elevated to permit cooling before being finally screened and stored ready for shipment.

As far as the writer is aware, this is the only mill of its kind on the American Continent and the success achieved may be instrumental in solving other problems of a similar nature elsewhere. Sixteen men were employed and 3,372 tons milled, which produced 898 tons of concentrates, with an approximate content of 84 per cent.  $\text{CaF}_2$ , and 6 per cent.  $\text{SiO}_2$ .

**Maple Leaf.** Owned and worked by the Maple Leaf Mines Company and situated approximately forty-four miles north of Grand Forks. H. W. Young, of Grand Forks, is manager of the property and is responsible for all the new development and construction carried on for the past few years. Development for 1919 is as follows: Lower tunnel, 160 feet; crosscut, 100 feet. A 3-drill compressor and gasolene-engine were installed and housed, also an assay office.

The lower tunnel has been driven about due west into the hill. At the mouth of this tunnel a coarse brownish-red tuff, highly altered to sericite and chlorite and containing small amounts of limonite and hæmatite, was cut. In the fractures of this rock a considerable amount of native copper was apparent. About 10 feet in from the mouth of the tunnel the native copper was replaced by minute particles of iron and copper sulphides, the latter disappearing almost entirely as the tunnel was driven farther into the hill. Near the face of the tunnel a finer-grained volcanic tuff was encountered and a microscopic examination showed small pyritohedrons of pyrite scattered through the rock. A few of the pyrite crystals contained minute quantities of chalcopyrite and gold, but not in sufficient quantities to make the rock commercial.

The manager of the mine was able to get in his own assay office between 18 and 20 per cent. of lead from some of the samples taken from the mine. Other samples brought down by the manager were found to contain no lead, and no lead minerals could be discovered under a high-power microscope. One of the buttons obtained by the manager was tested and found to be lead.

It is possible that the samples brought down and sent to the Department of Mines to be assayed differed from those tested by the manager, and it will be interesting to receive the pulps of the samples from which the manager obtained such a high percentage of lead. Until this is done it is impossible to state absolutely that there is no lead present.

The formation a short distance to the north and east of the workings is cut by a porphyry dyke, which has caused a considerable amount of fracturing. These fractures have been filled, largely with sericite, kaolin, and silica, and showed calcite and limonite replacing the pyrite-hedrons of iron. Under the microscope many of the pyrite-grains were shown to be hollowed out, leaving a thin shell filled with powdery limonite. Whether this mine has a future as a low-grade copper property remains to be proved, and future development along these lines is looked forward to with interest.

#### GREENWOOD MINING DIVISION.

*Granby Consolidated Mining and Smelting Co., Phoenix.*—The mines of this company at Phoenix were operated until June 18th, 1919, when operations ceased on account of the coal strike at Fernie, necessitating the closing-down of the company's smelter at Grand Forks. Since that time work has not been resumed, owing probably to the depletion of the larger ore-bodies in the mine and the extreme high costs of operation. Development-work consisted of 1,908 feet of raising and 55 feet of drifting.

Leased by Joe Cunningham, of Phoenix, and 29 tons of copper and gold ore shipped. The ore was sorted from the dump. This mine was first started in 1891 by James Attwood and James Schofield and was afterwards sold to the Dominion Copper Company, which did considerable development-work in open-cuts, 400 feet of inclined shaft, and a crosscut 75 feet long, besides other minor workings. For the past ten years nothing has been done in the mine and the workings are filled with water.

Two ore-bodies were stated to have been cut, being 18 and 30 feet respectively. The ore-body is situated along the western border of a lens of crystalline limestone which is brecciated and in part replaced by epidote and quartz. The ore strikes in a northerly direction and dips vertically. In the "glory-hole" the body was 110 feet long, 60 feet wide, and 40 feet deep. It is not certain that the lower ore-bodies belong to this surface body. The ore consists of chalcopryite, hæmatite, and pyrite in a gangue of calcite, quartz, and epidote.

This mine, situated one mile north of the town of Greenwood, has been operated under lease by Al. Morrison and W. McGillis, of Greenwood. The rock surrounding the mine is a green tuff near a contact with granodiorite. The vein, which is chiefly quartz, with small particles of calcite, averages about 1 foot in width and occurs in the tuff. An alkali-porphyry dyke cuts the formation in an easterly and westerly direction and has evidently disturbed the vein to a very considerable extent, causing a divergence of the strike of the vein of about 20 degrees. The strike is approximately north and south, dipping 60 degrees to the east.

There appears to be some replacement in the green tuff, occurring in silicified and pyritized veinlets. The ore is galena, zinc pyrite, chalcopryite, tetrahedrite, argentite, pyrargyrite, and native silver and gold. There has evidently been some secondary enrichment, caused by surface waters. On the 400-foot level there is still a considerable amount of ruby-silver in the lead.

The present owners have installed an electric compressor with a capacity of 600 cubic feet of air, and also pumps, with which they have unwatered the old shaft down to the 500-foot level. Development consists of 260 feet of drifting in a southerly direction on the 300-foot level and 216 feet in the 400-foot level, with 80 feet of raising between the 300- and 400-foot levels.

Shipments were made to the smelters amounting to 338 tons, with a total content of 267 oz. of gold, 38,903 oz. of silver, and 7,616 lb. of lead. Cost of treatment, about \$5.50 a ton; rail transportation, \$5.50 a ton.

Leased by J. St. Claire and approximately 120 tons of copper ore shipped to Trail. The mine was originally owned by the British Columbia Chartered Company, Limited, and afterwards by the British Columbia Copper Company, which in turn leased it to A. Luciani, of Phoenix. A detailed description of the geology and ore-bodies of this mine is to be found in the Summary Report of the Geological Survey, Ottawa, 1902, by R. W. Brock, who had an opportunity to visit the mine whilst in operation. All the

**B.C.**

lower workings are now filled with water. The ore taken out of this mine averaged 5.8 per cent. copper, 2.45 oz. in silver, and 0.015 in gold.

According to data, the diamond-drill holes, driven to a depth of 911 feet, cut several bodies of ore, but a large proportion of the core was alkali porphyry. It is unfortunate that the exact data derived from these drill-holes are not available, because up-to-date machinery and concentration methods might make the reopening of this mine profitable.

Owned by Chas. Johnson, of Greenwood, and leased to Leo. Sartoine, who  
**Don Pedro.** shipped 18 tons of ore to Trail, having a total content of 4 oz. of gold and 1,864 oz. of silver. The ore is galena, zinc pyrite, and tetrahedrite in a gangue of quartz and calcite.

This claim was developed by Walter A. Johnstone *et al.*, of Edgewood. The  
**Lumpy.** ore occurred in small stringers and segregations in an altered limestone, close to the contact of a granite-mass, and consisted of galena, pyrargyrite, and native silver. A considerable amount of development was done to try and trace the continuance of this lead at depth, but without satisfactory results. The claim is situated on the north slope of Lightning peak.

Owned by J. Glover, of Edgewood, and situated about three miles in a north-  
**Dictator and** easterly direction from the *Waterloo* mine on the headwaters of the East fork  
**Cloriator.** of the main Kettle river. The country-rock surrounding the claims is a medium coarse grey granite, occasionally cut by porphyry dykes. The ore consists of galena, sphalerite, and iron, carrying gold and silver, in a gangue of quartz and broken country-rock. The vein has a northerly and southerly strike, dipping 75 degrees to the west. The lead, which outcrops for about 300 feet, is developed by open-cuts and shafts varying from 10 to 30 feet in depth. Owing to the bad state of repair of the deepest shaft it was impossible to visit it, but the owner claims an 18-inch lead in the bottom. The flatness of the surrounding country prohibits any development by tunnels, and the cost of sinking the shafts farther is beyond the means of the present owner.

This mine was bonded to San Francisco interests in 1919 and H. H. Sawyer is  
**Carmi.** in charge. The present company has commenced the construction of a concentration plant to treat the ores. A definite plan of treatment has not been decided upon, but will probably consist of a suitable crushing plant followed by oil-flotation. Development-work consists of an extension of the lower tunnel about 100 feet. The lead in this tunnel strikes north-east and south-west and dips nearly vertical, being frequently offset by cross-faults. The ore consists of sphalerite, chalcopyrite, pyrite, and galena in a gangue of quartz, ankerite, and in places an intensely sericitized dyke material. It is to be hoped that the shaft will be unwatered and a good deal more development-work done before a plant to concentrate the ores is finally constructed.

Owned by G. A. Rendall *et al.*, of Greenwood. Three men were employed and  
**Waterloo.** a new sleigh-road cut out to join the main sleigh-road near Galloping mountain. Development-work consisted of driving a tunnel below No. 1, the dimensions of which are not to hand. Ore was struck in this tunnel and a shipment of 13 tons made. About 100 feet to the west of the workings the limestone is invaded by a granite-mass which has an easterly and westerly strike and dips about 45 degrees to the north. Tongues of granite cut the limestone in the vicinity of the lower workings, altering the lime to a dark-grey colour.

The vein-filling is chiefly calcite and in some of the lower workings the minerals, such as zinc, galena, and pyrargyrite, appear in isolated segregations a few inches apart and about  $\frac{1}{2}$  inch in diameter, each segregation containing either pure galena, zinc, or pyrargyrite, as the case may be.

#### WALLACE MOUNTAIN.

Most of the properties referred to below have been geologically discussed by Mr. Reinecke in the Geological Survey, Memoir 79, and since that time no theories have been worked out on the ground whereby any reliable system of the dipping and faulting of the veins can be followed. There seems to be no general relation between the direction of the fault-planes or the amount of the displacement.

Owned by Duncan McIntosh and Pat Crane, of Greenwood. Nine men were employed throughout the season and 294 tons of ore shipped to Trail, containing 6 oz. of gold, 52,612 oz. of silver, and 18,256 lb. of lead. Development consisted of the following: Drifting, 699 feet; raising, 65 feet; new roads, 2,600 feet. A new dining-hall was constructed, also a bunk-house and two dwelling-houses remodelled and repaired.

Several new veins were uncovered to the north and east of the old workings, carrying high values in silver. These leads varied in width from 1 to 18 inches and were displaced by faults in a short distance. In some cases a high-grade vein of lead ore will change, after faulting, to a low-grade zinc ore.

**Bell.** This property was leased to McKellar, J. Dale, and P. Crane, and later to Mr. Bailey, of Eholt. In 1904 this property was acquired by the Wallace Mountain Mining Company and development consisted of shafts and tunnels. About 200 tons of ore was shipped. In 1911 this company ceased operations. Since that time very little has been done until the above lease was taken, when the lower drift was extended 100 feet and two lots shipped, divided as follows: First lot, 13 tons, carrying 0.03 oz. of gold, 112.4 oz. of silver, and 4.10 lb. of lead; second lot, 17 tons, carrying 0.01 oz. of gold, 75.70 oz. of silver, and 3.10 lb. lead. The lead varied in size from a few inches to 14 inches and at the end of the new tunnel became too low grade for profitable shipping purposes.

**Duncan.** This claim is owned by the Alaska Mining Company and is now operated by Joe Kelly. A small shipment was made of 8 tons, assaying 81.10 oz. of silver to the ton, 3.10 per cent. of lead, and 11.20 per cent. of zinc. The lead is somewhat broken and varies from a few inches to 3 feet wide. The ore contains tetrahedrite, galena, sphalerite, and pyrite in a quartz-sericite gangue.

**Buster.** *Castor Frac.*—Leased by J. Perry *et al.*, of Greenwood, and 35 tons of silver ore shipped to Trail. About 200 feet of tunnels was driven.

The owner of this property, M. J. Cummings, has done several hundred feet of development-work, which has been dealt with in other reports. In 1918 the first indications of silver-lead were discovered near the mouth of a crosscut tunnel. This amounted to float in the shape of boulders and some carbonates in the gravel-wash. On the supposition that this ore came from a lead close at hand, the owners carried out extensive development-work, but at the date of the writer's visit no trace of ore in-place could be found.

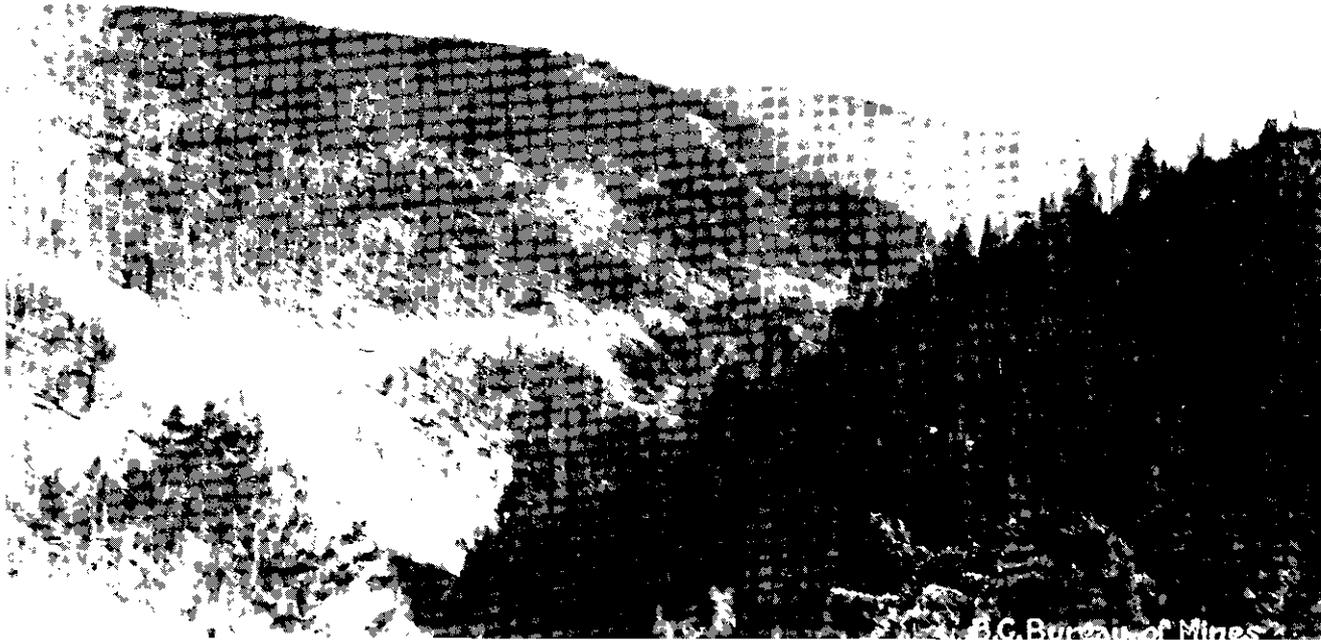
In the vicinity of the discovery about 10 feet of gravel-wash overlies the country-rock, which makes exploration a difficult matter. As there are no other indications of silver-lead ores in the immediate neighbourhood, it is possible that this float has been carried for some distance. One ton of this ore was shipped to Trail, assaying 0.14 oz. of gold, 68.4 oz. of silver, and 15.2 lb. of lead.

**Rob Roy.** This mine is included in the *Sally* group and nearly all the past year's development-work has been done upon it. The property is now owned by the Wallace Mountain Mines, Limited, with H. B. Morley, of Pentticton, as secretary. About twelve men were employed during part of the season and 145 tons of ore shipped to Trail, having a total content of 3 oz. of gold, 21,092 oz. of silver, and 7,735 lb. of lead.

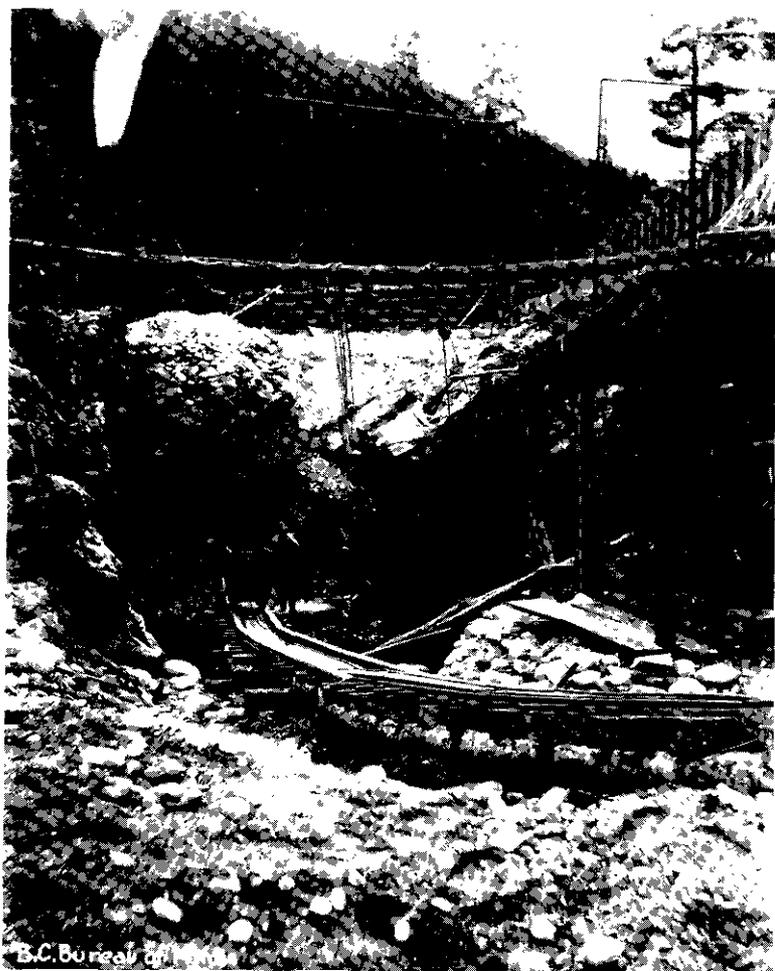
The ore occurs in shear-zones in an acid quartz diorite and dips generally about 55 degrees to the south. Its character consists of galena, pyrite, sphalerite, tetrahedrite, and pyrrargyrite, and is in a gangue of sericite, quartz, and altered diorite. A crosscut was driven in the upper tunnel and the ore-body cut and drifted on for over 100 feet. The width of the lead varied from 1 inch to 2 feet and carried a considerable amount of tetrahedrite. Both overhand and underhand stoping were resorted to and a considerable amount of ore shipped.

As the ore seemed to persist at the bottom of the underhand stopes, the management deemed it advisable to extend the lower tunnel 60 feet below to facilitate the handling of the ore. At the time of writing this report no ore had been struck in this tunnel. The ore in the upper tunnel follows a pink aplite dyke and is probably the same one referred to by Mr. Reinecke in his Memoir 79, and regarded by him as probably intruded at the time of the ore-deposition. This theory seems to have been borne out in this instance.

**Revenge.** The owner, J. M. Barrett, leased this property to Oscar Lachmund, J. Hoffstetter, and P. Crane. Several open-cuts on the lead and crosscut tunnels driven below to develop it at depth summed up the development of this property before the lease was taken. The lessees continued the lower drift on the lead for 80 feet



Canada Copper Corporation, showing Railway up Similkameen River to Concentrator.



B.C. Bureau of Mines

Placer Development Co. of America—Sluice, Tulameen River.



B.C. Bureau of Mines

Stevenson's Claim, Summit Camp, Similkameen M.D.

and stoped out 26 tons of ore, assaying 0.13 oz. in gold, 102.20 oz. in silver, and 5.80 lb. of lead to the ton.

The ore carried a high percentage of zinc and had to be sorted closely to avoid heavy penalty charges from the smelter. The country-rock is a quartz diorite and the ore occurs in shear-zones displaced by numerous faults.

*Standard Frac.*—This claim was under lease to E. Nordman and Sons, of Coltern. Two men were employed and 27 tons of ore taken out, containing 3,860 oz. of silver and a small amount of lead.

*Bounty Frac.*—A lease was given on this property to Carl Carlson, Harry Anderson, and Robt. Neill. The old shaft was cleaned out and some surface work done, and 40 feet of development done in the drifts without finding any new bodies of ore. Work continued for two months and a half and 8 tons of ore was shipped to Trail, carrying 945 oz. of silver and 451 lb. of lead.

*Trapper.* and about eighteen miles distant from Westbridge, on the Kettle Valley Railway. No work has been done on these claims for many years and the old shaft, sunk close to the present wagon-road, has been partly filled in. This shaft is said to be about 25 feet deep and has a short drift from the bottom of it on the lead. The lead, as far as could be seen, has a general strike of N. 45° W. and dips nearly perpendicular. The vein varies from 3 feet to a few inches and contains a high percentage of quartz and disintegrated country-rock. The minerals are pyrite, pyrrhotite, limonite, gold, and silver. A sample taken across the lead above the tunnel and containing a high percentage of limonite carried 3.22 oz. in gold and 2 oz. in silver. This return is probably a good deal higher than the average ore will run.

About 300 feet west of the above shaft two small open-cuts were put in on another lead, striking E. 2° W. and dipping 50 degrees to the north. The ore lies in stringers up to 2 inches in width and consists of pyrite and pyrrhotite, with a small quantity of gold and silver. Owing to the heavy covering of gravel-wash it was difficult to find any outcrops of the country-rock. In the vicinity of the leads the rocks appeared to be a cherty quartzite.

#### OSOYOOS MINING DIVISION.

*Spotted Lake.*—This lake contains a deposit of magnesium and sodium sulphates and is owned by the Stewart-Calvert Company, of Oroville, Wash. The termination of the war created a slump in the demand for magnesium sulphate, which accounted for the reduction of tonnage shipped from this lake during the year. About 120 tons was hauled by motor-trucks to the company's plant at Oroville, but it was not treated.

*Nickel Plate.*—The Hedley Gold Mining Company operates this mine near Hedley. About eighty-five men were employed by the company in the mine and on the surface. A total of 62,907 tons of ore was mined, which produced \$17,998,478 from cyanidation and \$6,136.47 from concentration.

*Horn Silver Mine.* This mine is owned and has been continuously operated throughout the year by the Condit Bros. and Powell Bros., of Similkameen and Victoria. Development for the year was confined to No. 2 and No. 3 levels. On No. 2 level 445 feet of crosscuts and tunnels were driven, and the vein, where encountered, showed an average width of 4½ feet of ore carrying about 40 oz. in silver. As development extended to the east the vein increased in width. This lead was continuously faulted to the south, the displacement varying from a few inches to a maximum of 7 feet.

At a point 300 feet from the portal of No. 2 level a crosscut was driven N. 11° E. for 200 feet, cutting what is known as the north vein at 175 feet. The lead here varies in width from 18 inches to 2 feet and it contains a considerable amount of native silver and argentite. No assays of this ore are to hand. No. 3 tunnel was driven 80 feet on the dip of the vein below No. 2. The ore in this tunnel is a good shipping grade and averages 3 feet in width.

The ores are pyrrargyrite, argentite, native silver, and gold in a gangue of quartz. Total shipments for the year amounted to 1,049 tons, with a total content of 84 oz. of gold and 30,911 oz. in silver. About seventeen men were employed during the year.

*Golconda.*—This mine is situated about one mile in a westerly direction from Olalla and is owned by McEachern Bros., of Keremeos. Twenty tons of copper and gold ore was shipped to Trail smelter.

## INDEPENDENCE MOUNTAIN.

This mountain forms part of the Okanagan range, situated north of the Similkameen river, between Keremeos creek and 20-Mile creek, and has an elevation of about 6,400 feet (barometric). This mountain and surrounding country can be reached by an old wagon-road which branches from the main Penticton-Keremeos road near its summit.

The greater part of Independence mountain is covered by Crown-granted mineral claims, some of which were visited by the writer; i.e., *Gem* group, owned by J. McNulty, Hedley; *Lake View*, owned by R. H. Northey, Olalla; *White Grouse*, owned by W. Darymple, Princeton; *Dominion* group, owned by Alex. Ford, Joyce P.O.; *Connell Fraction*, owned by J. McNulty & Matheson, Hedley; *Amusis*, owned by J. McNulty, Hedley; *Goldsmith*, owned by J. McNulty et al., Hedley; *Apeæ* group.

*Geology.*—The country-rocks in the vicinity of Independence mountain are limestones, quartzites, and argillites, all highly metamorphosed and broken. The general strike is north-east and south-west, dipping nearly perpendicular. According to Chas. Camsell, of the Geological Survey, these rocks are similar in structure and lithological character to the rocks (Palæozoic) of the Nickel Plate mountain, which lies across the valley to the west, and on which is the *Nickel Plate* mine.

The Palæozoic rocks are intruded in many places by diorite, diorite porphyry, andesite, and granite porphyry, and to the north by a granite batholith. The intrusion of these igneous rocks into the sedimentaries has produced contact metamorphism, altering the limestones into lime silicates, garnet, epidote, pyroxene, and hornblende. Most of the mineral-deposits are in the sedimentaries, especially the limestones, and appear to be genetically connected with the diorite and diorite porphyry. They are mainly of contact-metamorphic origin, having a copper-gold content.

The metallic minerals appear to be pyrrhotite, chalcopyrite, pyrite, magnetite, with a little arsenopyrite in a gangue of calcite, and epidote garnetite.

The ore-bodies have not been developed sufficiently to prove their character, but judging from surface exposures they are very irregular in shape, with no definite walls.

*Development.*—*Gem* group, tunnels 240 feet, open-cuts 50 feet; *Lake View*, shaft 15 feet, open-cuts 100 feet; *White Grouse*, shaft 10 feet, open-cuts 50 feet; *Dominion* group, shaft filled with water, open-cuts 25 feet, trench 50 feet; *Connell Fraction*, shaft 8 feet, open-cuts 220 feet; *Goldsmith*, open-cuts 25 feet; *Apeæ* group, shaft 150 feet, tunnel 200 feet.

Samples were taken from some of the old workings on the *Dominion* and *Lake View* claims, with the following result:—*Dominion*: Gold, trace; silver, trace; copper, 0.70 per cent. *Lake View*: Gold, trace; silver, trace; copper, 0.50 per cent.

These assays can hardly be called an average of the deposits, because the workings were in such a state as to prohibit the taking of a proper sample. Some high assays in gold have been obtained from picked specimens in different localities on Independence mountain, and these are probably due to the presence of arsenopyrite, which seems to carry increased gold values.

## SIMILKAMEEN MINING DIVISION.

## CANADA COPPER CORPORATION, ALLENBY.

Active operations have been delayed on this company's property on Copper mountain owing to a strike on the railroad-construction between Princeton and the mine. The following is a résumé of work done, kindly furnished by the management of the company:—

“Work during 1919 has been chiefly in construction of surface plant and installation of machinery and equipment preparatory to commencement of operations. We have been obliged to revise our plans for completion from time to time owing to non-completion of the branch line of railway from Princeton to Copper mountain and of the power-transmission line from Greenwood; delay which is proving very costly.

“At Allenby the work comprises the following: Concentration-plant building (commenced December, 1918) has been completed. All machinery for same received and installed, with exception of power-transmission shafting and belting. The shafting is on the ground and will be installed forthwith; the belting will not be installed until next spring. Permanent pumping plant at South Similkameen river completed ready for electric power. Additional water-lines for industrial, domestic, and fire-protection systems installed. Heating plant with battery of four 100-horse-power boilers completed. Assay office and laboratory building erected.

"On February 6th a skeleton track was completed to Allenby, on the Kettle Valley branch line from Princeton, which permitted the delivery of about forty car-loads of machinery and material. The ties were laid on top of frozen ground and traffic had to be suspended as soon as the spring thaw commenced. Following this and before the road was ballasted, a strike of railroad-construction employees was called on April 1st, and further deliveries did not take place until the end of August, at which time some thirty-odd car-loads of machinery and equipment were waiting delivery in the Princeton yards. Traffic has been maintained to Allenby since that time, but completion of the road to Copper mountain will be delayed until the early summer of 1920.

"*Copper Mountain Mine.*—Work at this property has been carried forward throughout the year to December 1st, when the camp was closed down for the winter, with the exception of a small crew on replacing temporary underground trackage with permanent track. Progress has been retarded by railroad and scarcity of labour, but sufficient time will be found in the spring to complete all necessary work for commencement of mining operations at a date when the railroad will be ready to transport ore to the mill at Allenby. Following is a brief résumé of work accomplished during the year:—

"*Underground.*—Timbering main shaft and stations; enlarging haulage levels and timbering where necessary; main ore-passage from surface, 4,073-foot level, completed; installing dumping-stations and loading-chutes; raising and drifting.

"*Surface.*—Temporary power plant; head-frame for shaft; temporary compressor plant dismantled and replaced with permanent plant; air-lines; hoist-house and hoist; concrete powder-magazine; addition to dining-hall; steel-sharpening shop; laundry building; extending telephone system; primary bins and crushing plant, with trestle and trackage connecting with portal of 3,170-foot level tunnel complete with foundations ready to receive crushers; conveyor-house from crushing plant to shipping ore-bins ready for installation of conveyor; main storage (or shipping) ore-bins of 'straddle' type completed; surface tramway from railroad-station site to 3,170-foot tunnel level for transportation of incoming supplies.

"*Railroad.*—Following are approximate percentages of completion of various classes of work: Grading, 85 per cent.; tunnels, 50 per cent.; bridges, 40 per cent.; track-laying, 40 per cent.; ballasting, 10 per cent.

"*Wagon-roads.*—A large quantity of material had to be hauled by motor-truck and teams to Allenby and Copper mountain, as a result of which the main Government road was subjected to heavy and continuous traffic throughout the year, and we wish to record our appreciation of the speedy measures taken in making much-needed repairs when the matter was brought to the attention of the Minister of Public Works and the District Road Engineer. We would mention that, in addition to moneys spent by the Government, we have spent during the year for new roads and maintenance of local roads the sum of \$5,350."

This group consists of six claims—*Ben Hur, Shamrock, Blue Ridge, Dixie, Belemnite, and Bornite*—and is owned by Cox & Uhler, of Princeton. These claims are situated approximately four miles east of Princeton, close to the main Hedley-Princeton wagon-road on the north side of the Similkameen river, and approximately 4,500 feet from the Great Northern Railway.

*Geology and Ore-bodies.*—The country-rock, lying to the east of the mountain on which the claims lie, is chiefly of a basic variety, overlain by remnants of the sedimentaries and intruded by pulaskite and quartz-porphry dykes. To the west of this mineralized area the igneous rock is a monzonite, which is probably part of the batholith so much in evidence to the south across the Similkameen river.

The quartz-porphry dyke on the *Bornite* claim is about 75 feet wide, has a general north-and-south strike, and outcrops over several claims. This dyke contains small specks of chalcopyrite and pyrite and is probably the source of some of the ore-deposition in its locality.

*Development.*—Nearly all the development-work has been done on the *Blue Ridge* claim, which lies on the southern slope of the mountain facing the Similkameen River valley. This amounts to over 200 feet of drifting and crosscutting. At the mouth of the lower tunnel a highly altered remnant of the sedimentaries was cut, containing epidote and garnetite, with inclusions of chalcopyrite and pyrite. From thence the tunnel followed a fissure in a dark-grey fine-grained basic rock. This fissure varied considerably in width, from ½ inch to 3 feet, and was mineralized for over 10 inches for 20 feet, but for the most part was only from 1 to 2 inches

wide. Where the ore widened, 10 tons was stoped out and shipped to the Granby smelter at Grand Forks. This shipment carried 15 per cent. copper.

On this side of the mountain, in spite of the many open-cuts and tunnels, no workable ore-bodies have been discovered, with the exception of the above-mentioned body, which was stoped out. It is probable that there has not been a sufficient amount of fracturing in the country-rock to allow any egress for mineral-carrying solutions, and the older sedimentaries have been eroded off to such an extent that there are only small remnants left. On the east side of the mountain a comparatively small amount of work has been done, chiefly on the remnants of the limestones where they showed some mineralization. There seems to be a better opportunity for finding any ore closer to the quartz-porphry dyke, and it is in this direction that the owners intend to do their development in future.

#### SUMMIT CAMP.

**Indiana.** This claim is situated near the headwaters of Amberty creek, which flows into the Tulameen river. Development-work consists of about 340 feet of tunnels and crosscuts. The lead near the mouth of the main tunnel averages 3 feet 6 inches for 20 feet and contains silver-lead and zinc in a gangue of calcite mixed with quartz, and strikes south-west. From this point, 20 feet from the mouth, the tunnel follows a stringer of ore varying from  $\frac{1}{2}$  to 3 inches and carrying silver, lead, zinc, and iron in the same gangue. Several crosscuts were driven from the main tunnel in hopes of finding a larger body of ore, but without success. The country-rock appears to be a highly siliceous argillite. No work has been done upon this claim for many years.

**Stevenson.** This claim adjoins the *Indiana* on the south-west and is owned by R. Stevenson, of Princeton. Development-work consists of an open-cut, at the end of which a shaft 10 feet deep has been sunk in the lead, also other cuts and some stripping. Unfortunately the shaft which was sunk in the lead was full of snow and water, so that a proper examination was impossible. The owner claims that there is a 3-foot lead at the bottom of the shaft, 10 inches of which is galena ore carrying high values in silver. This lead is probably the continuation of the *Indiana*.

#### TULAMEEN RIVER DISTRICT.

**Mary Jensen.** This claim is owned by Andy Jensen, of Tulameen, and is situated on the south-east side of Olivine mountain near Slate creek. Development-work consists of open-cuts, trenching, and stripping. General samples taken across the larger of the open-cuts gave as high as 2 per cent. copper, and picked samples up to 4 per cent. copper. The mineralization occurs in segregations in the olivine rock and is probably a primary constituent of these rocks. In the upper open-cut there is a strong copper-carbonate stain in the fractures of the olivine rock. Until more development-work has been done it is impossible to say whether these segregations are large enough to be worked profitably.

#### KENNEDY MOUNTAIN.

This mountain is situated about twelve miles in a southerly direction from Princeton and about two miles in a south-westerly direction from Copper mountain across the Similkameen river.

There are several groups of claims on the summit and northern slope down to the Similkameen river, which are owned and have been developed to some extent by tunnels, open-cuts, and in one case diamond-drilling.

The names of some of the claims visited are as follows: *Bench Fraction, Fraser, Fraser Fraction, Hamilton, Don, Star, Bruce, Pearley, Apex, Ajax, Francis, Hamilton Fraction, Brooklyn Fraction*, and *Hamilton No. 3*, all of which are owned by the three McRae Bros., of Princeton. Other claims are the *Platinic, Yale, Fern, Glory*, and *Celtic*, owned by Hugh Kennedy, of Princeton, and the *Red Buck* group, owned by Allison P. Johnson *et al.*, of Princeton.

Geologically, these groups of claims will be dealt with collectively. The country-rock is a batholithic intrusion of igneous rock, generally a granodiorite, which has intruded and absorbed practically all the older sedimentaries, leaving only small remnants in the intrusive rocks. There are many dykes, some of which are diabase andesite and quartz porphyry, cutting the older formations and causing fracturing in an easterly and westerly direction.

Most of the ore occurrences on the north side of Kennedy mountain appear to be in zones of fracture in the igneous rocks, and those near the summit seem to be of contact origin in the sedimentaries. There also seems to be a considerable amount of mineralization in the country-rock, which is probably an original constituent of that rock. There is little doubt that the intrusion of the dykes, which caused a good deal of fracturing, is responsible for the deposition of most of the ore. The ores are mainly chalcopyrite, pyrite, bornite, and magnetite, and samples carried from 1 to 3 per cent. in copper and a small amount of gold.

*Development.*—On the first group of claims, owned by the McRae Bros. and situated on the north slope of Kennedy mountain from the Similkameen river up to an elevation of 950 feet, three tunnels have been driven into the mountain, two of which cut the granodiorite and show a slight mineralization disseminated through the rock. There is also evidence of copper carbonates wherever fracturing occurs.

The centre tunnel, approximately 300 feet above the river, is driven through 40 feet of fractured granite rock, which is well mineralized with chalcopyrite, pyrite, and some copper carbonates. Samples across this lead varied from 1 to 3 per cent. copper, with a small amount of gold. Other open-cuts showed copper carbonates in the fractures of the rock.

Farther to the west of the *McRae* group of claims, and adjoining, lie the *Red Buck* group, which have been developed by tunnels, open-cuts, and a little diamond-drilling. In the lower tunnel about 30 feet of ore lying in a crushed zone was cut. This ore contained chalcopyrite, pyrite, and copper carbonates, and samples ran from 4 to 8 per cent. in copper. No returns are to hand regarding the amount of ore found in the diamond-drill holes. The ore-bodies seem to have a general strike of S. 45° W. and a nearly perpendicular dip.

On the *Kennedy* group the work done amounts to surface-trenching and open-cuts and two short tunnels, approximately 25 feet long, driven in loose rock. There is some evidence of copper carbonates in the fractures of the monzonite, with occasional segregations of pyrite and chalcopyrite.

Both the *McRae* group and *Red Buck* groups have had enough work done upon them to warrant further development to ascertain the length of their respective ore-bodies and the possibility of finding others. A good wagon-road has been built from Princeton to a point directly above the claims, which should facilitate transportation.

## BOUNDARY DISTRICT.

### GREENWOOD MINING DIVISION.

REPORT BY W. R. DEWDNEY, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Greenwood Mining Division for the year 1919.

The *Providence* mine, near Greenwood, shipped to the Consolidated Mining, Smelting, and Power Company of Canada, Limited, 338 tons of ore containing: Gold, 267 oz.; silver, 33,903 oz.; lead, 7,616 lb. Gross value of all metals, \$50,000. The number of men employed during the year has been increased from nine to twenty-eight. The property is leased to A. J. Morrison, of Greenwood.

*Skylark and Silver Cloud*.—Situating in Skylark camp. Leased to Duhamel & Bryant. Thirty tons of silver-gold ore was shipped from the *Skylark* to the Trail smelter during the year.

*Crescent*.—W. E. Thompson is operating this property and has shipped some ore to the smelter at Trail.

#### WALLACE MOUNTAIN, NEAR BEAVERDELL.

*Bell*.—Mine development: Drifting, 699 feet; raising, 65 feet. Claim development: New dining-hall, two dwellings, and bunk-house built and 2,600 feet of new road was constructed. Ore shipments and contents: 368 tons; gold, 8,647 oz.; silver, 45,844.8 oz.; lead, 24,489 lb.

*Wellington*.—Under lease and bond to James Sutherland and W. T. Thompson and owned by Ralph Smailes *et al.* The work done during the year consisted of 70 feet of drifting on the vein and some stoping. Twenty tons of very fine ore was extracted. Another promising lead has been uncovered. Two men employed.

*Rob Roy Group*.—Leased to Nordman & Sons and a Pentticon syndicate. One hundred and six tons of ore was shipped to the Trail smelter in 1919. Twenty men employed.

*Castor Fraction*.—Thirty-five tons of ore was shipped from this mine. The lessees, Perry, Hambley & McKenzie, have been running a lift since July, 170 feet. They have tapped the lead, 1 foot wide and well mineralized. Two men employed.

*Bounty*.—Owned by S. M. Johnson and Stanhope. Three men are employed developing this property, which is considered to be a very promising one.

*Carmi*.—Situating at Carmi. H. H. Sawyer has been engaged during the year erecting a mill at this mine, but construction has been retarded on account of shortage of material and labour.

#### LIGHTNING PEAK CAMP.

*Waterloo*.—Owned by G. A. Rendell *et al.* Ten tons of ore was shipped from this mine in March, having an average assay of 528 oz. in silver and 5 per cent. lead to the ton. In the month of April 3 tons was shipped, the average assay being 293 oz. in silver and 4 per cent. lead to the ton. The owners built about five miles of road during the year. A new bunk-house and a stable were erected on the property.

*Rampulo and Silver Lump*.—Owned by T. Cortiana. Considerable work was done on the *Rampulo*. Drifting on the vein disclosed some fine ore.

*Lightning Peak Group*.—Ten tons of silver ore was shipped during the year.

*Killarney*.—A trial shipment was sent to the Trail smelter by the owner, W. J. Banting, of Edgewood.

Shipments of ore from this camp were curtailed to a great extent owing to the lack of proper transportation facilities, much difficulty being experienced in taking in supplies and shipping out the ore to Edgewood.

#### OFFICE STATISTICS—GREENWOOD MINING DIVISION.

Free miners' certificates .....	178
Locations (quartz) .....	71
Certificates of work .....	163

Bills of sale .....	18
Abandonments .....	1
Filings .....	22
Placer (rerecords) .....	3
Miscellaneous .....	3
Forfeited claims leased .....	4

## GRAND FORKS MINING DIVISION.

REPORT BY S. R. ALMOND, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining in the Grand Forks Mining Division for the year 1919.

I would state that, as Philip B. Freeland, the Mining Engineer for District No. 4, which includes the Grand Forks Mining Division, is sending in a detailed report of the progress of mining in the Southern District, it would only be traversing the same ground, in a minor way, for me to furnish a report; however, I might remark that the main industry, the Granby smelter, was closed down during the season, and, in consequence, the mines at Phoenix closed. The *Emma* mine at Coltern was closed down for a period, but is again working; this mine, together with the *Rock Candy* mine and a few smaller shipping mines, now form the bulk of the industry in this Division.

### OFFICE STATISTICS—GRAND FORKS MINING DIVISION.

Free miners' certificates .....	113
Locations .....	39
Certificates of work .....	109
Bills of sale, agreements, etc. ....	19
Filings .....	11
Certificates of improvements .....	14
Crown grants .....	15
Leases of reverted claims .....	6

## OSOYOOS MINING DIVISION.

REPORT BY J. R. BROWN, GOLD COMMISSIONER, FAIRVIEW.

I have the honour to submit the annual report on mining operations in the Osoyoos Mining Division for the year 1919.

I regret that for the year there has been no improvement in mining matters; in fact, less has been done, both in prospecting and in development, than in the previous year.

### OFFICE STATISTICS—OSOYOOS MINING DIVISION.

Locations .....	61
Certificates of work .....	121
Conveyances .....	12
Leases of mineral claims .....	5
Free miners' certificates .....	59

## CENTRAL DISTRICT (No. 3).

REPORT BY R. W. THOMSON, RESIDENT ENGINEER.

Central Mineral Survey District No. 3 comprises the seven Mining Divisions of Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale.

In the 1918 Report an attempt was made to give a general idea of the geological history and structure of District No. 3 as taken from excerpts of reports on investigations made by officials of the Canadian Geological Survey extending over a period from 1877 to date.

During the year 1919 the Canadian Geological Survey had a party working in the Cadwalader Creek gold area completing investigations begun by the late C. W. Drysdale in 1915, also a party on topographical work in the area from Louis creek to Mount Olie, on the North Thompson river.

This district, although covering a large area, stands lowest of the six Mining Districts into which the Province is divided as regards mineral production.

Prospecting-work has been carried on in a vigorous manner over the whole of the district. The major portion of the time of the Resident Engineer has been occupied in making examinations of newly staked claims for the purpose of determining if there was justification for Government appropriations for trails. This work is very necessary and valuable from a general economic view-point, in that it frequently prevents the expenditure of a great deal of time and money on the exploitation of properties that have no possible chance of making good. The results of prospecting operations on the whole have been encouraging, and have added largely to the known mineral potentialities of the district. Perhaps the most important development to be noted in reviewing the year's work is that in connection with the limonite occurrences of the Taseko River vicinity, Clinton Mining Division, as investigated and reported on by Wm. M. Brewer, Resident Engineer of District No. 6. The potential importance of this field can scarcely be overestimated. The opening-up of these limonite-fields as an adjunct to the large magnetite occurrences known to exist should encourage the establishment of a steel industry in the Province in the near future. Mr. Brewer's report is published in full in the report on his District No. 6.

The results from the development-work being carried out by the Department of Mines in the Highland Valley copper area of Ashcroft Mining Division are very encouraging.

Reports of promising finds from the vicinity of the headwaters of the Clearwater and Thunder creek, in the Kamloops Mining Division, are coming in. This appears to be a silver-lead-copper belt.

The extension of the Pacific Great Eastern through the Clinton Mining Division will probably mean the opening-up of the hydromagnesite-deposits known to exist in this portion of the district. The completion of the Okanagan branch of the Canadian National Railways from Kamloops to Vernon via Grande Prairie, now under construction, should result in the exploitation of the gypsum-deposits situated about nine miles easterly from Grande Prairie. These deposits are reported to be of large extent and high quality and are situated within a mile of the location-line of the railway.

An industry that is becoming of considerable importance is that in connection with the utilization of the extensive natural magnesium-sulphate deposits in the Ashcroft and Clinton Mining Divisions. These latter will be mentioned under the heads of their respective Mining Divisions.

A large amount of Government-aided trail-work was carried out during the year, much to the benefit of those engaged in prospecting in new districts.

### CLINTON MINING DIVISION.

The principal output from this Division during the year 1919 consisted of crude magnesium sulphate (Epsom salts) and a small amount of placer gold from Watson Bar creek. The prospects, however, are very promising for future development on a large scale, as indicated by the report of Wm. Brewer, Resident Engineer of District No. 6, on the iron-ore occurrences of



Basque Chemical Production Co.—No. 1 Lake, Epsom Salts.



Basque Chemical Production Co.—Storehouse.

the Taseko (Whitewater) river and the report of L. Reinecke on the magnesite-deposits of the Division. Mr. Brewer's report will doubtless be given in full in another portion of the Annual Report.

Extracts from Mr. Reinecke's report\* on the magnesite and clay occurrences are as follows:—

#### MAGNESITE.

"The composition of certain of these earths is given in the table below.† Analyses 4 and 5 illustrate the increase in calcium content with depth. I have been informed by F. Calvert, who tested the Meadow Lake deposit, that the change takes place rather abruptly at a depth of 2 feet in the Meadow Lake deposit. This is true in general of the deposit at Watson lake. The silica content also increases with depth.

"Amounts available.—In general it may be said that the purer hydromagnesites are flat deposits outcropping on low ground. The upper 1½ to 2½ feet is, in general, of high grade, but from that depth down the siliceous and lime content is too high for commercial exploitation. The only known exception is one of the outcrops at Watson lake which is believed to be of good quality to a depth of 5 feet. Dr. K. A. Clark, of the Mines Branch, determined the 'apparent specific gravity' of lumps of this material as they were dug from the deposit at Watson lake as 1.22. This makes the weight of a cubic yard of the hydromagnesite as it lies in the deposit, including voids, 2,050 lb. Tonnage was calculated from this factor on the supposition that only the material outcropping was of commercial value, and from such scanty data as to depth as were available. Figured on this basis, there is about 7,000 tons of high-grade material at Clinton, 25,000 tons at Watson lake, and 180,000 tons at Meadow lake. Besides the better-grade hydromagnesite, there are large quantities of impure material in all three places."

A hydromagnesite-deposit near 105-Mile House, Cariboo road, is referred to in the 1918 Annual Report, page 228; also note by Provincial Mineralogist on page 243 of same publication.

#### CLAY.

The following extract is from that portion of the above-mentioned report appearing in the August bulletin of the Canadian Mining Institute, page 874:—

"This district is one of the few in Canada in which occurrences of residual clay has been found. There is a great dearth of workable deposits of kaolin and high-grade fireclay in Canada, and as kaolins are to be looked for in such residual deposits, a special effort was made to examine and sample as many outcrops of residual clay as possible. . . . Only one residual clay was of high grade. This occurs in an outcrop of argillites and quartzites of the Cache Creek series west of Fraser river at Chlmney Creek bridge. Robert Gardner, of Riske Creek, holds it under a quarry lease. The results of the laboratory tests on clay from this bank may be summarized as follows: The beds tested are numbered from top to bottom.‡ It will be noticed that 27 feet out of the 55-foot section can be considered fireclay—that is, using above cone 26—and of that 2 to 3 feet is highly refractory. It would be difficult to quarry without including the other less refractory beds. According to Keele, 'these clays as a whole might be worked for the manufacture of low-grade firebrick or mixed with more plastic clay for making sewer-pipe. Crushed and washed they would yield some fine-grained clay for the manufacture of stoneware goods, but the yield of washed clay would probably be too small to repay that operation.' The clays lie fifteen miles by road over a stiff grade from the railway at Williams lake, and the nearest water for washing purposes is 1,500 feet or so below, in Fraser river. They cannot be looked on as a commercial proposition, but the finding of fireclay here should encourage prospecting close to the railway-line farther up the river."

#### MAGNESIUM SULPHATE (EPSOM SALTS) LAKE.

Situated a mile and a half south of Clinton. Extraction of the salt-crust from this lake was carried on to a considerable extent during the winter of 1918-19. Two grades were taken out and stored on the shores of the lake—No. 1 grade, the purer, upper crust, and the No. 2 grade, which underlies No. 1 and is more or less mixed with muddy impurities. No. 1 is sufficiently pure to be classed as technical salts to be used in the arts and manufactures. No. 2 requires

\* Undeveloped Mineral Resources of the Clinton District, B.C., by L. Reinecke.

† Table omitted.

‡ Tests omitted.

refining. During the early part of the present year fifteen cars of No. 2 were shipped from Clinton to the Oroville refinery of the Stewart-Calvert Company, the owners of the deposit.

Little was done during the latter part of the year. Shipping, however, has been resumed since the beginning of the year 1920.

#### SCOTTIE CREEK CHROME-IRON. MINE.

No work has been done during 1919.

#### WATSON BAR CREEK PLACER.

The Gold Commissioner, Clinton, estimates recovery for 1919 at about 270 oz. of gold.

Taseko (Whitewater) River iron-ore deposits. (See report by Wm. M. Brewer, Resident Engineer of Mineral Survey District No. 6.)

*Mad Major* and *Copper King* groups of mineral claims. (See report by Wm. M. Brewer, Resident Engineer of Mineral Survey District No. 6.)

### LILLOOET MINING DIVISION.

#### CADWALLADER CREEK AREA.

This camp was visited on October 18th and 19th. The only property operating underground work and reduction plant at that time was the *Lorne* mine.

During the summer the Geological Survey of Canada had a party in the neighbourhood completing the geological survey of the district begun by C. W. Drysdale in 1915.

*Pioneer*.—This property was worked under normal conditions until the latter part of the year, when operations were suspended pending the result of reconstruction proceedings, an Eastern mining company having taken an option to purchase the *Pioneer* holdings.

*Lorne*.—Operations were carried on continuously during the year with a small crew, attention being directed chiefly to development-work. About 400 tons of rock was milled. The development as carried out on the several veins worked is of a promising nature.

*Ida May*.—This property was operated with a small force of men for a short time during the summer and a limited tonnage of rock treated with the plant described in last year's Report.

*Wayside*.—The main tunnel has been driven to a length of over 900 feet and a crosscut a short distance back from the face has been run for a distance of something over 30 feet. No developments of particular interest have been reported.

*Coronation*.—Nothing has been done on this property for the past three years. Assessment-work has been carried out on a large number of properties in this area which are at present of minor importance.

*Copper Mountain*.—Situated on Gun creek. Assessment-work and trail-construction have been carried out on this property. No developments of special interest have been reported. A good trail has been completed from the Bridge River wagon-road up Gun creek to the mine. This trail has been found very convenient in giving access for a portion of the trip into the Taseko River iron-ore deposit.

#### TENQUILLE CREEK AREA.

Assessment-work has been prosecuted in this camp during the year. The trail running from Mile 71 on the Pacific Great Eastern to the centre of the mining activity has been completed, giving easy access to the camp. This will have considerable effect in stimulating interest in the district, the old trail up the Lillooet river being very difficult and trying as a route for getting in supplies.

### KAMLOOPS MINING DIVISION.

This might be termed the Copper Division of District No. 3, as up to date this forms the principal metalliferous product not only of this Mining Division, but of the whole district, and is practically all produced by one mine. Prospecting and development operations in the vicinity of the North Thompson river, however, point to possibilities of a future in silver-lead operations, also lode gold in the vicinity of Dunn lake and coal about fifty miles up the North Thompson river from Kamloops.

*Iron Mask*.—This property was discussed in last year's Annual Report. During the past year the mine has been working steadily with a force of about fifty men employed. Shipments

of copper concentrates to the Trail smelter have been going on throughout the year. The management remains the same as during the past three years.

*Lydia Group.*—(See 1918 Report.) Work has been suspended on this property, the option under which work was being carried out during 1918-19 having been allowed to lapse.

*Queen Bess.*—(See 1918 Report.) The new mill was operated for a short time during the early part of 1919, when it was thought advisable by the management to confine attention to development only. Twenty-six tons of silver-lead concentrates was shipped during the year, leaving approximately 75 tons of zinc concentrates at the mine awaiting favourable terms for marketing. The development-work carried out during the year has much improved the prospects of the mine, milling operations having resumed during the early months of 1920.

*Copper King and Camp McLeod Groups.*—The option held by the Granby Company on these properties has been dropped. The trail, however, leading to this promising field (see report by Wm. M. Brewer in Report of Minister of Mines, 1913, page 203) from the head of Seymour arm was completed during the year.

*Tenderfoot.*—(See report by Wm. M. Brewer, Minister of Mines' Report, 1913, page 196.) This property has been idle during the greater part of the year. An option held by Eastern financiers has been renewed, one of the conditions of which is that machinery for a concentrating plant is to be on the property by the middle of June, 1920.

*War Colt Group.*—Situated near the headwaters of the Clearwater river and Thunder creek, in the extreme northerly portion of the Division. Staked by Adolph Anderson, of Swift Creek, and Lewis Knutson, of Tete Jaune Cache. The samples of ore from this vicinity consist of a complex of galena, chalcopyrite, and sphalerite. An Edmonton syndicate has secured an option on the claims and has constructed a trail from the Canadian National Railway to the camp, a distance of approximately forty miles.

*Gold Hill and Keystone.*—On the north side of Dunn creek, in the vicinity of the *Windpass* group (described in 1917 Annual Report), is a group of claims owned by Fennell & Skoning, of Chu Chua. Mr. Skoning has been working on these claims for the past three years and has opened up several leads on the surface, besides doing a considerable amount of tunnelling. I have not had an opportunity to examine these claims since 1917, but it is reported that "visible" gold occurs in places and that average values are encouraging.

#### COAL.

In the Annual Report of the Geological Survey of Canada, Vol. VII., 1894, pages 228-231B, there is a report by G. M. Dawson on the coal area situated about fifty miles up the North Thompson river from Kamloops, in the vicinity of Newhykulston (Coal) creek.

In Dawson's report the coal is stated to be of excellent quality, but that the seams as exposed appeared to be too narrow to be successfully worked as a commercial proposition, although it is stated that if development-work showed increased widths in the seams the field might become of considerable importance. Recent investigations along the banks of Newhykulston creek have shown the existence of coal-seams of workable thickness. During the latter part of 1919 a syndicate composed principally of parties interested in the Queen Bess Mines, Inc., took a working option from the original leaseholders of the ground and have been shipping to the Queen Bess Mines since the beginning of 1920. Eight car-loads had been shipped at the end of February. The coal is used for supplying power for underground and mill operation and is said to give the best of satisfaction as a fuel. Work has been carried out so far on one seam only, which at 200 feet from the tunnel portal is said to give 42 inches of clean coal. It is the intention to develop other seams and also to test the ground by drilling.

#### GYPSUM.

In the Annual Report of the Minister of Mines, 1913, on page 205, there is a report by Wm. M. Brewer on the gypsum occurrences situated on Bolean creek, a tributary of the Salmon river. These lie about eight miles easterly from the post-office at Grande Prairie.

Mr. Brewer states that this can be traced along a distance of a mile and a quarter and that in some places it reaches a maximum thickness of 300 feet between walls. A typical sample taken by Mr. Brewer showed this deposit to consist of practically pure gypsum.

Dr. Dawson in a preliminary report in 1889 says: "Gypsum . . . has since been discovered, and, according to the accounts received, in large quantity. The locality is stated

to be on the Salmon river about twenty miles distant from the railway. From the excellent quality of the specimens which I have seen, this discovery may prove to be of importance."

In 1895 James McEvoy reported as follows: "On the hillside north of the middle crossing of Salmon river there is a fine deposit of gypsum, associated with grey schists and white crystalline limestone. The principal deposit, in which a tunnel 25 feet long has been made, is 100 feet and over in thickness. The exact thickness could not be ascertained on account of the heavy covering of drift on the hillside. Above this is another deposit with a thickness of 30 feet or more; still higher up are two more small deposits, one of which shows bedding. The large deposit is massive and perfectly white in some places, showing slight traces of anhydrite. The general strike of the deposits is true east and west, with vertical or high northerly dip."

Dr. Dawson's inference as developed in the reports of Mr. McEvoy and Mr. Brewer will probably be verified at an early date, as there is no doubt that steps will be taken to make this an active commercial proposition as soon as the railway now under construction, and which passes within a mile of the property, is completed.

#### ASHCROFT MINING DIVISION.

The only developments of importance that have taken place during the year in this Division are those in connection with the operations of the Basque Chemical Production Company, Limited, working the magnesium sulphate or Epsom salts deposits near Basque, on the Canadian National Railway, and the development by the Government, under the provisions of "Mineral Survey and Development Act," of the claims known as the *Snowstorm* group in Highland valley. The former can now be said to be established on a permanent basis and promises to develop into an industry of considerable magnitude and importance; the latter, although still in the initial stages of development, is sufficiently encouraging to warrant considerable further work being done in the way of proving up the size and value of the ore body or bodies in the vicinity.

#### BASQUE CHEMICAL PRODUCTION COMPANY, LIMITED.

(See 1918 Annual Report.) This property changed control during the past year, having been taken over by Eastern financiers. Head office, 509 Richards street, Vancouver; Jesse G. Miller, manager. The operations of the company during the year and the prospects for the future are best described by extracts from a report by Mr. Miller, the manager, under date of January 31st, 1920, and are as follows:—

"We started actual work in the production and manufacture of Epsom salts on July 14th, 1919, and up to the end of December we have shipped five car-loads of salts, 138 tons in all; 120 tons of this amount was shipped to large tanners in Ontario for their purposes; also 6 tons of medicinal Epsom salts for human use went to Ontario and 12 tons of the medicinal salts was distributed in Vancouver.

"Our salt is practically 100 per cent. pure Epsom salt as we take it out of the lakes; the enclosed analysis is that of the last car we shipped to Ontario and is approximately the same as all previous shipments.

"We have been operating with an average force of ten men for the six months ending December 31st, 1919.

"We are practically still in an experimental stage and our present plant and equipment which we installed has a capacity of two to three car-loads per month, but the extreme cold weather we have experienced during the past two months has prevented us making this average. However, we expect to overcome all difficulties, and as time goes by we hope to increase the output and naturally increase the number of employees.

"We will now begin experimental work with a crystallizing plant in a small way in order to determine which will be the cheapest method of manufacturing the salts on a large scale.

"Samples of our product have been submitted to large dealers in the United States, United Kingdom ports of call, the Orient, and Far East.

"We have been informed that Canada imports approximately \$2,000,000 to \$2,500,000 worth of magnesium sulphate each year. It is our ambition to even the balance of trade on this commodity, and we believe we should have no difficulty in doing so, especially because of the high grade of purity of our product.

"One of the largest tanners under the British flag is using our Epsom salts in car-load lots, and we have been advised that they obtain better results in the tanning of leather with our salts. All who have purchased our medicinal salts have expressed themselves as highly pleased.

"We are handicapped because of the high freight rates to the East and are seeking a reduction. The rate we are obliged to pay at present is 94 cents a 100 lb., or \$18.80 a ton. The American manufacturers can ship Epsom salts into Canada and pay the duty and war-tax, even with the high rate of exchange, at a much lower cost than we can, because their rate is only about \$3.50. We are experiencing the same difficulty with the ocean freight rates to London, Liverpool, and Glasgow, which are \$35 and \$40 a ton. This makes it prohibitive to do business in the British Empire. The British firms would give us the preference, but we cannot compete with the European market on account of the high freight rates prevailing at the present time. We are making every effort to get lower rates, which will be absolutely necessary before we can do business abroad.

"With our unlimited quantities of pure Epsom salts we feel assured that we will develop a large industry of Canada."

Analysis of salts shipped in car referred to in paragraph 2 of report above:—

"Messrs. Basque Chemical Production Co., Ltd.,  
North West Building, Vancouver, B.C.

"GENTLEMEN,—We have analysed the sample of magnesium sulphate submitted by you, and report the following results:—

	Per Cent.
Insoluble matter .....	0.02
Lead .....	None.
Arsenic .....	None.
Zinc .....	None.
Iron .....	None.
Lime (CaO) .....	None.
Chlorides .....	Slight trace.
Loss on ignition (as moisture) .....	50.74
Magnesia (MgO) .....	16.20
Sulphuric anhydride (SO <sub>3</sub> ) .....	33.02
Sodium (Na <sub>2</sub> O) .....	0.02
	100.00

"The above results show that this material will pass the B.P. and U.S.P. specifications.

"Yours faithfully,

"G. S. ELDRIDGE & Co.

"Per NORMAN ARMSTRONG."

#### SNOWSTORM GROUP.

(See Report of Minister of Mines, 1917.) Recently this group of claims has been surveyed, the survey showing a compact block of twenty-two claims and fractions. For convenience in discussing the development accomplished on these claims during the past year, the work will be described under two heads, the *Snowstorm* sub-group and the *Iona* sub-group.

Diamond-drilling operations were started on the *Snowstorm* claim about the middle of January, 1919, by the Department of Mines under the provisions of the "Mineral Survey and Development Act," the work being done on contract by the International Diamond Drill Contracting Company, of Spokane, Wash., using a drill cutting a  $\frac{7}{8}$ -inch core. As the mass of data secured in the way of geological sections, assay plans of cores and sludge, etc., is too bulky to publish in this report and would be of little value without an accompanying survey plan which is not yet to hand, a condensed general descriptive report only can be given.

Work was carried on continuously throughout the summer, eight holes being put down, varying in dips between 30 and 63 degrees and in lengths between 400 feet and 1,125 feet, aggregating a total length of 5,736 feet. In the holes put down three distinct types of rocks

were encountered. Specimens of these were submitted to John A. Dresser, mining geologist, of Montreal, for classification, which is as follows:—

Specimen submitted.	Dr. Dresser's Classification.
No. 1. Country-rock of the locality.....	Granodiorite, approaching quartz diorite in composition.
No. 2. Porphyritic rock .....	Hornblende porphyry, approaching hornblende porphyrite in composition.
No. 3. Ore-bearing rock; has the appearance of a much-altered basaltic rock	Judging from a single specimen of each, this rock would appear to have been originally similar to No. 2, but is now much altered, perhaps near an intrusive contact.

Neither No. 2 nor No. 3 are exposed to any extent on the surface, but the boreholes show both to be of considerable extent, both laterally and vertically, below the surface of the country granodiorite. No. 3 occurs as an extrusive or injected rock in association with the granodiorite, having well-defined contacts, but the boreholes do not show it in any case as being in contact with the porphyry.

In starting operations the only surface conditions to influence the location of No. 1 borehole was the position of the workings from which shipments had been made as published in previous reports on this property: this is a fissure or fracture striking in a north-east south-west direction which carried high-grade bornite and chalcopyrite. Hole No. 1 was put down at an angle of 30 degrees to crosscut this fissure at a point about 100 feet below the workings, or 150 feet below the surface. No positive results were secured from No. 1 hole. No. 2 was drilled from the same position at an angle of 63 degrees to see if the fissure may not have pinched and then swelled at a greater depth, but this did not appear to be the case.

In the old workings a cross-fissure carrying low-grade ore was observed, and it was decided to drill along the general direction of the fissuring of the country-rock, which, as mentioned before, is in a north-east south-west direction. Two holes, No. 3 and No. 4, were put down in this general direction with very encouraging results, the mineral-bearing rock being passed through in both. In No. 4, which was put down at a dip of 45 degrees, 93 feet of the mineralized altered basaltic rock and 67 feet of the granodiorite were passed through between the distances 355 and 515 feet on the borehole, the granodiorite occurring in four separate tongues interbedded in the ore-bearing rock. The drill-hole No. 4 probably passed through the ore-bodies at a small angle with the direction of their strike, thus accounting for the long lengths of ore encountered in the drill-holes. Hole No. 6 was put down at a dip of 57 degrees to crosscut the ore-bodies shown in No. 4, and at a vertical depth of 600 feet passed through 33 feet (along the direction of the drill-hole) of the ore-bearing rock. No. 7 verified conditions to be similar to No. 6 about 600 feet north-easterly from same, mineral being passed through at a vertical depth of over 800 feet. No. 8, the last hole put down, was for the purpose of prospecting the country to the south-east of the line on which the preceding work had been done. It was put down on a dip of 45 degrees, crosscutting the general direction of fracturing of the country-rock and the ground adjacent to that on which the previous work had been done. The following is a condensed log of the results secured from hole No. 8:—

Distance along Borehole.	Average Vertical Depth.	Width of Ore-body along Line of Borehole.	Length of Core recovered.	Average Assay Value of Core (Copper).
Feet.	Feet.	Feet.	Feet.	Per Cent.
199-207.....	142	8	8	2.70
239-241.....	168	2	2	2.67
396-400.....	280	4	2	2.40
472-476.....	330	4	4	1.00
508-521.....	360	18	10	1.80

The hole was continued to a length of 939 feet without encountering further ore-bodies, and it was the intention to carry on until the zone crosscut by Nos. 6 and 7 had been reached, but

at the depth of 939 feet caving ground prevented further progress with this borehole. With detailed survey plans, geological and assay sections, it will then be possible to give an accurate idea of the work as carried out, but it is hoped the above descriptive report may give a general idea of the work accomplished and the nature of the country being prospected. The results so far secured by diamond-drilling, indicating as it does the existence of ore-bodies of commercial value extending over large areas and to considerable depths, should justify the undertaking of active development-work by the ordinary methods.

Situated about three-quarters of a mile south-westerly from the *Snowstorm Iona Sub-group*. sub-group. In the 1917 Report of the Minister of Mines the *Iona* occurrence is described as being mineralized ground showing on the surface over an area at least 60 feet in diameter and from which a sample gave 1.3 per cent. copper. During the summer efforts were directed towards determining the boundaries of the mineralized zone exposed on the *Iona* claim by surface open-cuts, and these show the zone to be at least 200 feet in width. After the drilling on the *Snowstorm* sub-group had been completed an attempt was made to prospect the *Iona* group by diamond-drilling, but the rock formation near the surface was found to be so badly fractured that difficulty was encountered in operating the drill in such broken ground, and it was decided necessary to open-cut or tunnel until the more unbroken formation was reached, which would permit of the diamond-drill work being continued. On the approach of snow surface work had to be discarded, and efforts were made to reach the solid formation by a tunnel, started in a north-westerly direction to cross-cut the ore-bearing zone.

At the end of March, 1920, this tunnel had been driven 225 feet, but had not then struck formation sufficiently unbroken to permit of diamond-drilling being restarted. The whole of this tunnel is in the ore-bearing zone and shows it to be an occurrence quite distinct from the country granodiorite.

Samples from the surface submitted to Dr. J. A. Dresser, of Montreal, were classified by him as "quartz-carbonate" rocks. The ore-body as shown in the tunnel is very much fractured and broken and impregnated with the green carbonate of copper on the fracture faces; streaks of bornite also occur and small cavities lined with copper carbonate which in some cases carry residual bornite. Apparently there has been considerable leaching action. Judging from description, this ore very much resembles the Ajo (Arizona) monzonite-porphry copper occurrences, which are being worked by the leaching system of extraction with commercially successful results. Chip samples taken along the tunnel-walls indicate large bodies of ore averaging over 1 per cent. copper. The maximum depth of the tunnel below the surface at its deepest point is 70 feet, which is still in the oxidized zone. The sulphide zone which should underlie the oxidized zone in this occurrence has not yet been investigated. The work so far done has shown that there is a very large body of mineralized monzonitic rock in this locality, but sufficient data has not yet been secured to warrant estimating quantities or ultimate average values.

Further work will be carried out on the properties, which, it is expected, will not be finished within the next year at least.

#### O.K. MINE, HIGHLAND VALLEY.

Work on this property was resumed with a small crew of men during the latter part of the year. A raise has been put up and sinking on a winze is now in progress. A considerable amount of ore is said to have been opened up in the recent development-work, but milling operations have not yet restarted.

#### DIATOMACEOUS EARTH.

Situated about twenty-five miles up Deadman creek from the Thompson river is a large deposit of a material that has been designated by the Mines Branch, Ottawa, as a "diatomaceous earth." The Milton-Hersey Company, Limited, of Montreal, in a report giving the analysis, etc., of a sample submitted by the owners, make the following statement: "This is an extremely fine siliceous rock. On a microscopic examination more than 75 per cent. of the particles are from one ten-thousandth to five ten-thousandths inch in diameter. Few pieces show a maximum of fifteen ten-thousandths; that is, practically all the material when crushed would pass through a 200-mesh sieve. This material would make a very good filler for soap and paint."

#### NICOLA MINING DIVISION.

The important output from this Division is coal. The Middlesboro Collieries, Limited, and the Fleming Coal Company have been operating steadily throughout the year.

## STUMP LAKE AREA.

Stimulated no doubt by the rather abnormal price of silver, there has been increased interest taken in this camp during the past year.

**Donohoe.** Operations were resumed on this property during the summer, a crew of about twelve men being employed during the latter half of the year. The workings at the *Joshua* shaft were unwatered to below the 400-foot level and the mine put in shape for proper working. A compressor and air-drills were installed for working the mine. Shipments of the high-grade silver ore have been started since the beginning of 1920, and arrangements are under way for the installation of an up-to-date concentrating plant.

**Mary Reynolds.** R. R. Hedley has been carrying on operations on this property. During the year considerable development-work was done and a road built to connect the mine with the Nicola-Kamloops highway. During the early part of the year 1919 about 130 tons of ore was shipped. The latter part of the year was devoted largely to prospecting-work in the locality. Several new and promising veins are reported to have been discovered.

## ASPEN GROVE.

During the autumn of 1918 options were taken on a large number of claims in this camp by a very strong financial group which later transferred an interest to New York operators. Investigations of geological conditions were carried on during the summer of 1919, and in the autumn of the same year it was decided to start drilling operations. These are now in progress. No other developments of importance are reported for this locality.

## VERNON MINING DIVISION.

Several examinations of prospects were made in this Division during the year, but the only one examined deserving of mention is the property known as the *Black Hawk*.

**Black Hawk.** Situated near the head of Irish creek, about sixteen miles northerly from Vernon; owner, A. J. McMullen, of Vernon. Considerable work has been done on this property. One tunnel 240 feet in length, with branch tunnel 40 feet in length, has been driven in country-rock; also another tunnel 100 feet in length, with a branch tunnel 50 feet. Both of these were driven with the idea of tapping a vein which traverses the property, but from which no results ensued. There is a quartz vein traversing the property which shows on the surface in occasional outcroppings over a considerable distance. The country-rock is of a basaltic nature. Surface samples taken in the vicinity of the workings along a distance of approximately 150 feet gave the following results:—

(1.) Near south-east end of workings, across 3 feet 6 inches: Gold 0.56 oz. and silver 0.20 oz. to the ton.

(2.) About 75 feet north-west from No. 1, across 6 feet: Gold 0.56 oz. and silver 0.20 oz. to the ton.

(3.) Across 5 feet in shallow incline north-west from No. 2: Gold 0.20 oz. and silver 1.50 oz. to the ton.

This property is situated less than half a mile from the location-line of the Okanagan branch of the Canadian National Railway and should be deserving of further investigation.

This Mining Division is more important at the present time as an agricultural than as a mining district, but there are possibilities in the latter.

## YALE MINING DIVISION.

*Emancipation Mining Co., Ltd.*—Work has been continued on this property throughout the year. A small gasoline-hoist has been installed in the mine for the purpose of facilitating hoisting operations underground. About 8 tons of ore was shipped during the year, the value of which is estimated at \$350 a ton in gold.

*River Gold Recovery Co.*—Operating last year on a lease situated about half a mile below Hope. Operations closed last autumn. The plant has been removed.

## LADNER CREEK.

A trip was made up Ladner Creek valley in the month of June for the purpose of investigating as to whether conditions warranted the construction of a trail to facilitate prospecting operations in this vicinity. The examination was necessarily of a very casual nature.



B.C. Bureau of Mines

**Snowstorm Group, Iowa Claim.**



B.C. Bureau of Mines

**Snowstorm M.C.—Diamond-drilled.**

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Ladner creek runs south-easterly to the Coquihalla river, which it joins about sixteen miles above Hope. This creek traverses a series of argillites which are generally ascribed as belonging to the Cache Creek formation. This argillite-belt appears to be of considerable width and extends north-westerly to Slwash creek, on which the *Emigrant* mine is situated. The *Emancipation* mine on the north slope of the Coquihalla valley is also situated in this same belt. Numerous occurrences of quartz, either of lenticular or vein conformation, are present throughout this whole argillitic formation, and a number carry gold values of commercial importance. Only two samples were taken, and these were from the *Idaho* claim, owned by Palmer & Bailey. Pannings were made from O'Connell's and other claims which showed good gold values. The assay results from the *Idaho* samples were as follows:—

(1.) Across 4 feet on hanging-wall side of vein (vein 23 feet width): Gold 0.44 oz. and silver 0.06 oz. to the ton.

(2.) Across 5 feet near centre of ore-body, which is exposed for width of 20 feet with walls not yet uncovered, and 150 feet north-west from No. 1 on same vein: Gold 0.16 oz. and silver 0.04 oz. to the ton.

This area is deserving of further investigation.

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## LILLOOET DISTRICT.

### LILLOOET MINING DIVISION.

REPORT BY JOHN DUNLOP, GOLD COMMISSIONER.

I have the honour to submit the annual report on the progress of mining in Lillooet Mining Division during the year 1919.

#### MINERAL CLAIMS.

Cadwallader creek being the important section in so far as mining operations are carried on the year round, the recovery of bullion has fallen short of other years. The cause may undoubtedly be attributed to labour and other untoward circumstances.

*Pioneer.*—For some seasons past this camp has been highly successful and the ore milled on the premises gave good returns to the owners. In the latter part of the year operations ceased, the mine being virtually closed down for some time. Pending negotiations anent a deal on the property, the owners did not resume operations and granted an option to purchase to an Eastern mining company. Work has been again commenced under new management.

*Lorne.*—This property treated about 400 tons of ore during the early part of the season that had been mined in the winter of 1918, the gross value of which yielded in gold bullion \$2,565.55. No further milling of ore was made and development-work thereafter was carried on steadily with a small crew.

*Ida May.*—Work of a prospecting character was conducted with a small force, and I understand that an important discovery of valuable ore was disclosed late in the season.

*Wayside.*—The owner is persevering and diligently confines attention to the extension of tunnel-work and crosscutting.

*Coronation.*—This property has been idle for the past three years.

Very little development was done on the mineral claims in the Copper Mountain section. It is essential and to the interest of the locators and others that the trail, commencing at a point at Bridge river and leading up Gun creek, a distance of about thirty miles, be completed, so that the requisite materials and mining supplies may be brought on the ground at a reasonable figure. I understand that considerable work in this direction was done during the past year and the owners of claims devoted the best part of the season thereto, such work being in direct relation and in direct proximity to their recorded interests. I am also informed that the *Copper Mountain* mineral group is under option to a mining syndicate, and it is the intention to open up a camp as soon as weather permits.

*Index Group.*—This group is situated on Texas creek, a tributary of the Fraser river. The company owning the property had a force of men employed building a narrow road to the mine via Cayoosh creek; while considerable work was done, there is much yet to accomplish, as the country is steep and rugged.

*Anderson Lake Mining & Milling Co.*—Situated on McGillivray creek at Anderson lake. Beyond performing the necessary assessment-work on the two mineral claims, no mining or milling of ore has been done. This property has been idle for a number of years past.

The usual annual assessment-work as required under the "Mineral Act" on the mineral claims in and around Tenquille creek and Pemberton Meadows had the attention of the owners. There is nothing special to report.

#### PLACER CLAIMS.

The mining leases, with one exception, were dormant and idle. The recovery of gold along the creek-beds and rivers by the individual miner during the season is \$1,590; a little increase over 1918.

#### OFFICE STATISTICS—LILLOOET MINING DIVISION.

Free miners' certificates issued .....	208
Mineral claims recorded .....	244
Certificates of work recorded .....	297

Placer claims recorded and rerecorded .....	11
Mining leases in force .....	37
Transfers and agreements recorded .....	76

*Revenue.*

Free miners' certificates .....	\$ 942 00
Mining receipts, general .....	2,402 35
Tax, Crown-granted mineral claims .....	613 52
Total .....	\$3,957 87

## CLINTON MINING DIVISION.

REPORT BY G. MILBURN, GOLD COMMISSIONER.

I have the honour to submit the annual report of the Clinton Mining Division of Lillooet District for the year ending December 31st, 1919.

Almost as great activity in locating of claims prevailed this year as last, a total of 270 mineral claims having been recorded and twenty-five placer claims, inclusive of eleven which were rerecords.

Mineral claims were recorded in nearly every locality in the Division. A lake containing a form of salts was staked early in January and may develop into a shipping mine of the same nature as the Epsom salts claims now in the hands of the Stewart-Calvert Company, Inc., of Oroville, Wash.

A block of twelve claims in the immediate vicinity of Clinton was also staked during January, but I have no information as to what mineral was found on this ground. Within the area staked, however, is a block of porous, honeycombed, sedimentary lime-deposit which is reported to be very pure, and, as it is intersected by the Pacific Great Eastern Railway, it is advantageously placed for shipping.

In the northern portion of the district, in the vicinity of the Pacific Great Eastern Railway where it parallels the Cariboo road near the 141-Mile House, a block of ninety-four mineral claims were staked and recorded in the early part of the year. This ground, I understand, was located for hydromagnesite, but I do not know the results of the analysis of the various samples taken.

Towards the south-western extremity of the Division a group of mineral claims now known as the *Mad Major* group was staked towards the end of last year, and this year assessment-work was recorded and further claims were recorded, thus enlarging the property. In the same portion of the Division a block of fifty-three claims was recorded on the west slope of Iron mountain, situated in the Taseko country. These iron claims are in a portion of the country away from the regular means of transportation and development would appear to be contingent upon projection of a railroad to the claims.

In addition to the claims already mentioned, several soda-lakes scattered through the northern part of the district have been staked and the contents tested.

A greater amount of assessment-work than ever before in the experience of my office was recorded during the year, the number of certificates issued being 120, as compared with twenty-seven in the previous year. Certificates of work were issued in connection with a large number of the claims referred to in my report of last year as a nickel proposition, the work done consisting largely of test-bores made with a drill brought in for the purpose. I have no information regarding results.

Further development-work was prosecuted by C. E. Cartwright on his magnesite claims east of the town of Clinton and several tunnels were driven, the greatest depth being 150 feet. This work was performed in the early part of the year, since when no further work has been done.

The Stewart-Calvert Company, Inc., has been shipping magnesium-sulphate salts from the lake situated about one mile south of Clinton, and in the past twelve months has sent out in the neighbourhood of twenty car-loads. The salts have not been refined and the only process they have gone through before shipment has been that of grinding. A considerable tonnage

collected during the winter of 1918-19 still remains and no further work collecting from the lake has been done.

The soda claims at the 70-Mile House have not been worked during the past year. This is also true of the Scottie Creek claims, where a considerable tonnage of chrome iron awaits a favourable market before being shipped. Pending the outcome of litigation, the hydromagnesite claims at Meadow lake have not developed into shipping mines, but, as the deposit is apparently exceptionally pure and valuable, developments should take place in the near future.

#### PLACER-MINING.

The outlook for placer-mining in this Division has been much brighter, but it would appear that until dredging on a large scale in the Fraser river is seriously taken up this form of mining will not amount to very much.

Several individual placer-mining claims on Watson Bar creek have been worked and upwards of \$5,000 worth of gold has been recovered. One creek lease on the North fork of Watson Bar creek was granted, and the lessee immediately proceeded with development-work necessary to making it a producer. Upwards of \$1,500 worth of preparatory work was done, and it is hoped that some of the precious metal will be recovered next season.

One dredging lease was cancelled and one granted. This latter was for one mile of the bed of the Fraser river, which it was the intention of the lessee to prospect by means of a diver's outfit. I have had no report of the outcome of this unusual method.

#### OFFICE STATISTICS—CLINTON MINING DIVISION.

Free miners' certificates .....	125
Free miners' certificates (special) .....	2
Mineral claims .....	270
Certificates of work .....	120
Placer claims recorded and rerecorded .....	27
Bills of sale, etc. ....	79
Dredging leases in force .....	14
Creek leases in force .....	1

#### Revenue.

Free miners' certificates .....	\$ 605 75
Mining receipts, general .....	1,561 60
<b>Total</b> .....	<b>\$2,167 35</b>

## YALE DISTRICT.

### NICOLA MINING DIVISION.

REPORT BY J. A. MURCHISON, MINING RECORDER.

I have the honour to submit herewith the annual report and office statistics of the Nicola Mining Division for the year ending December 31st, 1919.

Development-work on silver and copper properties has been vigorously prosecuted, and with satisfactory results, though progress has been retarded by unsettled labour conditions and the excessive cost of mining supplies.

#### ASPEN GROVE (COPPER).

*Aspen Grove Amalgamated Mines, Ltd.*—A good camp has been established and good progress has been made with one diamond-drill since about the middle of December. Another drill is to be put in operation shortly, and should drilling results continue satisfactory extensive operations may be anticipated. The option-holders of this property are experienced mining men of good financial ability.

#### STUMP LAKE (SILVER).

**Donohoe.** The group of properties known as the *Donohoe* mines comprise eight Crown-granted mineral claims located on Mineral hill, in the Stump Lake district.

Over \$200,000 has been expended in development-work, and during the current year work has been confined exclusively to reclaiming the ore-bodies in the lower levels of the *Joshua* mine and in the installation of modern mining machinery. This property is being developed by practical mining men and work is progressing with encouraging results. Regular shipments of silver ore are now being made to the Trail smelter, but smelting results are not yet known.

**Mary Reynolds Group.** Development-work on this silver property at Stump lake during the year consists of 74 feet of drift from the shaft and 140 feet of tunnel, with 30 feet of raise and 60 feet of open-cut approach. As a result of recent prospecting a new vein has been uncovered paralleling the old vein 150 feet to the west. This vein, where exposed, is over 8 feet wide, is thoroughly oxidized and leached, and carries low values in silver. Outcrops have been traced about 500 feet north and 800 feet south. Work has also been done on outlying claims located as extensions and a mountain wagon-road has been built from Rockford to the mine.

With this group is the *Robert Dunsmuir* Crown-granted claim, lying about 750 feet west of the *Mary Reynolds*, on which a strong outcrop has been traced and two claims located.

Recent locations were the *Elkhorn* group of four claims, on which are four strong quartz veins with high-grade silver minerals in evidence; also the *Blue Grouse* group of three claims, with a strong vein striking at right angles to that of the *Elkhorn*.

Ore shipped during the year, 130 tons, with analysis as follows: Silver, 51.2 oz. a ton; gold, 0.143 oz. a ton; lead, 1.4 per cent.; zinc, 2.4 per cent.; sulphur, 2.6 per cent.; silica, 52.5 per cent.; iron, 6.6 per cent.; lime, 6.4 per cent.

#### TEN-MILE CREEK (COPPER).

*Aberdeen.*—This mine has been unwatered and arrangements are being made to resume development-work.

To enable the more profitable mining of this and the Highland Valley districts, where immense bodies of copper have been proved, a railway from Highland valley via the Aberdeen district to Coyle is being suggested in mining circles. The grade is fairly good and the distance from Highland valley to Coyle Railway Station is about thirty-two miles.

## OFFICE STATISTICS—NICOLA MINING DIVISION.

Locations recorded .....	130
Free miners' certificates .....	142
Certificates of work .....	150
Bills of sale .....	13

## VERNON MINING DIVISION.

REPORT BY L. NORRIS, GOLD COMMISSIONER.

I beg to say that lode-mining has come practically to a standstill in this Division. Evidently we are not in the mineral-belt.

During the year 1919 there was practically no placer-mining.

## OFFICE STATISTICS—VERNON MINING DIVISION.

Free miners' certificates .....	129
Mineral claims recorded .....	20
Placer claims recorded .....	2
Certificates of work .....	14
Transfers .....	3

## YALE MINING DIVISION.

REPORT BY H. BEECH, MINING RECORDER.

I have the honour to submit the annual mining report and office statistics for the year ending December 31st, 1919.

## PLACER-MINING.

Renewed interest has been shown in the above branch of mining during the year. Although the River Gold Recovery Company removed its machinery from its lease near Hope, there have been many inquiries as to the placer prospects on other parts of the Fraser river and two applications have been filed on placer-ground near Yale.

## LODE-MINING.

Extensive development-work has been done on most of the claims in the Yale Division during the year. Owing to the high cost of labour and materials free-gold properties are not as attractive as formerly. The high price of silver has drawn a number of prospectors into the silver-bearing areas at Summit camp, 23-Mile, and Eureka mountain. In all these places a number of new claims have been located on proved silver-bearing lodes. New claims were also staked near the *Queen* mine at Yale.

*Emancipation Mining Co.*—This company made two small shipments of ore during the year, amounting to 11 tons, which averaged about \$350 a ton; exact figures are not yet available from the management. A small gasolene-hoist has been installed preparatory to sinking the winze on the high-grade ore.

*Snowstorm Group.*—This group is owned by J. O'Connell, who has done considerable development-work since his return from the war.

*Emigrant Mines, Ltd.*—Apart from the annual assessment-work, nothing further was done on this property. Lack of capital and high costs has tended to retard the opening-up of free-gold properties in this Division.

The high price of silver has awakened fresh interest in the Summit camp, 23-Mile, Eureka mountain, and *Queen* mine. New claims have been staked and a mild boom in silver properties has taken place.

## OFFICE STATISTICS—YALE MINING DIVISION.

Free miners' certificates issued .....	142
Locations recorded .....	170
Certificates of work issued .....	93
Bills of sale recorded .....	26

## ASHCROFT MINING DIVISION.

REPORT BY J. S. ALEXANDER, MINING RECORDER.

I have the honour to submit my annual report as Mining Recorder for the Ashcroft Mining Division for the year 1919.

The greatest mining activity in this district centres around Highland valley, in which are a large number of claims, nearly all of which are being worked. I understand the Resident Mining Engineer is making a detailed report covering the work done during the past year on the claims situated in this vicinity.

## OFFICE STATISTICS—ASHCROFT MINING DIVISION.

New locations recorded .....	81
Certificates of work .....	128
Conveyances, etc. ....	32
Free miners' certificates issued .....	110

## KAMLOOPS MINING DIVISION.

REPORT BY E. FISHER, GOLD COMMISSIONER.

I have the honour to submit the annual report on the Kamloops Mining Division for the year ending December 31st, 1919.

There has been no active development-work during the past year, although considerable interest has been shown in the Division by outside parties. Assessment-work has been well kept up and the number of new claims recorded shows a large increase from the previous year.

The *Iron Mask* mine has been working steadily throughout the year, and production has, I understand, been about the same as for 1918.

Steady development-work has been carried on at the *Queen Bess* group. The concentrator has been completed, a shipment of silver-lead concentrates was made, and a considerable amount of zinc concentrates is being held at the mine pending favourable market conditions.

The *Lydia* group, where a large amount of work has been done, was closed down and the option allowed to lapse.

The option of the Granby Company on the *Copper King* and *Camp McLeod* groups has also been dropped, but the owners expect that work will be starting up again shortly now that the trail into the claims has been completed.

Work was also stopped and the option allowed to lapse on the *Homestake* group, but negotiations are now under way for a new option.

Properties were examined by mining men at Birch Island, Barriere river, Adams lake, Vavenby, and Seymour arm, and favourably commented on, and it is expected as a result of these examinations there will be considerable activity on the properties at these places during the coming year.

Active work was started on coal properties at Chu Chua by a Seattle syndicate, which has obtained an option on the properties, and a seam of excellent quality of coal about 40 inches wide is now being worked. A shipment of four cars of coal a month is being made to the *Queen Bess* mine at Blackpool.

Near the end of the placer-mining season some good coarse gold was discovered by James D. McKay on 3-Mile creek, a tributary of Nehalliston creek, on the North Thompson river, and as a result a number of claims were located, but owing to the lateness in the season little work could be done. What was done, however, gave promising results, and it is the intention of the owners to push the prospecting of these claims as soon as conditions permit.

A few placer claims were taken up on Louis creek, but I have no report as to the result of the work done there.

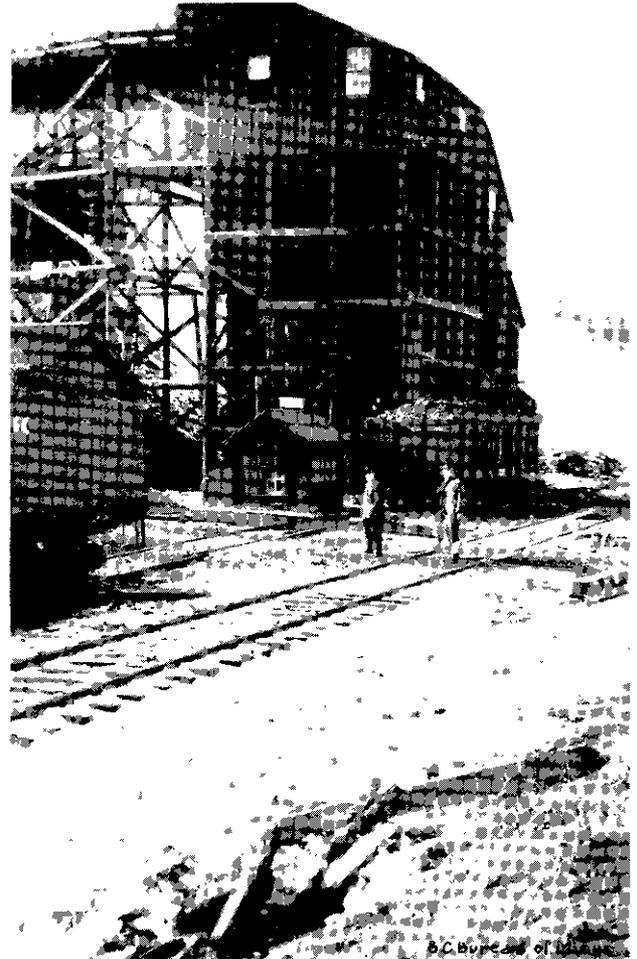
OFFICE STATISTICS—KAMLOOPS MINING DIVISION.

Free miners' certificates .....	369
Mineral claims recorded .....	236
Placer claims recorded .....	30
Placer creek leases .....	2
Certificates of work issued .....	174
Bills of sale .....	37
Mining receipts .....	\$4,034.25



B.C. Bureau of Mines

**Queen Bess Mine, Kamloops B.C.**



B.C. Bureau of Mines

**Fleming Coal Co.—Loading-bunkers.**

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## WESTERN DISTRICT (No. 6).

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REPORT BY WM. M. BREWER, RESIDENT ENGINEER.

### INTRODUCTION.

The Western Mineral Survey District (No. 6) includes the seven most westerly Mining Divisions in the Province. These are Alberni, Clayoquot, Quatsino, Victoria, and Nanaimo on Vancouver and adjacent islands, and New Westminster and Vancouver on the Mainland.

It is unnecessary to repeat the description of the sections into which, for convenience of reference, these various Mining Divisions of the Western Mineral Survey District are divided, as these were published in the Annual Report for 1918.

Although the number of shipping metalliferous mines in District No. 6 has not been increased during 1919, yet progress in the mineral industry has been satisfactory because systematic development-work on a larger scale than in the past has been done on several mineral claims with very gratifying results. In this connection it is expected that the Consolidated Mining and Smelting Company of Canada will install two concentrating-mills—one of 500 tons capacity on the *Sunloch* mine on the Jordan river, in Victoria Mining Division, and the other in the vicinity of Elk lake near the South-east arm of Quatsino sound—to treat the ore in the *Old Sport* mine. It may be well to note that, although it is generally recognized that the Consolidated Company owns the control in both of these properties, they are recorded as being owned by the Sunloch Mines, Limited, and the Coast Copper Company; the first named operating the *Sunloch* mine and the last named the *Old Sport* mine.

The introduction of corporations possessed of ample capital to thoroughly and systematically develop mining properties in No. 6 District instead of attempting to ship ore before any quantity of "actual" or "positive" ore has been blocked out is a factor of very great importance to the industry. A large proportion of the failures in the mining industry is the result of attempts to open new mining properties by individuals and corporations which either do not possess sufficient cash capital or else fail to realize how necessary it is to carry on development-work to the point where sufficient "positive" ore is blocked out to determine the productive capacity of the property, so that every economy in construction and operation of the mining and metallurgical plants can be taken advantage of.

In this connection the *Indian Chief* group of mineral claims on Sidney Inlet, west coast of Vancouver island, is an illustration. In 1916 a concentrating-mill was rushed to completion in order to make shipments. In this mill boilers were installed to generate steam for power instead of taking advantage of a near-by water-power. Necessary development-work in the mine was neglected. In consequence it was found to be impossible to supply the mill with a grade of ore sufficiently high to pay and the mill and mine were closed down. Later new capital was subscribed and a new manager appointed in 1918, who has since directed all his efforts towards extending the development-work until he has demonstrated that there is sufficient "positive" ore blocked out to warrant the installation of a water-power plant instead of steam, and thus reduce the cost of treating the ore in the concentrating-mill nearly \$2 a ton by cutting out the necessity of purchasing coal for the boilers.

The year 1919 has witnessed the first production of manganese ore and talc in District No. 6. Manganese was mined on the group of mineral claims known as *Hill 60* near the outlet of Cowichan lake, and shipped to the Billroy Alloys Company, Tacoma, Wash.

Talc of good quality was mined from a deposit on Wolf creek, a tributary of Leech river, in the Victoria Mining Division, from which it will be shipped to the paper-mills by way of the Canadian National Railway, the track of which is about half a mile from the deposit.

The completion of the Island Division of this railway should have considerable influence in promoting the progress of the mining industry along its route, especially in the vicinity of Leech river, where there are several occurrences of talc and some of gold-bearing quartz in the Leech River formation of rocks, which Clapp refers to as the oldest rocks on Vancouver island and as belonging to the Carboniferous period. This formation occupies a belt which

averages about four miles in width and extends across Vancouver island, with its eastern boundary near Goldstream river and its western at Port San Juan.

Owing to a popular demand that every encouragement be offered by the Government to assist the establishment of the iron and steel industry in British Columbia, legislation was passed at the 1919 session of the Legislature entitled the "Iron-ore Supply Act." A great deal of the writer's time was occupied during the year in administering this Act, which will be referred to later in this report under the head of "Vancouver Mining Division," in which the plants for making experiments are located.

The coal-mining industry is the most important in District No. 6, but the conditions with regard to it are so fully covered in the reports of the Inspector of Mines that in order to avoid duplication the writer will only make brief reference to it later under the heading of "Nanaimo Mining Division."

Prospecting for oil has been carried on by a few of the companies organized locally, but to date the results have not been satisfactory. The lower Fraser valley has been the scene of activity during 1919. This feature of the mining industry will be referred to in greater detail under the heading of "New Westminster Mining Division."

The conditions with regard to labour in the mining industry in District No. 6 have during 1919 been satisfactory indeed, exceptionally so when compared with the unrest resulting in strikes in other sections of the world in the mining and other industries. Even during the big strike in Vancouver the leaders were unable to create any discord amongst the miners either in the coal or metalliferous mines in the Western Mineral Survey District of British Columbia. For some years past the colliery-owners on Vancouver island have been working on the collective-bargaining system. Each company bargains with a committee elected by pit-head ballot from amongst its own employees, and this system is found to work so satisfactorily that no difficulty presented itself at the conferences held a short time back when new wage schedules were adopted for a term of three years from the autumn of 1919 that are mutually satisfactory. The miners' committees are elected by their fellow-workers in each mine, and the general managers of the companies take a broad view, and are always willing to receive the committee from their own employees for conference and discussion of any grievances, which conferences are carried on by both manager and committee in a friendly spirit.

One of the most gratifying features with regard to the coal-miners is the general desire to acquire knowledge relative to mine-rescue and first-aid work. Each colliery company encourages the miners to form teams under competent captains and to meet in competition for prizes at stated intervals, when the rivalry displayed equals that amongst the football or baseball teams.

The enthusiasm shown by the miners is illustrated by the fact that the Sunday morning lectures held at Nanaimo are usually attended by about 200 men, who show such interest and undivided attention that the doctors, mine managers, and others who prepare addresses on subjects connected with first aid, safety first, explosives, mine gases, etc., are well repaid for their efforts.

So far as regards the labour conditions in the metalliferous mines in District No. 6, the Britannia Mining and Smelting Company, Limited, employs a larger number of miners, millmen, and other classes of labour than any other metalliferous mining company in the district. The management in giving employment is endeavouring, as far as possible, especially since the Armistice was signed, to select men who saw service overseas, and at the time of the writer's visit to the mine in November last he was informed by the assistant manager that there were then nearly 400 returned soldiers on the pay-roll, who without any exception were giving complete satisfaction.

The production of District No. 6 during 1919 was: Copper, 17,062,100 lb.; gold, 5,514 oz.; silver, 104,806 oz.; manganese, 530 tons; coal, 1,699,348 tons (of 2,240 lb.).

The lack of copper-smelting facilities in the district, it is expected, will be rectified some time during the summer of 1920, when the Ladysmith Smelting Corporation proposes to blow in the Ladysmith smelter after it is overhauled, remodelled, and improved. W. J. Watson, the smelter manager, advises the writer that his company has carried development-work on their Latouche Island copper-mine to the point where there is an ample supply of ore blocked out, available for shipment at regular intervals to enable the smelter to be kept in continuous operation independent of any custom ore. The company will, however, be prepared to treat

custom ore in connection with its own, and has bonded some properties in District No. 6 in order to be assured of a sufficient supply of fluxes.

In concluding the introduction to his report, the writer desires to express his thanks and appreciation for the uniform courtesy, many favours, and assistance he has at all times received from mine managers, the staffs of mining companies, prospectors, and mining men generally. He also desires to thank the staff of the British Columbia Branch of the Geological Survey of Canada, as well as visiting engineers and geologists, for many favours and much valuable assistance rendered.

#### CONVENTIONS.

In 1919 the city of Vancouver was the scene of two notable conventions relating to mining. The first was held in March as an International Mining Convention organized by the British Columbia Chamber of Mines, and the second was held in November as the annual meeting of the Canadian Mining Institute. The success which attended both of the functions was to a great extent due to the energy, initiative, and perseverance of Dr. Edwin T. Hodge, Professor of Geology at the University of British Columbia, who accepted the onerous duties which fall to the lot of chief organizer of such events. He was ably assisted on both occasions by committees formed from resident members of the Canadian Mining Institute and the Chamber of Mines.

Several interesting and instructive papers were read which provoked considerable discussion, and were fully reported by the daily as well as the technical press, which was well represented at the meetings and was quite generous in the quantity of space devoted to the reports of the proceedings.

T. A. Rickard, editor of the *Mining and Scientific Press* of San Francisco, attended the convention in March as a guest of honour, when he graciously acceded to the request to address the meeting. This he did at an evening session, taking for his subject, "Mining as an Investment." The attendance on each occasion was large and the mining sections in the Pacific States south of the International Boundary were well represented by mining engineers, geologists, and metallurgists.

The annual meeting of the Canadian Mining Institute was attended by H. Mortimer Lamb, the general secretary of the institute, who, in company with many of the members resident in Eastern Canada, travelled across the continent in private cars. Some of these members presented papers on mining and metallurgy, which were followed by much instructive and interesting discussions. Members resident in the northern, eastern, and southern sections of the Province attended in considerable numbers, and the meeting was generally regarded as being one of the most successful in the annals of the institute.

Following the International Convention an excursion to Britannia Beach, Howe sound, was participated in by about 100 of the delegates, who were conducted through the mill and a part of the underground workings at the mine of the Britannia Mining and Smelting Company, as well as being hospitably entertained by the officials of the company, for whom three cheers and a tiger were given.

Following the annual meeting of the Canadian Mining Institute, some of the members enjoyed a trip to the Nanaimo, South Wellington, and Cassidy coal-mines on Vancouver island, while others made an excursion to Britannia Beach and were afforded an opportunity to examine the concentrator and electric power plant. Both parties expressed great appreciation for the hospitality and courtesy extended by the officials of the several companies, whose plants were visited.

In this connection reference may be made to the acceptance by Chas. Camsell, of the Geological Survey of Canada, to the secretaryship of the Western Branch of the Canadian Mining Institute, and also that the name of this branch will in future be known as the "British Columbia" Branch instead of "Western."

#### PROSPECTING.

In the 1918 Report of the Minister of Mines the writer devoted some space to the subject of "Favourable Districts to prospect," and in the present report desires to emphasize those remarks, because during 1919 prospectors report the discovery of good properties in some of the sections referred to in the 1918 Report. The mountains between Howe sound and Jervis inlet and north-westerly from the latter were recommended.

It is gratifying to be able to record that in one section which was referred to in the writer's report for 1918 as a favourable district to prospect, at least one party of prospectors, of which Thomas Lillie, of Pender harbour, was a member, was successful in discovering during 1919 some bodies of chalcopryrite ore carrying good values in copper as well as low values in gold and silver, near Mount Diadem, westerly from the mouth of Britain river, which flows into the west side of Jervis inlet.

In this connection it may also be noted that E. M. Allison, a prospector of Sardis, with associates, made discoveries of copper-bearing ore in the Chilliwack Lake section of the New Westminster Mining Division. These discoveries are situated near the easterly border of the granite batholith of the Coast range, south-easterly from the *Lucky Four* group, which is in the Cheam range of mountains.

While the number of working prospectors who have been exploring the mountains in District No. 6 has been greater during 1919 than for several years past, yet there is room for many more, especially in the mountains north-westerly from Jervis inlet on the Mainland, also on the islands between the Mainland and Vancouver island, as well as on the west coast of that island.

Wm. Poole, of Nootka sound, with partners, is reported to have made discoveries with promising possibilities in the mountainous country adjacent to Tahsis canal, between Nootka sound and Esperanza inlet, on the west coast of Vancouver island, while other discoveries are reported to have been made on Mount Brenton, in the Victoria Mining Division, by an old-time prospector named Jimmy O'Rourke.

All of the before-mentioned sections are strongly recommended to the attention of prospectors, for they cover a vast territory which up to date has only been scratched over. In fact, the whole of District No. 6, with the exception of the portions that are covered by the coal-measures, offers good opportunities to the prospector who is energetic, industrious, and persevering.

The opportunities to-day are better than twenty years ago in this respect, because at present several large mining corporations have their engineers and scouts in the field prepared to examine prospects, which, if attractive and possessed of promising possibilities, they are willing to bond at reasonable prices, provided sufficient time is allowed to permit of doing development-work to determine the value of the prospects and the possibility of developing them into commercial mining propositions.

As proof of this last statement it might be noted that during 1919 the *Lucky Four*, *Big I.*, and *Sunloch* groups of mineral claims have all been bonded; the first named by the American Smelting and Refining Company of the United States, usually referred to as the Guggenheim interests, and the last two by the Consolidated Mining and Smelting Company of Canada; while the writer is reliably informed that the prospects located by Thomas Lillie and partners near Mount Diadem and the *White* group on Deer creek, west coast of Vancouver island, have been bonded by Vancouver syndicates. The old *Lenora* mine on Mount Sicker has been bonded by G. D. B. Turner, M.E., and associates, and a group of claims on Mount Brenton has also been bonded by Louis Levansaler, M.E., on behalf of a syndicate of Tacoma capitalists.

On the Mainland the old *Blue Bells* group of mineral claims near Frederick arm and the *Dawn* group on Thurlow island have been bonded by the Ladysmith Smelting Corporation, Limited.

Such transactions show that the mining industry in District No. 6 is active and promises to progress with rapid strides in the near future, also that when the writer in his report for 1918 recommended some of the before-mentioned properties as good investments for capital, his judgment has been considered good by the representatives of capital seeking mining investments.

The section of the Mainland which forms a part of the Nanaimo Mining Division and lies northerly from the heads of Toba, Bute, and Knight inlets offers every opportunity to the prospector. This district may be said to be *terra incognita*, except along a portion of the Klinaklini river, which flows into the head of Knight inlet. Although at the present time the section is handicapped by lack of transportation, yet the navigable inlets which penetrate the Mainland for several miles afford the prospectors a good chance to establish central camps to which they can transport tools, supplies, etc., by water, and gradually explore the country from the rivers and many creeks, tributaries of those main streams.

This section can also be approached from the easterly direction from Chilcotin plateau, where several large cattle-ranches are located, but, in the writer's opinion, exploration could be carried on more satisfactorily by penetrating from the Coast than by the alternative route.

## ALBERNI MINING DIVISION.

Except that there has been the regular assessment-work done on the mineral claims that have not yet been Crown granted, and that some prospecting has been done in the mountains adjacent to Uchucklesit harbour and Henderson lake, Barkley sound, there is practically nothing to record with regard to activity in the mining industry in the Alberni Mining Division during 1919.

The prospects for the coming year, 1920, appear to be brighter than usual, for the reason that it is reliably reported that the Consolidated Mining and Smelting Company of Canada has taken a long bond on the *Big I*. group of mineral claims at the head of Drinkwater river, about ten miles by trail northerly from the head of Great Central lake, and proposes to thoroughly and systematically prospect the group by diamond-drill borings and working-openings. This group was described in the Annual Reports of the Minister of Mines for 1906 by H. Carmichael and for 1916 by the writer.

The fact that the Canadian Pacific Railway Company is building a branch from the Alberni branch of the Esquimalt & Nanaimo Railway to the foot of Great Central lake will relieve to some extent the handicap of lack of transportation, which has in the past proved quite a difficult barrier to overcome when attempting to interest capital in developing the centre of Vancouver island.

## CLAYOQUOT MINING DIVISION.

A few prospectors and some returned soldiers have been working in the Clayoquot Mining Division during 1919. Except on the *Indian Chief* group of mineral claims on Sidney inlet, there has not been any marked activity in the mining industry, but there has been sufficient to warrant drawing attention to it in detail in the following report.

## TOFINO SECTION.

*Kennedy Lake Subsection.*

During the past summer the writer recommended that the trail up Elk river from the head of Kennedy lake be cleared out and repaired. This was done and prospectors can now easily travel for about three miles above the landing on the *Leora* mineral claim.

There are about ten mineral claims recorded on Elk river above the *Leora* claim, including the *Rose* group of four claims, that is Crown-granted. No work other than the usual annual assessment-work has been done on any of the claims for several years, although narrow veins of gold-bearing quartz occur on the *Rose* and *Leora* properties, while on others are outcroppings of copper-sulphide ore of good grade. Under present conditions with regard to transportation the properties are badly handicapped, not only because of the rapids between the foot of Kennedy lake and Kennedy river, but also because of the rapids in Elk river, which prevents navigation above its confluence with Kennedy lake, while the rapids at the foot of the lake hinders gasoline-launches from entering the lake from Tofino inlet. Some time in the future this handicap will possibly be removed through the Canadian Pacific Railway extending the branch which is now being built to the foot of Great Central lake. Until some such railroad-construction is carried out it is quite unlikely that any mining operations of importance will be attempted on Elk river.

**Wanderer  
Group.**

L. Grant, of Tofino, the owner of this group of two mineral claims near the head of Kennedy lake, reports that he has been further prospecting the claims since they were examined in 1918, when they were reported on in the Annual Report of the Minister of Mines for that year, page 262. He says he has made arrangements to do considerable more work during 1920, and proposes driving a drift-adit on the gold-bearing quartz vein at such a depth as will prove it to a depth of at least 100 feet. The work done during 1919 exposed a quantity of high-grade, free-milling, gold-bearing ore, also indications that the vein maintains its continuity with considerable persistence. Several fine specimens of native gold in quartz were found during the course of work in 1919.

The transportation problem is not difficult to solve so far as this property is concerned, because it is only about a quarter of a mile from the lake-shore at an elevation of about 300 feet above the level of the lake, and the ore being well adapted for treatment by concentration, it can be reduced near the mine-workings and the concentrates shipped in such quantities as can be easily handled at the rapids, and transferred to deep-draught vessels at the Clayoquot Cannery wharf near the foot of the rapids.

*Northern Crown Group.*—J. E. Martin, of Tofino, the owner of this group of mineral claims, which was described in the Annual Report for 1918, page 263, has continued development-work during 1919 on a limited scale. This work has resulted in demonstrating that the prospect has quite promising possibilities.

*O.K. Group.*—No work has been done in 1919 on this group of mineral claims, which was described on page 262 of the Annual Report for 1918. The writer is informed that the group was examined by a mining engineer representing Eastern capital, but could not ascertain the result of the examination.

#### DEER CREEK SUBSECTION.

This group consists of five mineral claims known as the *White, Norman, White Group, Walton, Dunlop, and Alpha*, situated on the northerly side of Deer creek about a mile and a quarter above its mouth at the head of Tofino inlet, at an elevation of about 2,500 feet above sea level. The group is owned by Duncan McMillan, of Duncan, and Wm. Walton, of Clayoquot, and is reached by following a good trail from the head of Tofino Inlet.

*Geology.*—The country-rock on the *White* group is mainly diorite very much altered, sheared, and fissured. Associated with the diorite are zones of contact metamorphism which in places appear to attain very considerable widths. In the zones of contact metamorphism the non-metallic minerals garnet and epidote occur in large quantities and form the gangue, in which occurs lenses, masses, and small particles of copper ore, chiefly chalcopyrite, disseminated through it. The fissures in the shear-zones in the contact-metamorphic rocks afford very favourable opportunity for the deposition of ore-bodies.

*Characteristics of the Ore-deposits.*—There are quite a number of outcroppings of copper ore, chiefly chalcopyrite, on a bench about 2,500 feet elevation above sea-level and near the mine cabin. Some of these appear to have slipped down from higher altitudes in the side of a mountain which forms a prominent landmark. It is the divide between Deer and Tranquil creeks, and there is a wide fissure in the mountain-side which apparently is the source of some of the chalcopyrite ore found on the bench.

Samples from two of the outcroppings or lenses near the cabin assayed:—No. 1: Gold, trace; silver, 1.6 oz.; copper, 11.5 per cent. No. 2: Gold, trace; silver, 1.6 oz.; copper, 12.5 per cent. These samples were taken when an examination was made in 1918. No samples were taken on November 8th, 1919, when the property was again examined, because there was practically no change in conditions where the samples were taken, except that a larger quantity of ore is exposed than in 1918, the quality of which is so obvious to the naked eye that further sampling was not necessary. There is about 100 tons of chalcopyrite ore exposed in the several open-cuts on this part of the property.

During the past season considerable prospecting-work has been done in order to determine the source or origin of the ore exposed in the open-cuts. Most of this work has been confined to prospecting the wide fissure in the side of the mountain before mentioned.

At a point about 100 feet higher elevation than the cabin there is an outcropping of gossan or iron-capping with some chalcopyrite ore in the precipitous face of the fissure, measuring about 15 feet high by 15 feet wide, but in such a position as to make it very difficult to work. For that reason an adit has been started about 25 feet below the outcropping. This has not been driven sufficiently far to expose solid ore, but the face, which is in metamorphic rocks with much garnet and epidote, indicates the possibility of exposing an ore-body within a short distance.

About 50 feet higher elevation than the occurrence of the gossan-outcrop there is a bench on the mountain-side extending in a south-westerly direction, along which the fissure mentioned has been traced and prospected to some extent for about 300 feet, which work has exposed some chalcopyrite ore disseminated through the contact-metamorphic rock which fills the fissure between walls of dioritic rock.

#### CENTRAL WEST COAST SECTION.

##### *Bedwell Sound Subsection.*

On November 9th and 10th a visit was made to Bear river, which flows into Bedwell sound, for the purpose of making an examination of the *Seattle* and *Ptarmigan* groups of mineral claims, but a severe rain-storm accompanied by snow in the mountains, together with the impassable condition of the trail to the *Seattle* group, rendered it impossible to make the

examinations within the time at the writer's disposal; consequently such examinations had to be postponed until the season of 1920.

It is expected that operations will be resumed on this group of mineral claims during 1920, as Mr. Johnson, the chief engineer for the Ptarmigan Copper Mines, Limited, returned from service overseas during the summer of 1919, and paid a flying visit to a portion of the property in order to ascertain the conditions; as since work was suspended immediately war was declared in November, 1914, there has been no caretaker on the property. Owing to this the camp buildings at the mouth of Bear river are in a state of disrepair, and the contents, which included a large quantity of dynamite as well as general mining supplies, are ruined. The cable and terminals of the aerial tramway which were taken from the *Tyee* mine on Mount Sicker to be used for transporting ore down the Ptarmigan mountain are extremely rusty, but possibly will be found in good enough condition for use for light loads. The wagon-road which the Ptarmigan Copper Mines, Limited, constructed from the beach up the Bear River valley is in quite a bad condition and unfit for hauling even light loads over until repairs are made.

The location of the *Ptarmigan* group of mineral claims is very interesting, because it is on the western slope of the Big Interior range of mountains, which forms the backbone of Vancouver island, at an elevation of about 6,500 feet above sea-level, and from which the waters flow in three directions—northerly towards Buttle lake and Campbell river, southerly towards Great Central lake and Alberni canal, and westerly towards Bear river and Clayoquot sound.

#### *Sidney Inlet Subsection.*

This group contains eight mineral claims owned by the Tidewater Copper Company, Limited; H. B. Price, of Victoria, general manager. The group is located in the mountains northerly from the West arm of Sidney inlet, with the main mine-workings connected with the concentrating-mill at the beach by an aerial tramway. Although the *Indian Chief* group has been described in the Annual Reports of the Minister of Mines for 1917 and 1918, it is again referred to because of the extensive development-work that has been done during 1919 and which was examined by the writer on November 4th, 5th, and 6th.

*Geology.*—Although the geologic conditions which surround the *Indian Chief* group were described in detail in the Report for 1917, it is necessary to again refer to those conditions in order to convey an intelligible idea of the results from the further development-work that has been done since that report was made.

The rock classified in that Report as grey granite has since been more precisely classified by Victor Dolmage, of the Canadian Geological Survey, as granodiorite. This rock extends from the beach up the side of a mountain to an elevation of about 1,300 feet, where it contacts with garnetized limestone, in which occur ore-bodies composed chiefly of bornite with small quantities of chalcopyrite and chalcocite. A portion of the summit of the mountain referred to is on the *Scollet* and *Victor* mineral claims of the *Indian Chief* group, where it reaches an elevation of about 1,900 feet, but in a westerly direction from these claims the summit is at a much higher elevation. The rock on part of the summit of the mountain is andesite, which appears to occur as an intrusion in the metamorphosed limestone, and in No. 3 East adit, driven into the mountain at an elevation of about 1,500 feet, this andesite rock is well exposed. At the face of the No. 2 East adit, or "Green" drift, the contact between limestone and andesite is also well defined at an elevation of about 1,550 feet, where the andesite appears to form the north-westerly boundary of the ore-bodies on the southerly side of the mountain.

On the northerly side of the mountain a contact occurs between limestone and granodiorite as an intrusion in the metamorphosed limestone, and in No. 3 East adit, driven into the mountain apparently corresponds with that occurring between similar rocks on the southerly side of the mountain, and also appears to mark the boundary of the ore-deposits; at least up to the present time no outcroppings of ore have been found on the mountain-sides below the line of this contact.

*Characteristics of Ore-deposits.* The ore-deposits on the *Indian Chief* group of mineral claims belong to the contact-metamorphic type. The mineralization consists of bornite, some chalcocite, chalcopyrite, magnetite, and some iron pyrite in a gangue composed of garnet, epidote, and metamorphosed limestone.



There are apparently two systems of ore-bodies, as shown by the accompanying sketch; these are known as the "South" and "North." The "South" system is composed of the lenses and veins which occur on the southerly side of the mountain and have been developed by adits Nos. 1, 2, and 3, Bonthrone, and No. 2 East, or "Green" drift; the "North" system is composed of the ore-bodies which occur on the northerly side of the mountain and have been developed by the North side adits Nos. 1 and 2. There is approximately 450 feet of ground that has not yet been prospected between the present face of No. 2 South adit at an elevation of 1,550 feet and the face of No. 1 North adit at an elevation of 1,726 feet.

In the following report the characteristics of the "South" system of ore-bodies will be discussed first, and it is interesting to note that, although the surface rocks exposed over the unprospected zone between the "North" and "South" systems of ore-bodies indicate the rock formation to be an intrusion of barren andesite, yet in the face of the No. 2 South adit on November 4th last ore was exposed, an average sample of which assayed 0.73 per cent. in copper, while a picked sample assayed 1.2 per cent. in copper. This exposure occurs at a point about 100 feet in a north-westerly direction from the junction of the No. 2 East adit, or "Green" drift, with the main No. 2 adit, which is about 800 feet from the portal of the main No. 2 adit.

The occurrences of ore exposed by the No. 2 South side adit on the south side of the mountain constitute a series of swells or enlargements in a vein, the strike of which is irregular, and apparently follows the line of least resistance in the metamorphosed limestone, because for about 200 feet from the portal the line of strike of the ore-body is north-westerly; then for about 375 feet it strikes in a north-easterly direction, when the strike changes again to north-westerly for about 250 feet, where it turns almost directly towards the west and continues in ore in that direction for a distance of 156 feet to the face of the West drift on November 4th, 1919. About 50 feet northerly from the junction of the main No. 2 South side adit and the West drift from it, just referred to, a ledge of barren white limestone is exposed, which apparently forms the northern boundary of the ore-body driven on by the main No. 2 South side adit.

The No. 2 South side adit is driven through the barren limestone for a distance of 80 feet, when a vein of ore is intersected which strikes in an easterly direction, is 5 feet wide, and corresponds with the ore exposed in the No. 2 East adit, or "Green" drift. After crosscutting this ore for 5 feet andesite occurs, and the main No. 2 South side adit is continued through that rock for about 100 feet, when the ore is exposed near the face of the drift, from which samples showed the assay results already mentioned.

The portal of the No. 2 East adit, or "Green" drift, is 550 feet northerly from the portal of the main No. 2 South side adit and within a few feet of the same elevation. This adit is driven towards the west and was started in the mountain-side as a prospecting-drift to determine the value of a mineralized outcropping which assayed about 1 per cent. in copper. It was driven 200 feet to the point where it formed a junction with the No. 2 main South side adit. The "Green" drift is driven in ore the entire distance, and samples taken by the superintendent in 5-foot sections showed by assay an average of 1.2 per cent. copper for the first 100 feet and 1.4 per cent. from that point to the face. At a point 100 feet in from the portal of the "Green" drift a crosscut is driven 73 feet long in ore. For a distance of 28 feet in the crosscut, starting from the main drift, samples taken in sections of 5 feet by the superintendent showed an average content in copper of 4.8 per cent., while the next 32 feet samples in the same manner showed an average content in copper of 2.6 per cent.

At a point in the main No. 2 South side adit about 100 feet beyond the junction of the "Green" drift with the adit a horizontal diamond-drill hole is bored about 200 feet long in a south-westerly direction, which intersected an ore-body, presumed to be an extension of that exposed in the "Green" drift, at a point about 70 feet from the main No. 2 South side adit and about 100 feet west of the face of the "Green" drift. The core from this drill-hole showed 5 feet of ore that assayed 1.5 per cent. copper, and the core also showed that this ore occurred between andesite walls. The diamond-drill boring was continued in andesite until it intersected the West drift from the main No. 2 South side adit near its face, where ore occurs. The drill-cores assayed from 2 to 2.64 per cent. in copper for about 30 feet. When the West drift from the No. 2 main South side adit was driven to intersect the diamond-drill hole and a working-opening made in the ore-body, samples taken of 5-foot sections and assayed by the superintendent showed a copper content of from 1.5 to 2.1 per cent.

The diamond-drill boring was continued in a south-westerly direction for 146 feet from the south-westerly face of the ore in the West drift. Ore was not exposed in this part of the hole for a distance of 50 feet, when the drill-cores showed ore, which was continuous for 56 feet farther, and for that distance the cores assayed an average of 2.1 per cent. copper. Beyond that point andesite was exposed continuously to 146 feet, which was the end of the drill-hole at the time of examination on November 4th, 1919. The management proposes to continue this drill-hole to intersect at depth the ore-body exposed in the open-cut above the No. 1 South side adit. The drill-boring is expected to intersect the ore about 200 feet vertically below the level of that adit and about 600 feet horizontally in a south-westerly direction from the face of the West drift from the No. 2 main adit.

A second examination of the property of the Tidewater Copper Company has revealed interesting and important information with regard to the ore-body exposed underground by the diamond-drill boring from the West drift from the No. 2 main South side adit. A working-opening has been driven from near the face of the West drift in a south-westerly direction a distance of 146 feet, or to the end of the diamond-drill hole. The working-opening exposed the same conditions as regards the occurrence of ore as were shown by the diamond-drill cores and referred to above, that an ore-body occurred nearly 60 feet wide.

At a point in the last-named working-opening about 116 feet from the West drift the ore-body is exposed by drifts driven in both north-west and south-east directions for a total distance of 160 feet, with both of the faces of these drifts still in ore on March 31st, 1920. This ore, sampled every 5 feet with hammer and moil, assays an average of a little over 2 per cent. copper. As this ore-body is exposed in the underground workings nearly 400 feet below the surface of the mountain, it is possible that a tonnage of approximately 250,000 tons may be available without sinking.

The conditions with regard to the "North" system of ore-bodies are that they occur as contact-metamorphic deposits at the immediate contact between metamorphosed limestone and granodiorite. So far as at present known, ore-bodies occur only on the Victor mineral claim, and apparently there are two distinct deposits. One of these is developed by No. 1 North side adit, which was fully described by the writer in the Annual Report of the Minister of Mines for 1917, page 252, and as no further development-work has been done at that point since, it is not necessary to repeat the description in the present report.

The second ore-body is developed by No. 2 North side adit and is apparently connected with the ore-body exposed in the old "Robinson" cut at an elevation of about 60 feet below the No. 1 North side adit. The "Robinson" cut and a shallow shaft were work done for assessment about 1902, when ore carrying less than 5 per cent. copper could not be mined, shipped, and smelted profitably.

The ore-body exposed in No. 2 North side adit appears to strike in a N. 70° W. direction and dips nearly vertical, with a slight inclination towards the north. The course of the adit is south; consequently it does not crosscut the ore-body exactly at right angles. The crosscut adit is 86 feet long. For the first 40 feet it intersects mineralized material which, sampled by the superintendent in 5-foot sections, shows the following assay values in copper from 0.5 per cent. at the portal to 1.5 per cent. at a point 40 feet in from the portal. The remainder of the crosscut adit, sampled in 5-foot sections by the superintendent, gave the following assays in copper:—

Sample No. 9, 45 feet from portal	} 3.97 per cent.
Sample No. 10, 50 feet from portal	
Sample No. 11, 55 feet from portal,	2.17 per cent.
Sample No. 12, 60 feet from portal,	2.17 per cent.
Sample No. 13, 65 feet from portal,	1.85 per cent.
Sample No. 14, 70 feet from portal,	3.99 per cent.
Sample No. 15, 75 feet from portal,	6.56 per cent.
Sample No. 16, 80 feet from portal,	3.6 per cent.
Sample No. 17, 86 feet from portal at face,	2.62 per cent.

Whether there is any relationship between the ore-body exposed in the No. 1 North side adit and the No. 2, just described, has not yet been determined.

*Development.*—The development-work done in addition to surface prospecting since the property was examined in 1917 consists of the following: No. 2 South side adit advanced 400 feet; West drift, No. 2 South side adit, advanced 210 feet; No. 3 South side adit advanced 200

feet; upraise from No. 2 South side adit, advanced 40 feet; No. 2 East adit, "Green" drift, driven 200 feet; crosscut from No. 2 East adit, "Green" drift, driven 73 feet; diamond-drilling, about 1,000 feet; No. 2 North side adit driven 86 feet.

At the concentrating-mill at the beach there has been much activity during the past year. A new terminal for the aerial tramway has been constructed and new ore-bins built above the mill. The mill has been remodelled and its capacity increased about 150 tons a day, so that its capacity is now fully 200 tons of ore a day.

The water-power in Mill and Indian creeks has been developed to furnish 350 horse-power under a head of 560 feet. The length of flume from Mill creek to the penstock is 800 feet and from Indian creek to the penstock 4,500 feet. The length of pipe-line from the penstock is 1,600 feet. The water-power is being installed in four units, and steam-power will be abandoned except in a case of serious emergency. One unit of the water-power will drive the rock-crushers, ball and tube mills; one unit will furnish power for flotation plant; one unit for the compressor plant and another for lighting purposes.

The old bunkers on the wharf have been torn down and in future concentrates will be delivered from the mill to the ship by belt-conveyors.

#### *Nootka Subsection.*

There has been considerable prospecting during 1919 in the Nootka subsection of the Central West Coast section of Clayoquot Mining Division. This has been confined chiefly to the mountains bordering on the Tahsis canal and Gold river. As mineral claims were only located late last summer, none have been yet examined, but the section, because of the geologic conditions, should prove a promising one to prospect. The prevailing rock formations are of the contact-metamorphic type, and one of the most extensive deposits of magnetite ore in British Columbia occurs in the belt of country which extends from Gold river to Tahsis canal. This is located near the head of Head bay, Thupana arm of Nootka sound, south-easterly from the part of Tahsis canal where most of the prospecting has been done.

#### QUATSINO MINING DIVISION.

Since the spring of 1917 there has been but little general progress in the mining industry in the Quatsino Mining Division on the north-west coast of Vancouver island, because, except on the *Old Sport* group of mineral claims on Elk lake, in the South-east Arm section of the Mining Division, there has been no development-work of any considerable extent done in the other sections of the Division.

Early in 1919 the *Yreka* group of mineral claims on the South-east arm of Quatsino sound was bonded by the Tidewater Copper Company, Limited, of Victoria, and the *Yreka* was examined by H. B. Price, the new manager of that company, who proposed working it in conjunction with the *Indian Chief* group on Sidney Inlet, but later decided to await the results of the extensive development-work he was carrying on at the last-named mine before starting work on the *Yreka*. There is some probability that during 1920 he will reopen the *Yreka* and ship the concentrating-ore from that property to the flotation plant at Sidney inlet.

Some prospecting was done on mineral claims near Holberg, at the head of the West arm of Quatsino sound, also in the vicinity of Klaskino inlet near Cape Cook, in a southerly direction from the entrance to Quatsino sound.

Operations in this last-named section are much handicapped by the fact that, being exposed to the storms in the Pacific ocean, it is very difficult to make boat-landings except when the weather is quite fair and the sea calm. Some years ago considerable work was done in this vicinity and specimens of free gold in a quartz vein were obtained, but all work on the mineral claims was abandoned and no attention has been paid to this portion of the west coast until last summer.

#### SOUTH-EAST ARM SECTION.

##### *Elk Lake Subsection.*

**Old Sport Mine.** The Coast Copper Company, under the management of Wm. Clancy, has prosecuted development-work vigorously on the *Old Sport* group of mineral claims during 1919. The Coast Copper Company is a subsidiary to the Consolidated Mining, Smelting, and Power Company of Canada. The company

bonded the *Old Sport No. 1, Penstock, Idaho, Edith, and Machete* groups of mineral claims in 1916, and after appointing Wm. Clancy as manager, began a systematic extension of the development-work previously done by Clancy for the Quatsino Copper Company, the former owners. Each one of the five groups of mineral claims contains eight claims, and the entire property is known as the *Old Sport* mine.

In the Annual Report of the Minister of Mines for 1916, pages 240-241, also in the Report for 1917, page 255, the *Old Sport* mine is described in detail; consequently in the present report reference will merely be made to the extension of the development-work for the past year, together with an extract from the report by V. Dolmage, of the Geological Survey of Canada, published in Part B, Summary Report, 1918, Department of Mines, Ottawa.

The development-work during 1919 was interrupted for some time during the summer owing to the destruction of some of the camp buildings, compressor plant, etc., by fire, but this damage was repaired as soon as possible by rebuilding the burned buildings and installing new and more modern equipment of increased capacity, and in increasing the horse-power of the water-power plant.

The development-work in the mine has been mainly confined to driving a long crosscut adit to intersect the ore at a vertical depth of about 500 feet below the upper crosscut adit. This lower adit, when finished, will be about 2,000 feet long. In addition to this work, there has been about 7,000 feet of diamond-drill boring along the outcroppings.

In his report V. Dolmage says as follows: "The geological relations of the *Old Sport* ore-body are illustrated diagrammatically in Fig. 1. It will be seen that the Quatsino limestone overlies a thick floor of andesite, and has interbedded in it, near its base, a much thinner flow of andesite as well as some very thin beds of tuff. The main concentration of ore is confined to the bed of limestone lying between the two andesite flows. The whole series has been cut by a large intrusion of diorite which has extensively metamorphosed both the limestone and the andesite, and evidently produced the ore. The intrusion is a true diorite, having grey colour and medium coarse texture, and consisting essentially of labradorite, biotite, and augite.

"The limestone where unaltered is very fine grained, exceptionally pure, and well crystallized. It is, however, intensely altered in the vicinity of the mine. The altered parts are extensive, but their outlines against the unaltered parts are remarkably sharp, and the unaltered parts contain no secondary minerals whatever. The altered limestone now consists of garnet, quartz, epidote, serpentine, and actinolite, the latter being abundant. The sulphides and magnetite are largely confined to highly altered limestone and best developed in the garnetite, but some chalcopyrite and pyrite are also found in the altered andesite.

"The alteration in the volcanic rocks is also intense and wide-spread, even occurring at a considerable distance from the exposed contact of the intrusion. This is thought to be due to the sloping nature of the contact and its being brought still nearer to the surface by the steep slope of the hillside. The secondary minerals most commonly developed are quartz, epidote, and actinolite. The alteration to quartz frequently takes the form of a closely spaced series of parallel replacement quartz veins, a quarter of an inch or less in width, though there is also considerable incipient silicification.

"The principal commercial ore-mineral of the *Old Sport* mine as well as that of the district is chalcopyrite, which occurs both as small rounded grains and large irregular bodies several feet in diameter associated with a large amount of magnetite, smaller amounts of pyrite and pyrrhotite, and a very small amount of gold. Pyrrhotite in general is much more plentiful in those deposits situated close to the contact of the diorite, and chalcopyrite is more plentiful in those deposits situated at a distance from the contact.

"There can be little doubt that the copper originated with the magma of the diorite, and was carried up into the limestone and andesite by solutions and vapours which passed along joints and bedding-planes, and was finally deposited where proper conditions were reached. Owing to the more insoluble and therefore more impervious character of the volcanic rocks, the mineralizing solutions would be to some extent guided by them, and have a tendency to develop large channels along the contacts with the more easily soluble limestone and form the largest deposits there. Many basic dykes crosscut the ore. These, similarly, would be relatively impervious and at their intersections with the andesite flows would form troughs in which the invading solutions would be more or less trapped and induced to form rich ore-shoots. In the case of the narrow band of limestone enclosed by the two beds of andesite, as shown on the

diagrammatic section, the conditions are as outlined above, and, as might be expected, the best ore-bodies are in this bed.

"In the *Old Sport* property the depth of the ore-body will obviously depend on the position of the diorite-contact, and this has not yet been determined. The present workings go to a depth of about 500 feet measured along the inclined ore-body, and since very little pyrrhotite is present there and no noticeable increase in amount of it has been detected, it might be expected that the contact is still a considerable distance away and that the ore will persist much farther. The length of the ore-body has been proved on the surface for a distance of nearly 3,000 feet, so that the ore-body is one of considerable size."

#### WEST ARM SECTION.

The West Arm section of Quatsino Mining Division comprises that portion of the Mining Division tributary to the West arm of the sound which extends for about twenty miles in a N. 70° W. direction from its junction with the South-east and Rupert arms near the village of Quatsino.

At the south-easterly end of the West arm, on the north shore around Coal harbour, Cretaceous sandstone, shales, and conglomerates with narrow seams of coal occur. A tract of considerable acreage covered by these rocks is owned by a California syndicate, which about twenty years ago made an attempt to prospect for coal by sinking some shallow slopes and by boring with diamond-drills, but all work was suspended about 1901, the workings filled with water, and no attempt has since been made to resume operations. It is impossible to make any examinations of the old workings; consequently no data as to width of seams underground or possibilities of opening a colliery on a commercial scale can be ascertained.

About a mile west from Coal harbour and at a point from the shore about half a mile there are occurrences of bog-iron ore, from which some 1,500 tons was shipped in 1906 and 1907, but all work was then abandoned and has not been resumed since. There are also other occurrences of bog-iron ore a few miles farther west and about two miles from the shore which were prospected to some extent about 1906, but on which no work has been done in recent years.

These occurrences of bog-iron ore are described by the Provincial Mineralogist in the Annual Report of the Minister of Mines for 1907, and are also referred to in Bulletin No. 3, 1917, Provincial Bureau of Mines, on the iron-ore deposits on Vancouver and Texada islands.

Westerly from the area covered by the Cretaceous rocks, the Vancouver group of volcanics occur. This group is represented by andesites, tuffs, and basalt, interbedded with limestones. The volcanics form the prevailing country-rock on both sides of the West arm, and, indeed, cover a considerable extent of the northern end of Vancouver island beyond the head of the arm.

The section has not yet been prospected with any degree of thoroughness; in fact, only two groups of mineral claims have so far been located near the West arm; one of these is known as the *Bowerman*, which is about six miles in a northerly direction from the mouth of 6-Mile creek; the other, known as the *Millington* group, is on a small tributary of Spruce river about three miles from Holberg at the head of the West arm.

This group contains eight mineral claims, known as the *Jewel, Elk, F.B., Bowerman Group, Providence, Bell, Hope, Birthday, and Gold-drop*. The owners are E. Spooner, D. Spooner, J. Spooner, F. E. Bowerman, P. Obling, J. Bell, and E. Peterson, of Holberg. The group is reached by walking along a poor trail a distance of

six miles from the mouth of 6-Mile creek, which flows into the West arm of Quatsino sound on the north side about six miles below the head of the arm.

Owing to the extremely bad conditions of the weather during the writer's visit to the West arm in November, 1919, and the fact that but little prospecting-work had been done on the property, it was not visited, but a sample of ore that had been brought to Holberg by the owners when they had finished their assessment-work was sent to the Provincial Assayer at Victoria. This sample assayed: Gold, trace; silver, 2 oz.; copper, 0.7 per cent.; lead, *nil*. The mineralization occurs in a quartz gangue.

This group contains six mineral claims, known as the *Cracker Jack, Millington, Hood, Mollie B., Mollie Bawn, and Paystreak*, which were examined by the writer on November 16th, 1919. The group is owned by Dave Spooner, E. Spooner, E. Peterson, P. Obling, J. Bell, and James Spooner, of Holberg.

*Location.*—The *Millington* group of mineral claims is on a small unnamed creek that flows into Spruce river about two miles and a half above its mouth. Spruce river empties into the West arm of Quatsino sound at the head of the arm near the settlement of Holberg. The group is reached by travelling the wagon-road from Holberg a distance of about two miles, where a trail branches off in a westerly direction to Spruce river, which is crossed on a big log, and the trail continues in a westerly direction to the small creek on which the mineral claims are located, and their boundaries extend up the creek a distance of about 4,500 feet. The claims are staked two abreast and occupy an area of about 3,000 feet from east to west and 4,500 feet from north to south. The general course of the creek is nearly north (mag.), but there are several crooks and turns, and for most of its length the creek-bed is in a rather deep canyon.

*Geology.*—In the Summary Report, 1918, Part B, Geological Survey of Canada, V. Dolmage states: "The only rock found in the neighbourhood of the *Millington* group of mineral claims is a highly amygdaloidal basalt much fresher than the ordinary members of the Vancouver group. It outcrops for a vertical distance of over 1,000 feet."

*Characteristics of Ore-deposits.*—In ascending the bed of the creek, which is quite steep, at a point about 400 feet elevation above sea-level, on the *Cracker Jack* claim, there occur outcroppings of bornite ore as impregnations in the basalt country-rock, as irregular masses, and as grains frequently found in the amygdules. Other outcroppings of a similar nature are found at intervals in the bed of the creek for about 300 feet higher elevation. Some of these outcroppings reach a width of about 4 feet almost solid bornite; at other places the country-rock is impregnated merely with grains of bornite associated with a small amount of chalcopyrite.

Apparently the occurrences of ore occupy a zone in the country-rock, striking in a general north-easterly direction, of an undetermined width so far as work has yet shown. The most promising of the several outcroppings of bornite occurs at an elevation of about 500 feet above sea-level, where there is a fairly solid body of ore about 30 feet long exposed in an open-cut. A selected sample from this assayed: Gold, trace; silver, 2 oz.; copper, 21 per cent. Apparently this ore-body does not maintain its continuity with depth, because in an adit driven 20 feet lower altitude with the intention of intersecting the ore there is no well-defined body exposed, but a bunch of low-grade bornite was taken out while driving the adit. A grab sample from the dump at the portal of this adit assayed: Gold, trace; silver, 0.2 oz.; copper, 2.1 per cent.

About 80 feet lower elevation than the open-cut from where the high-grade sample was taken and on the opposite or westerly side of the creek there is another outcropping of bornite as an impregnation about 4 feet wide in basalt country-rock, with other smaller impregnations of similar ore. An adit has been driven in an attempt to intersect the ore-body about 40 feet below the outcropping. Some ore is exposed at the face in the roof of a drift 15 feet long driven to the right from the adit, a sample from which assayed: Gold, trace; Silver, trace; copper, 2.5 per cent.

From the foregoing description it will be seen that, while there are occurrences of high-grade outcroppings of bornite, they are irregular, and the work done underground has failed so far to expose any bodies of bornite of similar grade as that exposed on the surface, but the showings are sufficiently promising to warrant more thorough and extensive prospecting than has so far been done.

*Development-work.*—The development-work on the *Millington* group of mineral claims has all been done on the *Cracker Jack* claim. This work consists of two adits, open-cuts, and surface-stripping. The No. 1 adit is at an elevation of about 380 feet; it is driven in the right bank of the creek a length of about 70 feet, with drifts to the right and left at a point of 50 feet from the portal. The drift to the left is 21 feet long, that to the right is 15 feet long. No. 2 adit is at an elevation of about 110 feet higher than the No. 1. This adit is about 60 feet long with an open-cut approach about 15 feet long. The main open-cut is about 30 feet long and 4 feet deep.

A good cabin has been built on the property and the trail from the main wagon-road has been partly constructed, also a log bridge across the Spruce river.

In concluding his report on the *Millington* group, V. Dolmage says: "The deposit appears to be that class of mineral-deposit in which native copper is sparingly concentrated in a basic lava, usually associated with zeolites. The peculiar thing about this deposit is that there is no native copper and very little chalcopyrite. However, in the same flow about three miles to the east, native copper does occur in small veins, and as disseminated grains associated with the amygdules."

## NANAIMO MINING DIVISION.

The Nanaimo Mining Division, especially that part on the Mainland, has not, in the past, received the attention of prospectors in search of metalliferous minerals to which it is entitled, when the geology, extent, and ease of access, and favourable climatic conditions are considered; consequently the writer may be excused for introducing the most outstanding facts with regard to the Division in the present report.

The fact is often overlooked that within its boundaries there is included a large section of the Mainland in addition to all of the islands between the 49th and 51st parallels of latitude, as well as all of the easterly coast-line of Vancouver island between the same parallels, while its westerly boundary follows the summit of the chain of mountains which forms the backbone of the island and includes the easterly slope and the summit of the Beaufort range. In this range of mountains are the highest peaks on Vancouver island, to wit: Big Interior, 6,500 feet elevation; Dome, 6,500 feet; Beaufort, 6,200 feet; Septimus, 6,200 feet; Arrowsmith, 5,976 feet; Joan, 5,200 feet; Hals, 5,000 feet; Crown, 6,082 feet; Irwin, 3,200 feet; Mark, 3,080 feet; Comox Gap, 3,000 feet; and several lower peaks. The greatest distance from south to north of the Nanaimo Mining Division is attained on a line drawn from the head of Buttle lake about the centre of Vancouver island to the headwaters of the Klinaklini river on the Mainland, a distance of about 175 miles. The greatest distance from the south-east to north-west is attained on a line from the Chemainus river on the east coast of Vancouver island to the south side of Queen Charlotte sound, about 225 miles.

Within the area described on the Mainland are several long fiord-like inlets which form deep indentations penetrating the Mainland for several miles and navigable for the largest vessels afloat. Into the heads of these inlets there flow rivers of considerable size, although not large enough to be navigable except for canoes or small boats. The most important inlets, reading from south-east to north-west are Toba, Bute, Loughborough, Knight, Kingcome, and Seymour. The most important rivers flowing into these are the Toba into Toba inlet, the Southgate and Homathko into Bute inlet, the Klinaklini into Knight inlet, the Kingcome into Kingcome inlet, and the Seymour into Seymour inlet.

*Water-powers.*—The water-power it is possible to develop in the Nanaimo Mining Division deserves mention because of the great number of streams adaptable for the development of water-powers, only a few of which have up to the present time been utilized.

The following is a list of the streams in the Nanaimo Mining Division in which there are power possibilities, and which have been investigated for the Commission of Conservation, Canada, by Arthur V. White, Consulting Engineer:—

## LIST OF STREAMS.

Stream.	Tributary of	Horse-power.	Remarks.
<i>On the Mainland.</i>			
Powell river .....	Malaspina strait ... ..	32,000	Developed by the Powell River Pulp Co.; 24,000 h.p. in operation.
Stafford river .....	Loughborough inlet .....	4,000	Licensee, Davison-Ward Co.; not developed.
Forbes river .....	Homfray channel .....	1,000	
Brem river .....	Toba inlet .....	4,000	
Canyon creek .....	South fork of Toba river..	17,000	
Chewson creek .....	Toba inlet .....	5,000	
Hazel creek .....	Toba river .....	3,500	
Little Toba river .....	" .....	1,600	
Falls creek .....	North fork of Toba river..	5,000	
Owens creek .....	" .....	2,000	
Thomlinson creek .....	South fork of Toba river..	5,500	
East fork of Toba river..	Toba river .....	4,700	
Summit creek .....	South fork of Toba river..	1,000	
Goat creek .....	" .....	500	
	<i>Carried forward</i> .....	86,800	

## LIST OF STREAMS—Continued.

Stream.	Tributary of	Horse-power.	Remarks.
<i>Brought forward</i> .....		86,800	
<i>On the Mainland—Con.</i>			
Tahumming creek .....	Toba river .....	1,000	
Salmon river .....	Bute inlet .....	4,500	
22-Mile creek .....	Southgate river .....	3,000	
Homathko river .....	Bute inlet .....	6,000	
East fork, canyon on ....	Homathko river .....	6,000	
West fork, canyon on ....	" .....	6,000	
Ice river .....	" .....	2,500	
Eckheimick river .....	" .....	4,000	
Rodell creek .....	" .....	3,000	
Second West tributary....	" .....	3,000	
Third West tributary....	" .....	1,500	
Wawkash creek .....	Knight inlet .....	6,000	
Klinaklini river .....	" .....	15,000	
Mussel .....	Klinaklini river .....	300	
Slide creek .....	" .....	3,000	
Sim creek .....	Knight inlet .....	6,500	
Huaskin lake .....	Drury inlet .....	600	
Warner Inlet lake .....	Seymour inlet .....	200	
Seymour river .....	" .....	4,000	Queen Charlotte sound.
<i>On East Coast of V.I.</i>			
Nanaimo river .....	Strait of Georgia, .....	26,000	
Campbell river .....	Seymour narrows, Strait of Georgia	85,000	Licensee, the Campbell River Power Co.; not developed.
Englishman river .....	Strait of Georgia .....	250	Licensee, the British Pacific Hydro-Electric and Tramway Co.; not developed.
Millstone river .....	Strait of Georgia .....	1,300	Nanaimo Electric Light, Power, and Heating Co.; partially developed.
Puntledge river .....	Comox harbour .....	22,500	Canadian Collieries (Dunsmuir), Ltd.; 20,000 h.p. has been developed; 10,000 h.p. in operation.
" .....	" .....	4,600	Site below the Canadian Collieries development.
South fork of Elk river...	Campbell river .....	600	
Wolfe creek .....	Buttle lake .....	500	
Marble creek .....	" .....	700	
Myra creek .....	" .....	900	
Thelwood creek .....	" .....	4,000	
Ralph river .....	" .....	600	
Shepherd creek .....	Ralph river .....	500	
Salmon river .....	Johnstone strait .....	1,200	
White river .....	Salmon river .....	5,000	
Memeky river .....	" .....	1,550	
Adams river .....	Johnstone strait .....	200	
Tsi-itka (Robson) river..	" .....	500	
Kokish river .....	" .....	10,000	
Nimkish river .....	Queen Charlotte sound ...	5,500	
Camosun canyon .....	Nimkish river .....	3,500	
Big falls .....	" .....	3,000	
1-Mile riffle .....	" .....	1,500	
Quartz river .....	Hardy bay .....	350	
Shushartie river .....	Queen Charlotte sound ...	1,200	
Total .....		343,850	

In the foregoing list where there are no notes in the column headed "Remarks" the power possibilities have not been developed or licences applied for, and there are only 35,300 horse-power in actual operation.

There is a very large area of the Nanaimo Mining Division which has never been visited by prospectors and is entirely unexplored; especially is this the case on the Mainland northerly and north-westerly from the westerly shore of Jervis inlet, also on Vancouver island in the westerly part of the Division.

Since the territory occupied by Strathcona Park has been thrown open for the location of mineral claims there has been much activity in staking on Myra and Price creeks near the head of Buttle lake, where about forty mineral claims have been staked during the past two seasons. It is reported that these mineral claims have been bonded by the Temiskaming Mines Company, of Ontario, after having been examined by Joseph Errington, that company's consulting engineer, but operations have not yet been commenced.

Although no prospecting has been done up to the present time in the mountainous country between Myra and Price creeks or Buttle lake and Big Interior mountain, on which are located the *Big I.* and *Ptarmigan* groups of mineral claims, it appears as though that section should offer attractive inducements to prospectors for exploration. Reference to the official maps show that the distance intervening between the Big Interior mountain and the head of Price river is only about three or four miles. It also appears that the mineral-bearing zone in the vicinity of Big Interior mountain is very similar geologically to that in which the Myra and Price Creek locations are made. The intervening country is made up of ranges of high mountains, with the Big Interior peak reaching an elevation of 6,500 feet above sea-level, which is in the north-easterly corner of the Alberni Mining Division, while the westerly slope of that mountain is in the Clayoquot Mining Division.

On the Mainland in the Nanaimo Mining Division but comparatively little prospecting has been done north-westerly from Jervis inlet during recent years, although about twenty years ago there was much activity in the vicinity of Loughborough inlet, Phillips and Frederick arms, and on Thurlow island. During 1919 this section has again been the scene of more activity than during any year since the closing-down of the *Doratha Morton*, *Blue Bells*, and *Douglas Pine* properties. This activity will be referred to again in this report under its proper heading.

The geology on the Mainland in the Nanaimo Mining Division is that which predominates throughout the Coast range; the rock formation is chiefly granodiorite, but in this are found broad belts or bands of altered stratified rocks which were not destroyed by the intrusion of the eruptive rocks, mainly granodiorite, nor carried away by erosion. Occurrences of sulphide ores, mainly chalcopyrite and iron pyrite, are found at and near the contacts of the altered stratified rocks (schists, quartzites, argillites, and limestones) with the intrusive granodiorites and other eruptives.

Illustrations of such occurrences are seen in the *Britannia* mine in the Vancouver Mining Division and the *Lucky Four* mine in the New Westminster Division, both of which are in the Coast range, south-easterly from the Nanaimo Mining Division.

In this connection and as a further encouragement to prospectors to give attention to the Coast range, the following extract from the report of Chas. Camsell, published in the Summary Report, Geological Survey Branch, Canada Department of Mines, 1917, Part B, is quoted: "Geological maps of the western part of British Columbia show the Coast mountains to be made up of a great mass of eruptive rock, mainly granodiorite, forming a belt from 60 to 100 miles wide and 1,000 miles or more in length. Investigations have shown that in the section across the Coast mountains along the Pacific Great Eastern Railway such a simple condition does not exist, but instead there are several broad bands of stratified rocks—schists, quartzites, argillites, and limestones—which lie in the granodiorite and have been intruded by it. These bands are remnants of the old cover of the granodiorite batholith which were not destroyed at the time of intrusion nor removed by later erosion. They all strike parallel with the trend of the range, and consequently their greatest dimension is in a north-westerly direction and their shortest along the line of the railway. The contacts of these bands of stratified rocks with the granodiorite are all more or less mineralized. The lateral contacts are mineralized mainly by copper ores, and on the roof-contacts, that is where the batholith plunges north-westerly or south-easterly under a roof of stratified rocks, the mineralization is often by the more precious metals."

## SEYMOUR INLET SECTION.

The Seymour Inlet section of the Nanaimo Mining Division includes that part of the Mainland in the Division tributary to Seymour inlet, the most southerly arm of Queen Charlotte sound. Seymour inlet penetrates the Mainland in an easterly direction for a distance of about fifty miles to the head of Wigwam bay, where Seymour river flows in from a north-easterly direction. About forty miles from the entrance to the inlet there is a branch towards the south-east entered through Eclipse narrows, and about five miles up the branch, which is known as Frederick sound and is about ten miles long, there is a branch towards the north-east known as Salmon arm, which is about five miles long.

Seymour inlet is about two miles wide, with high mountains bordering both shore-lines, and there are only a few places where safe anchorage can be found owing to the exposed and rocky condition of the shores and extreme deep water in the inlet, which is persistent close in to both shores.

There has been practically no prospecting done in the mountains adjacent to the inlet and no mineral claims have been located, except near Wigwam bay, at the head, where there are some occurrences of magnetite which have been staked and recorded. These were visited by the writer in July, 1919, and are reported on as follows:—

This group contains five mineral claims, known as the *Dolphin*, *Dolphin Alexander Group*, *Fraction*, *Iron Pyrite*, *Gillis*, and *Gillis Fraction*. The group is owned by Colin Jackson and associates, of Vancouver, and the claims are Crown-granted.

*Location.*—The *Alexander* group of mineral claims is on the easterly side of Seymour inlet above Frederick sound and about five miles from the head of the inlet. The westerly boundary of the group is on the shore-line, where the mountains reach an elevation of several hundred feet, with precipitous slopes. Approach to the outcroppings of magnetite, where prospecting-work has been done, is made by ascending the bed of a small torrential stream which flows into a narrow gut or bay carved out of the mountain-side by erosion in the shore of Seymour inlet. This narrow bay is about 200 feet long by about 100 feet wide and so deep that there is no anchorage, but a launch can lie in safety by having lines fastened to the trees in the precipitous walls, which rise to an elevation of 500 feet on each side, the only danger being from slide-rock, which occasionally breaks down from either side.

*Geology.*—The country-rock on the *Alexander* group of mineral claims is the Coast Range granodiorite, much of it very much altered and sheared.

*Characteristics of Ore-deposits.*—There are outcroppings of magnetite about 40 feet wide which are exposed in a deep gulch on the right side of the small creek. These outcroppings have been stripped sufficiently to indicate that the structure of the ore-body is apparently that of a large lens occurring in a shear-zone in the country-rock, but the work has not been sufficient to determine the length or continuity in depth.

The outcroppings are exposed at an elevation of about 300 feet and a distance of about 500 feet from the beach. Along the strike of the ore-body, which is apparently in a north-westerly direction, the walls of the canyon are inaccessible, so that it is impossible to explore the occurrence of magnetite beyond the point where it is exposed. It is reported that there are other outcroppings at the head of the torrential stream, but, as the writer had no guide familiar with the property beyond the point examined, no further examination was made, also because the main object was to ascertain the facilities required for shipping and the upper occurrences are at present practically inaccessible.

A sample taken from the face of the exposed outcropping, which included some enclosed country-rock that cannot be separated in mining, assayed: Iron, 27.6 per cent.; sulphur, 0.05 per cent.; phosphorus, 0.10 per cent.; silica, 37.4 per cent.; titanium, *nil*.

The *Alexander* group was examined by G. A. Clothier, Resident Engineer for No. 1 Mineral Survey District, in 1917, and he reports an analysis, taken from a private report of a sample from an outcropping on another portion of the property, as follows:—

	Per Cent.
Iron oxide, equivalent to 60 per cent. metallic iron ( $\text{Fe}_2\text{O}_3$ ) .....	83.32
Alumina ( $\text{Al}_2\text{O}_3$ ) .....	7.60
Silica ( $\text{SiO}_2$ ) .....	6.37
Lime ( $\text{CaO}$ ) .....	1.80
Sulphur (S) .....	0.30
Combined water, etc. ....	0.11

Phosphorus (P) .....	Trace.
Magnesia (MgO) .....	Trace.

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99.50

This group contains ten mineral claims and two fractions. The group is **Kitchener Group**, owned by Gordon McLaren, D. H. Martin, and associates, of Vancouver, and is situated on the west side of Seymour inlet, about seven miles from the head of the inlet, a short distance inland from a small bay, locally known as Haig bay, which affords good shelter and anchorage for vessels.

This group is in the Bella Coola Mining Division and was reported on by G. A. Clothier, Resident Engineer for No. 1 Mineral Survey District, in the Annual Report of the Minister of Mines for 1917. The examination made by the writer in 1919 was for the purpose of ascertaining the facilities for shipping ore, in case any tonnage was needed under the provisions of the "Iron-ore Supply Act, 1919." As the property is not in the Nanaimo Mining Division, and as but very little work had been done since Clothier made a very full and comprehensive report, it is not necessary to repeat the particulars in the present one, beyond the statement that shipping facilities can be constructed at a reasonable cost, as the ore-bodies are very easy of access. Apparently the ore-bodies are of considerable extent and occur as metamorphic-contact deposits.

#### KNIGHT INLET SECTION.

The Knight Inlet section of Nanaimo Mining Division embraces all of the country between Knight inlet and the summit between it and Seymour inlet. The entrance to Knight inlet is about forty miles south-easterly from the entrance to Seymour inlet, and it penetrates the Mainland in an easterly direction for about forty miles, and from that point in a northerly direction for nearly the same distance. It is the longest inlet between Vancouver and Queen Charlotte sound. At the head of Knight inlet the Klinaklini river flows in from a northerly direction. This river is about sixty miles long, having its source in a high range of mountains which forms the western boundary of the Chilcotin plateau and the eastern boundary of the Coast Range granodiorite batholith.

The Nanaimo Mining Division extends to the extreme headwaters of the Klinaklini river where it reaches the farthest point north in that Division.

Knight inlet bears all the characteristics that are noticeable in the other fiord-like inlets which penetrate the coasts of the Mainland and Vancouver island. Both shores are bordered by high mountains ranging from about 1,000 to 7,280 feet, which is the extreme summit of Mount Rodeil at the easterly side of the inlet, a few miles from the head. There has been comparatively very little prospecting done in the mountains adjacent to Knight inlet on either side, the main reason being that there are so few places along the shore where small boats and launches can be anchored safely.

Glendale cove, about half-way up the inlet, at the point where its course changes from southerly to westerly, is about the only protected harbour in the entire inlet from Village island near its entrance from Queen Charlotte sound to the extreme head.

Knight inlet is included in the area of which a geological survey was made by J. Austen Bancroft, whose report is published in Memoir No. 23 of Canada Department of Mines, entitled "Geology of the Coast and Islands between the Straits of Georgia and Queen Charlotte Sound, B.C."

In that report Mr. Bancroft notes that the prevailing rocks belonging to the Coast Range intrusive are made up of granodiorite, granite, diorite, and gabbro, but in several points he notes that there are bands of undifferentiated rocks which include metamorphosed equivalents of the Marble Bay, Open Bay, Valdes, and Parson Bay formations.

It is, according to the experience of the writer, that at and near the contacts between the granodiorite and these metamorphosed bands are the most probable points where ore-bodies are likely to occur. Some of these bands of metamorphosed rocks have been prospected to some extent in the vicinity of Glendale cove, on the northerly side of the inlet.

Up to the present time there have only been two groups of mineral claims located on Knight inlet; these are known as *Princess* and *Union* groups.

This group contains six mineral claims, known as the *Agnes, Margaret, Princess Group, Charlotte, Ethel, Jessie, and Mary*. The group is owned by the Princess Copper Mining Company, of Vancouver, of which John Walker, of Wallbridge & Walker, is the managing director. With the exception of the *Mary* mineral claim, which is located on the beach in a small cove, the other claims in the group are about two miles from the beach up the Matheson (Matsin) river. The mining camp is at an elevation of 1,500 feet and is reached by a good trail about a mile and a quarter long, and then by a poor trail about three-quarters of a mile up the precipitous mountain-side.

The Matheson (Matsin) river flows in a southerly direction between high precipitous mountains. It carries a considerable depth of water and has a fall of about 1,500 feet between the head and the mouth, where it flows into Knight inlet about six miles from and at the opposite side of the inlet from Glendale cove.

*Geology.*—The *Princess* group of mineral claims is located in one of the bands of metamorphosed rocks already mentioned, made up chiefly of crystalline limestone and such contact-metamorphic rocks as garnetite and epidote. This band of metamorphosed limestone occupies a zone of quite a considerable width, with granodiorite on either side.

*Characteristics of Ore-deposits.*—Within the zone of metamorphosed limestone there occur lenses of garnetite mineralized with copper ore, bornite predominating. The occurrences of ore are lenticular in structure, very irregular in occurrence, and so far as work that has been already done demonstrates are so erratic as to make any systematic development-work very difficult; in fact, a mining geologist should be in charge of the work in order to obtain the best results.

*Development-work.*—The development-work consists of a main adit driven into the mountain at an elevation of about 1,500 feet for a distance of 210 feet. The course of this adit ranges from east (mag.) to S. 55° E. (mag.), and the courses have been changed several times, so that the adit itself is quite crooked. At the time of the writer's visit to the property on July 13th, 1919, there was ore exposed in only one place in the adit, which was at a point 24 feet from the face, where in the floor there was an occurrence of mineralized garnetite with bornite disseminated irregularly through it. This lens of garnetite was about 3 feet wide and a sample chipped across it assayed: Gold, trace; silver, 1.4 oz.; copper, 0.9 per cent.

In the face of the adit there was another kidney or lens of mineralized garnetite about 6 inches wide, which indicated that possibly a pay-shoot of ore might be exposed by further work.

About 400 feet up the mountain-side at a 50-degree grade there was an open-cut and another adit 10 feet long driven for the purpose of intersecting a body of mineralized garnetite that outcropped about 20 feet higher elevation, but this work had not been carried far enough to prove successful.

About 50 feet in a southerly direction from the last-mentioned adit there is an outcrop of heavily iron-stained rock which appears to strike south-westerly, but the face of this outcrop is in an inaccessible position, as it occurs in a bluff with a vertical side; therefore this outcrop could not be examined by the writer, but from the talus that has broken away from the bluff and is found in the slide below it would appear as though the iron-stained rock might possibly represent a capping that covered an occurrence of copper ore in a way similar to the occurrences of gossan found in many localities.

Another point where work has been done is about 12 feet from the portal of the main adit near the entrance to the open-cut approach to that adit. At this point occurrences of copper ore occur about 3 feet wide exposed by an open-cut about 5 feet deep, a sample from which assayed: Gold, trace; silver, 1 oz.; copper, 2 per cent.; zinc, 24 per cent.

In the writer's judgment the indications of the *Princess* group of mineral claims are sufficiently promising to warrant further work being done, but in order to accomplish satisfactory results the work should be under the supervision of a mining geologist who has had considerable experience in working in the contact-metamorphic ore-deposits on Texada island.

This group contains several mineral claims owned by the Union Copper Mining Company, Limited, of Vancouver, of which D. Campbell, of 503 Pender street, Vancouver, is the managing director. The group is located on the northerly side of Knight inlet and about ten miles in a northerly direction from Glendale cove, opposite Adeane point.

*Geology.*—There is on the *Union* group of mineral claims a belt of metamorphosed sedimentary rocks of blackish colour heavily iron-stained and having slaty structure, which occurs

as an inclusion in the granodiorite batholith, and has not been either carried off by erosion or destroyed by the intrusion of the granodiorite. This belt or band of altered sedimentaries outcrops on the beach and strikes north-west conformably with the strike of the contact between it and granodiorite, which is well defined, dipping about 50 degrees towards the north-east.

Reference to Bancroft's geological map of the mainland coast shows a series of similar belts of his "undifferentiated" rocks occurring towards the south-east on both shores of Loughborough inlet, both shores of Phillips arm, at Owen point in Cardero channel, as well as on the north-east part of Sonora island, in some of which locations occurrences of copper-sulphide ores have been discovered, some of which are described under the proper heading later in this report.

*Characteristics of Ore-deposits.*—So far, the work done on the *Union* group of mineral claims has failed to expose any occurrence of a deposit of mineral that can be classed as "ore." Four samples were taken at various points where quartz occurred, which carried cubes of iron pyrite disseminated through them. In the field these occurrences of mineralized quartz-lenses appeared promising, but when the samples were assayed the results were disappointing, being in each case: Gold, trace; silver, trace; copper, *nil*.

*Development-work.*—The quantity of development-work that has been done, considering the discouraging results from assaying, is remarkable, and indicates that either properly systematized sampling was neglected during the progress of the work, or that the management, in continuing the development, exhibited a degree of optimism that at least was unwise, as there is no exposure of ore anywhere in the workings.

The development-work consists of a main adit driven about 280 feet long with a crosscut 54 feet long from a point 37 feet from the face of the main adit; also an open cut at a point about 400 feet higher than the main adit, which is 50 feet above low water. There is a good cabin on the beach, as well as a blacksmith shop near the portal of the adit.

#### *Harbledown Island.*

As reports of the discovery of graphite on the south-westerly end of Harbledown island had been frequently brought to the attention of the writer during the past season, he visited that island on July 15th, 1919, and made an examination of the occurrence of the so-called graphite-deposit.

Harbledown island is in Johnstone strait, on the southerly side of and near the entrance to Knight inlet. This island has a maximum length of about eight miles and a maximum width of about three miles.

*Geology.*—The prevailing rock formation on Harbledown island, especially on the northerly side, is granodiorite and belongs to the Coast Range intrusive. On the southerly side there is a wide belt of volcanic rocks with intercalated beds of limestone, classified by Bancroft as the "Valdes" group, while a part of the south-westerly corner of the island is made up of metamorphosed carbonaceous shales, argillites, impure limestone, calcareous sandstones, and quartzites, classified by Bancroft as forming the "Parson Bay" group.

It is in the last-named formation that two prospectors (the Fyfe Bros.) have located mineral claims and sunk a shallow shaft on the beach, which was full of water and covered with boards when the writer examined the claims. The shaft is sunk in an outcrop of graphitic schistose rock, a sample of which assayed 0.5 per cent. graphite.

#### PHILLIPS ARM SECTION.

The Phillips Arm section of the Nanaimo Mining Division includes the mountainous country adjacent to Phillips and Frederick arms, which are situated north of Thurlow island and are two comparatively small inlets between Bute inlet and Loughborough inlet. Phillips and Frederick arms are about 130 miles north-westerly from Vancouver.

Phillips arm figured from 1896 to 1901 as one of the active mining camps on the mainland coast when several mineral claims were located, and during 1898 and 1899 the section was brought into special prominence because of the operations at the *Doratha Morton* mine, where about 15,000 tons of ore was crushed and treated by cyanide process, which yielded \$90,000 in gold and silver bullion. The mine was then closed down. Until 1916 there was no activity in mining in the Phillips Arm section. During 1916 a syndicate composed of George Golby and associates, of Victoria, commenced development-work on the *Ametihyst* mineral claim in Fanny bay, on the west side of Phillips arm. This work was continued during 1919, but, with that exception,

no mining was carried on in the section. The *Blue Bells* claim on Frederick arm was bonded to the Ladysmith Smelting Corporation, which proposes to use the ore for a flux.

This group contains two mineral claims known as the *Amethyst* and *Pathfinder*.

**Amethyst Group.** The *Amethyst* group is on the northerly side of Fanny bay, off Phillips arm, and connected with a sheltered cove on Phillips arm, where there is good anchorage, by a road about a quarter of a mile long which crosses the southerly part of the adjoining *Monte Cristo* Crown-granted mineral claim, owned by H. W. Treat, of Seattle, Wash., that was worked in 1901, but has been idle since.

**Accessibility.**—The *Amethyst* group of mineral claims is easily reached from Vancouver by travelling on one of the Union Steamship Company's vessels to the regular port of call at Shoal Bay, at the north-easterly end of Thurlow island, from which point the *Amethyst* group is easily reached by rowboat or launch.

**Geology.**—The rock formation on the *Amethyst* group of mineral claims belongs to Bancroft's "undifferentiated" group, including metamorphosed "Marble Bay," "Open Bay," "Parson Bay," and "Valdes" formations, with the "Marble Bay" limestones predominating. The limestone has been intruded by several dykes, and ore-deposits have apparently developed as replacement deposits in the limestone, usually close to a dyke, so that it would appear as though the dykes influenced the deposition of the ore.

**Characteristics of Ore-deposits.**—The occurrences of ore appear to belong to the contact-metamorphic type, although in the immediate vicinity of the ore there is not exposed any contact between the limestone and granodiorite of the Coast range, but the "undifferentiated" metamorphosed rocks occur as an inclusion in the batholith. The gangue in which the ore occurs is chiefly quartz.

**Development-work.**—The development-work was started on the *Monte Cristo* claim close to the westerly boundary-line of that claim, which is the easterly boundary of the *Amethyst* claim. The work consists of a series of open-cuts which were made on to the *Amethyst* claim from the *Monte Cristo*. There is also a shaft said to be 30 feet deep on the *Amethyst* claim, which was sunk several years ago, and is at present mostly filled in and cannot be examined until cleared out.

It is reported by G. F. Monckton, who has had charge of the development-work during 1918 and 1919, that there is approximately 94 tons of sorted ore in the bunker on the beach, which he estimates will yield at least 5 per cent. copper in addition to low gold and silver values.

#### THURLOW ISLAND SECTION.

Thurlow island is separated from the mainland by Cardero channel and lies southerly from Phillips and Frederick arms. During 1898 and 1899 the island was the scene of considerable mining activity owing to the development-work being carried on at the *Douglas Pine* mine on the island and the near-by *Doratha Morton*, *Alexandra*, *Blue Bells*, and *Colossus* properties.

Shoal Bay settlement, at the north end of Thurlow island, was the distributing centre for the several mining and logging camps in the neighbourhood on account of its being the only regular port of call in that part of the Coast for the steamers which plied northerly from Vancouver via Euclitaw narrows. Since about 1902 there has been no activity in the mining industry, either on Thurlow island or in the neighbourhood, until 1919. Then the Ladysmith Smelting Corporation, Limited, acquired the *Dawn* group of mineral claims on the north-easterly part of the island and bonded the *Blue Bells* group on Frederick arm. This action encouraged some old-timer prospectors, who were familiar with the locality, to resume prospecting. These men were scattered through the Thurlow Island section at the time of the writer's visit in July, 1919. He purposed visiting the sections later in the year if any important discoveries were made, but was unavoidably prevented from so doing.

This group contains three mineral claims—*Dawn*, *Sunrise*, and *Sunset*—which

**Dawn Group.** were bonded by the Ladysmith Smelting Corporation, of Ladysmith, during the spring of 1919 from the locators, A. Prichard, of Shoal Bay, and associates. The group is located on the easterly side of Thurlow island about seven miles from Shoal Bay. The landing-point, from which a good trail to the mine-workings has been constructed about half a mile long, is in a small bay off Nodales channel, which separates Thurlow island from Sonora island, the northerly of the Valdes group of islands.

**Geology.**—The rock formation on the *Dawn* group of mineral claims is a rather wide band of Bancroft's "undifferentiated" rocks, which contact with the Coast Range granodiorite in the

mine-workings. On other parts of Thurlow island the prevailing country-rock is granodiorite or other of the rocks associated with it in the Vancouver group.

*Characteristics of Ore-deposits.*—The ore on the *Dawn* group occurs as a vein at the contact of the altered sedimentary rocks and granodiorite. The gangue in which the minerals occur is quartz and the mineralization so far as can be detected in the field is principally confined to iron pyrite, but there is also some chalcopyrite associated with the iron. The results from assaying average samples of the ore from the mine-workings show that most of the value is in gold and silver, but that the values are quite variable.

The quartz vein strikes N. 40° W. (mag.) and dips from 50 to 60 degrees towards the south-west (mag.), except at the face of a deep open-cut and in the face of the drift adit about 50 feet below the open-cut, where it appears that faulting has taken place and changed the dip to north-east (mag.) at about the same angle.

An average sample across 15 inches of the vein at the face of the drift-adit assayed: Gold, 1.8 oz.; silver, 8 oz.; copper, *nil*. Another sample grabbed from the dump at the collar of a shaft said to be 17 feet deep, but full of water, assayed: Gold, trace; silver, 0.4 oz.; copper, 1.31 per cent.

*Development-work.*—The development-work on the *Dawn* group of mineral claims on July 16th, 1919, consisted of a drift-adit 70 feet long, a deep open-cut about 50 feet higher elevation than the adit, and a shaft about 200 feet south-easterly from the portal of the adit.

#### REDONDA ISLANDS SECTION.

The Redonda islands form a group of two islands known as East and West Redonda. They are bounded on the north by Pryce channel, by which the islands are separated from the entrance to Toba inlet and the mainland, on the east by Homfray channel, on the south by the Strait of Georgia, and on the west by Lewis channel and Deer passage. West Redonda island is separated from the East Redonda island by Waddington channel.

To the present time there have been no discoveries of mineral-deposits reported on East Redonda island, but magnetite-iron ore was discovered on the northerly part of West Redonda island as early as 1892, when the *Elsie* mineral claim was located. In 1893 a shipment of about 600 tons of magnetite was made to the Oswego Iron and Steel Company's furnace in Oregon and in 1895 the claim was Crown-granted. Later the *Eagle* and *Black Warrior* mineral claims were staked easterly from the *Elsie* and sufficient work done on them to obtain a Crown grant. Since then until the late fall of 1918 there has been no mining development on the island, except quarrying limestone at a point about half a mile easterly from the north-east corner of the *Elsie* mineral claim. This enterprise was closed down several years ago.

After the passage of the "Iron-ore Supply Act, 1919," the writer visited West Redonda island twice, the first time during April, 1919, and the second time during the following May, in order to examine the mineral claims and estimate the cost necessary for transportation facilities and development-work to ship iron ore to smelters for experimental treatment.

The north shore of West Redonda island is very precipitous; there are no beaches, sheltered coves, or anchorages where vessels could lie safely in the neighbourhood, except on the opposite or north side of Pryce channel.

This group contains twelve mineral claims—*Coast Iron, Coast Iron No. 1, Black Warrior Iron Bluff, Iron Mountain, Eagle, Black Warrior, Iron, Iron Cliff, Bonanza, Group. Homestake, Tidewater, and Tidewater No. 1.* The *Black Warrior* group, which

is owned by the Redonda Iron Copper Company, Limited, is staked in such manner that the *Elsie* mineral claim is surrounded, except on the north, where it extends to the water-front, being bounded on the east by the *Iron Bluff* mineral claim, on the south by the *Iron Mountain* mineral claim, and on the west by the *Coast Iron No. 1* mineral claim. All of the claims in the *Black Warrior* group, except the *Iron Mountain, Black Warrior, Eagle, and Homestake*, are staked along the shore-line. The north-west corner of the *Eagle* claim is also on the shore, but the north-east end line extends into the mountains in a south-easterly direction.

*Geology.*—The rock formation along the bold shore is for the most part porphyritic granodiorite to the west of the *Bonanza* claim, where there is a well-defined contact between the igneous rock and a much-altered limestone. The line of the contact strikes in a south-westerly direction up the precipitous mountain-side and is so well defined as to form quite a prominent landmark.

*Characteristics of Ore-deposits.*—The occurrences of ore on the *Black Warrior* group are magnetite-deposits and occur at the junction of the *Eagle* and *Black Warrior* claims, also on the *Homestake* claim. The first-mentioned occurrence of magnetite outcrops on the easterly steep bank of a torrential stream which is named Eagle creek and flows for most of its length through deep box canyons. A portion of the outcrop, which is 14 feet wide, occurs on the *Black Warrior* claim; the remainder on the *Eagle* claim. The ore-body appears to fill a fissure in a shear-zone of igneous rock. It could not be followed along its strike because the surface above the cliff in which the outcrop occurs is so densely covered with underbrush and timber as to cover up and hide all rock formation. Apparently the ore-body is striking south-westerly and dipping north-easterly about 85 degrees. A sample across 14 feet wide assayed: Iron, 64.8 per cent.; phosphorus, trace; sulphur, trace; silica, 5 per cent.; titanium, *nil*.

The ore-body referred to as occurring on the *Homestake* mineral claim could not be examined because the canyon in which it is reported to outcrop was full of snow at the time of the writer's visits, and although a serious attempt, by climbing up the snowslide for about 500 feet, was made to reach the point where the outcropping was reported to occur, the covering of snow was too deep for any examination to be made. This reported occurrence is about half a mile by a switchback trail from the shore and at an elevation of about 1,500 feet above sea-level, and in an easterly direction from the occurrence of magnetite on the *Black Warrior* and *Eagle* claims.

*Development-work.*—The development-work on the *Black Warrior* group of mineral claims consists of some stripping, open-cuts, and an adit 10 feet long in the steep bank of Eagle creek at the junction of the *Black Warrior* and *Eagle* claims, also stripping and open-cuts on the *Homestake* claim. In addition to this work, good trails have been constructed from the beach near the north-west corner of the *Eagle* claim to all of the mine-workings and outcroppings, except for the last 600 feet to the showing on the *Homestake* claim, where it was practically impossible to construct a trail along the precipitous mountain-side; consequently travelling is done up the steep bed of a deep canyon.

This mineral claim was Crown-granted in 1895 and is at present owned by the **Elsie.** estate of the late John Hendy, of Vancouver. The claim is located on the north shore of West Redonda island. The north-east corner is on the shore about 1,400 feet westerly from the north-west corner of the *Eagle* claim of the *Black Warrior* group, already described in this report. About 600 feet westerly from the north-east corner there is a small bay or cove into which the water from a mountain stream flows from a southerly direction through deep box canyons.

*Geology.*—In Bancroft's description of the rocks exposed on the shore-line on the *Elsie* claim, he states that they "comprise a porphyritic granodiorite which shades off into a light-grey hornblende granite, both of which include patches of massive darker rocks which are very rich in hornblende and which undoubtedly represent highly altered portions of the roof beneath which these batholiths cooled. Upon the shore-line of this property there is a patch of dark rock extending for a distance of about 120 feet which contains a few fragments of altered crystalline limestone." At an elevation of about 450 feet above sea-level and distant only about 700 feet southerly from the shore there occurs a belt of metamorphosed limestone which contacts with a light-grey hornblende granite. The limestone is so much altered as to make any classification in the field very difficult, but the contact is well defined and encloses a wide body of magnetite ore which apparently replaces some of the altered limestone.

*Characteristics of Ore-deposits.*—The occurrence of magnetite ore on the *Elsie* mineral claim is reached after climbing an almost perpendicular mountain-side to a vertical elevation of about 450 feet. The ore occurs as a contact-metamorphic type of deposit, which is apparently striking in a southerly direction and dipping vertically, but further development may show that the direction of the strike is incorrect.

The deposit of magnetite is exposed in a large open-cut or quarry about 50 feet wide from east to west, about 40 feet high at the face, and about 20 feet from north to south. About 30 feet of the width from east to west is practically pure magnetite, with the remaining 20 feet magnetite mixed with some enclosures of country-rock. A grab sample from the face of the open-cut or quarry assayed: Iron, 60.6 per cent.; phosphorus, trace; sulphur, trace; silica, 10.9 per cent.; titanium, *nil*.

*Development-work.*—The development-work on the *Elsie* mineral claim consists of the open-cut just mentioned, from which the shipment of about 600 tons of magnetite that was shipped to



Valdes Island Copper Co.—Copper Mountain Mine.



Valdes Copper Co.—Dump at Beach, Ingersoll Mine.

Oregon in 1893 was mined. There are also some remains of an ore-chute from the quarry to the beach, and bunkers, but in such a state of dilapidation as to require rebuilding, as it would be impossible to repair either the chute or bunkers.

*Quantity of Ore.*—It is impossible to make any estimate of the quantity of magnetite in the deposit until further work is done, because the only exposure is the face of the open-cut or quarry, and the rock-surface, both down and up the mountain, is hidden by slide-rock, timber, and underbrush.

#### QUADRA ISLAND SECTION.

Quadra Island section of the Nanaimo Mining Division comprises the area occupied by the Valdes group of three islands named Quadra, Maurelle, and Sonora. Quadra, the most southerly, is the most important as well as much the largest; Sonora, north of Quadra, is next in size; Maurelle, west of Quadra, is the smallest of the group of islands. A narrow channel which extends from Discovery passage west of the islands to Hoskyn inlet, the most northerly branch of the Strait of Georgia, separates Quadra from the other two islands, while a much narrower channel named "Hole in the Wall" separates Sonora island from Maurelle.

Up to the present time no discoveries of mineral-deposits have been reported on either Sonora or Maurelle islands. According to Bancroft's report and map, Memoir No. 23, Geological Survey of Canada, these two islands are made up almost entirely of Coast Range intrusive rocks, with granodiorite predominating, except a small area in the north-east corner of Sonora island, where a narrow belt of metamorphosed sedimentary rocks occur.

From a mining standpoint the centre portion of Quadra island is the most important and the only part of the island that has produced any ore of commercial value. This portion of Quadra island is bounded on the north and east by the contact between the Coast Range intrusives and crystalline limestone of the "Marble Bay" formation, which extends across the central part of Quadra island, from Granite bay on the west side of the island, in a south-easterly direction to Open bay on the south-east shore. On the south the productive part of the island is bounded by the contact between the "Valdes" formation, comprising greenstone, andesite, basalt, and glacial recent sand, gravel, and clay of the Quaternary period, which extends across the southern part of Quadra island from Quathlaski cove on the south-west side to Herlot Bay on the south-east shore. The north-west and south-west boundary of the productive portion is Discovery passage, of which Seymour narrows is a part.

The ores which occur in the central part of Quadra island are for the most part copper sulphides, with bornite predominating, also some chalcocite and a little native copper.

During the season of 1919 there have been only two mineral properties on Quadra island at which any mining operations have been carried on. These are the *Copper Mountain* (or *Ingersoll*) and *Santa Anna* groups of mineral claims, both of which have been fully described in former Annual Reports of the Minister of Mines; therefore in this report will only be briefly mentioned, as follows:—

The *Copper Mountain* (or *Ingersoll*) group of mineral claims contains fifteen  
**Copper Mountain** Crown-granted mineral claims owned by the Valdez Island Copper Company,  
**Group.** Limited; head office, Hibben-Bone Building, Victoria. The property extends  
 in a north-westerly direction from the head of Gowlland harbour, on the south-  
 westerly shore of Quadra island, for a distance of about two miles and a half.

*Development-work.*—During a part of 1919 development-work was done by Thomas Kerruish, who shipped about 300 tons of copper ore under a lease from the company, which expired late in the summer. Since then the company has been preparing to resume the work.

Kerruish extended the open-cut work for about 40 feet long on the *Senator* claim at a point about 4,000 feet from the southerly end of the property, and exposed a continuation of the ore-body about 4 feet wide for that distance from the southerly face of the open-cut made in 1918. The open-cut is about 8 feet deep, and at the southerly face a well-defined fault occurs, which appears to have changed the strike of the ore several degrees to the west. The fault-plane dips vertically, and the ore-body is apparently continuing along the fault and also dipping vertically. A large proportion of the shipment made in 1919 was mined from the open-cuts on the *Senator* claim. A grab sample from the dump assayed: Gold, trace; silver, trace; copper, 3.5 per cent.

On the *Ingersoll No. 2* claim, which adjoins the *Senator* on the south, an open-cut 60 feet long, 10 feet wide, and 6 feet deep, which nearly crosscuts the country-rock, but follows the

strike of an ore-body, was made across the summit of a high bluff. In this open-cut the ore exposed is chiefly bornite.

About 300 feet southerly from the bluff just mentioned and in the bank of the creek an ore-body is exposed, made up chiefly of chalcocite. This ore occurs along a fault-plane dipping vertically and striking nearly east (mag.). The occurrence was recently discovered and where exposed the ore is 18 inches wide.

On the *Copper Mountain* mineral claim, near the north-westerly end of the property, there are several large open-cuts and a shaft, said to be 30 feet deep, but not examined because it was full of water, and no facilities were handy to unwater it. A sample from an open-cut about 40 feet westerly from the shaft assayed: Gold, trace; silver, 0.4 oz.; copper, 3.2 per cent. Another sample from an open-cut about 30 feet easterly from the shaft assayed: Gold, trace; silver, 0.4 oz.; copper, 4.9 per cent. The width of ore exposed in the last-named open-cut is about 11 feet.

This group contains six mineral claims known as the *Santa Anna, Eureka, Green Meadow, San Lucas, Lucky Jack,* and *Happy Chance*, owned by Jack McConville, George Broadhurst, J. Danaher, and T. Tarmody, of Vancouver.

The group is located about a mile and a half northerly from Bold point, a prominent landmark on the south-easterly shore of Quadra island about ten miles northerly from Heriot Bay, which is the regular port of call for steamers plying the channels to the easterly from Quadra island. A good road connects the mine-workings with a wharf in a small cove near Bold point.

*Geology.*—The rocks on the *Santa Anna* group are chiefly metamorphosed limestones which contact with granitic rocks having a gneissic structure. The line of contact is well defined and has a general north-westerly strike. The belt of limestone occurring on the *Santa Anna* group appears to be isolated from the main lime-belt, which crosses Quadra island from near Bold point to Granite bay.

*Characteristics of Ore-deposits.*—The occurrences of copper-sulphide ore on the *Santa Anna* group are apparently lenticular in structure and belong to the contact-metamorphic type of ore-deposits. The ore occurs usually immediately at the contact between the limestones and granitic rocks. For a distance of about 700 feet in a north-westerly direction outcroppings of chalcopyrite, associated with pyrrhotite and iron pyrite, occur. These outcroppings are not stripped sufficiently to demonstrate continuity along the line of strike, consequently are only exposed at isolated spots where the outcroppings occur as low bluffs. Samples taken from an open-cut about 300 feet north-westerly from the main adit assayed: Gold, trace; silver, 2.4 oz.; copper, 3.1 per cent. The mineralization where this sample was taken is about 12 feet wide, but the sample is not an average across the entire width.

The main mine-workings are in a high bluff where ore-outcroppings can be followed up the face of the bluff in a south-easterly direction for about 200 feet on an incline of nearly 45 degrees. Below the outcroppings an adit has been driven 100 feet long with the expectation of exposing the ore-body that outcrops on the surface in the face of the bluff at deeper levels, but a well-defined fault appears to have interfered with the continuity of the ore, so that beyond 20 feet in the adit from the portal no more ore is seen. A sample from across an open-cut about 25 feet higher elevation than the portal of the adit, and about 60 feet distant, assayed: Gold, trace; silver, 2 oz.; copper, 3.4 per cent. Another sample from a dump near the portal of the adit, which represented ore sorted for shipment, assayed: Gold, trace; silver, 3.8 oz.; copper, 6.6 per cent.

*Development-work.*—The development-work on the *Santa Anna* group consists of two adits, several open-cuts, surface-stripping, and the construction of an ore-chute 220 feet long on a 40-degree incline and small bunkers and loading-platform for shovelling ore into wagons. The length of one adit is about 100 feet and of the other about 120 feet.

#### *West Side of Quadra Island.*

Extending from near Bold point across Quadra island to the west side near Granite bay there occurs a wide belt of crystalline limestone which occurs between Coast Range intrusive rocks on the north-easterly side and volcanic rocks of the "Valdes" formation on the south-westerly side. Several years ago this section was prospected to some extent and high-grade ore was discovered at some points, notably on the *Lucky Jim* group of mineral claims about five miles

from the boat-landing on Granite bay. There has, however, been no activity in mining or prospecting in the section since the war started in 1914.

From all the indications and the results of prospecting in the past, it would appear that this portion of Quadra island should offer quite an attractive field for prospectors in the future. Although in the interior of the island transportation facilities are lacking, yet the construction of such is a comparatively easy proposition; in fact, there is a graded road-bed of an old logging-railroad extending for about five miles from Granite bay which passes very near the *Lucky Jim* mine-workings, and could be made use of by the expenditure of a moderate amount in case any mineral claims possessing promise and merit were located or if the *Lucky Jim* mine was reopened.

#### TEXADA ISLAND SECTION.

During 1919 there has been about the same activity in mining on the northern part of Texada island as has been the case in that section for several years past. A little more attention has been paid to prospecting on the island than during 1918 and a few new locations have been made.

The southern portion of Texada island has never been prospected to any extent, but since several logging camps have been running in the vicinity of North-east point, on the easterly coast of the island, and as roads and trails are gradually being extended towards the vicinity of Davies bay, it is possible that some prospectors will in future prospect south-easterly in the vicinity of Mount Davies and farther towards the south-east end of the island.

The *Marble Bay* mine has been a regular shipper during 1919. The *Nigger Baby* mineral claim on the north-westerly part of the island was purchased during 1919 by Harvey Wells and associates, of Tacoma, Wash., from C. R. Miller. This was one of the early locations made on the island several years ago when the discovery of narrow quartz veins in the porphyrite, which occurs as the predominating country-rock in the north-western and south-easterly parts of Texada island, created considerable excitement.

There has been no activity in any of the properties owned by the Vananda Copper and Gold Company near the *Marble Bay* mine, but late in 1919 a bond was taken on these properties by the Calumet-Arizona Mining Company, and work is to be started in the near future unwatering the old mine-workings and extending them.

It was expected that after the passage of the "Iron-ore Supply Act, 1919," there would be quite a demand made by owners of the several small electric furnaces in and near Vancouver for a supply of magnetite ore, some of which would have been mined from the deposits on Texada island, but owing to litigation, in which the furnace companies became involved, the demand for magnetite ore for experimental purposes was limited to one small shipment.

This mine was visited on October 4th and 5th, 1919, when the progress in development-work made since the writer's visit on November 8th, 1918, was examined. In the Annual Report of the Minister of Mines for 1918, pages 275-277, a full description of the conditions on the 1,600-foot level is published.

*Development-work.*—During 1919 sinking the incline winze from the 1,600-foot level was continued. This winze starts from the 1,500-foot level near the north-westerly face of the long drift on that level. The winze is sunk 365 feet altogether on a 45-degree incline. The 1,600-foot level is 125 feet on the incline below the 1,500 foot level, and at 210 feet below the 1,600-foot level a station is made called the 1,700-foot level. This level is 1,610 feet vertically below the surface outcroppings at the main shaft and about 1,550 feet below the sea-level. The winze is sunk 30 feet below the 1,700-foot level. A diamond-drill station has been made on the west side of the winze about 15 feet below the 1,700-foot level, from which holes were being bored during the examination in order to prospect the ground laterally as well as to deeper levels. That point was selected for boring because, in sinking the winze on a 45-degree incline, it passed into the hanging-wall of the ore-body mined to the west of the winze on the 1,600-foot level; consequently it was advisable to prospect the ground under the floor of the winze, and at the point selected there was a lens of ore about 5 or 6 feet wide exposed on the west side of the winze. A sample from this exposure assayed: Gold, 0.7 oz.; silver, 0.5 oz.; copper, 2.8 per cent.

The winze from the 1,600- to the 1,700-foot level passed through the following series of rocks: 65 feet limestone, with bunch of ore on west side; 10 feet limestone; 5 feet quartz diorite; 1 foot garnetite; 30 feet igneous dyke (this dyke is 12 feet wide where it can be measured at a right angle to the dip, but the winze intersected it diagonally); 2 feet ore; 5 feet garnetite; 92 feet

limestone. The ore exposed on the west side of the winze below the 1,700-foot level was underhand-stoped for about 15 feet deep.

At the bottom of the winze, on October 5th, 240 feet below the 1,500-foot level, the formation is badly shaken up and the dip is south-easterly instead of westerly, as is the case on the upper levels. The rocks are limestone, garnet, quartz diorite, black silicified rock, apparently an igneous intrusive, with a narrow lens of ore enclosed in limestone garnet gangue. A sample of this ore assayed: Gold, 0.72 oz.; silver, 0.5 oz.; copper, 2.8 per cent.

*Shipments.*—During 1919 the shipments of ore made from the *Marble Bay* mine were mined partly from the stope above the 1,600-foot level and the remainder from stopes between the upper levels, some of which had not been entirely mined out. The stope between the 1,500- and 1,600-foot levels is 65 feet high to its highest point above the 1,600-foot level and 40 feet high minimum, 70 feet long, and an average of 8 feet wide.

This mineral claim is owned by W. S. Planta, of Vananda, and is located about two miles southerly from Vananda, near the main road from Vananda to the iron-mines, and on the west side of that road.

**Red Robin.**

*Geology.*—A contact between the Marble Bay limestone and Texada porphyrite rocks occurs to the west of the *Red Robin* mineral claim. The strike of the limestone appears to be east (mag.) and dips to the south, but no definite angle could be determined from the exposures because of the many fissures and shear-planes. The limestone is crystalline. In addition to the fissuring of the limestone, it is also cut by occasional diorite-porphyrity dykes. The fact that garnet and other secondary minerals do not occur in such quantity accompanying the metallic minerals, as is the case on the principal properties in the limestone formation on the island, is quite noticeable. Iron pyrite, chalcopyrite, some galena and blende are the metallic minerals occurring on the claim, and these are disseminated through the limestone.

*Development-work.*—There is a shaft, said to be 60 feet deep, which could not be examined because of being nearly full of water, also several open-cuts made on outcroppings of ore in the limestone.

*Samples.*—One sample taken from an open-cut about 200 feet easterly from the No. 1 post assayed: Gold, trace; silver, 0.6 oz.; copper, 2.4 per cent. Another sample selected from the dump at the collar of the shaft assayed: Gold, 0.24 oz.; silver, 6.8 oz.; copper, 5.5 per cent.

This claim is one of the older locations near the centre of Texada island, where a discovery was made of a gold-bearing quartz vein occurring at the contact

**Nigger Baby.**

between a much-altered limestone and the Texada porphyrite formation. The claim was owned by C. R. Miller, of Vananda, until 1919, when he sold out to Harvey Wells and associates, of Tacoma, Wash.

The claim was examined on October 4th, 1919, but little information could be obtained, because all of the older workings, consisting of several open-cuts and a shaft, said to be about 25 feet deep, were filled with water and debris, and the new work, consisting of a crosscut adit 75 feet long, had not been driven far enough to intersect the mineralized zone on which the shaft is sunk. The earlier work is along a ridge about 60 feet higher elevation than the level of the crosscut adit.

Prospecting has been done for about 300 feet in a general N. 60° W. (mag.) direction along the ridge where several outcroppings of gossan occur. These yielded colours in gold from panning, and the shaft mentioned was sunk at the point where the best values occurred.

It is proposed by the new owner to continue the crosscut adit in order to prospect the ground. The adit is driven in a S. 40° W. (mag.) direction. For 30 feet it is driven through porphyrite; next through a band of lime-silicate rock very much altered, 12 feet wide; then through porphyrite for 23 feet, where lime-silicate rock again occurs, and continues for 10 feet or to the face at the time the examination was made.

At the face of the adit a little mineral in the form of iron pyrite occurs disseminated in the lime silicate, but not in sufficient quantity to sample. It would appear, though, to be an indication that the face of the adit was near the contact on which the shaft mentioned earlier has been sunk.

STRATHCONA PARK SECTION.

*Buttle Lake Subsection.*

During the summer of 1919 there was a good deal of activity in the vicinity of Myra and Price creeks, at the head of Buttle lake, where about thirty mineral claims were recorded in

addition to the *Black Bear* group, referred to by the writer in the Annual Report of the Minister of Mines for 1918, page 268. This activity resulted from the report that Joseph Errington, consulting engineer for the Temiskaming Mines Corporation, had bonded the *Black Bear* group for his company.

A visit to this section had been arranged, but this had to be cancelled owing to the writer being called on to make an examination of the iron-ore deposits in the Taseko (Whitewater) River section on the Mainland; consequently the trip to Buttle lake had to be postponed until 1920.

Both Price and Myra creeks, which flow into Buttle lake near the head, rise in the high range of mountains north-westerly from the Big Interior mountain. The summit of this range forms the backbone of Vancouver island and marks the dividing lines between the Nanaimo, Alberni, and Clayoquot Mining Divisions. The waters from these mountains flow in torrential streams towards the north, west, and south. The waters flowing towards the north empty into Buttle lake; thence into the Campbell lakes, Campbell river, and into Discovery passage, near Seymour narrows, on the east coast of Vancouver island. The waters flowing towards the south empty into Great Central lake; thence into Stamp river and the Sumas river into Alberni canal, at its head, on the west coast of the island. The waters flowing towards the west empty into Bear river, which flows into Bedwell sound, one of the largest arms of Clayoquot sound.

The geographical location of the headwaters of Price and Myra creeks is interesting, because there is a possibility of an extension of the mineralized zones which occur in the vicinity of Big Interior mountain, reaching that part of the range of mountains in which the two creeks rise.

Buttle Lake subsection is at present handicapped by lack of transportation facilities for hauling heavy machinery or ore, but it is easy of access for prospectors and others who travel light. There is an auto-road for about twelve miles or so after leaving Campbell River settlement, and beyond the end of the auto-road there is a pack-trail to the foot of Buttle lake. The total distance by road and trail is about thirty miles and Buttle lake is about twenty miles long.

There has been no other noticeable activity in mining or prospecting in other sections of the Strathcona Park section of the Nanaimo Mining Division during 1920.

#### COMOX SECTION.

The Comox section of the Nanaimo Mining Division includes the comparatively narrow strip of Vancouver island contiguous to the east coast southerly from Campbell river to North-west bay, a distance of about seventy miles, together with Denman and Hornby islands, which are in the channel off Baynes sound between Vancouver and Texada islands. The area is known as the Comox coal-basin. It is separated from the Nanaimo basin by an axis of the Vancouver volcanics which occurs in the vicinity of North-west bay. The extreme north-westerly boundary of the Comox coal-basin is about six miles northerly from Campbell River settlement in the neighbourhood of Duncan and Menzies bays, outside of that portion of Vancouver island known as the Esquimalt & Nanaimo Railway concession. No mining operations are at present being carried on in that part of the Comox coal-basin.

The mining activity in the Comox section is confined to coal-mining in the vicinity of the town of Cumberland by the Canadian Collieries (Dunsmuir), Limited. The details of these operations are included in the reports of the Inspector of Coal-mines; consequently it is unnecessary to repeat in this report.

It is deemed advisable by the writer to call attention to the new work which has been carried on by the Canadian Collieries (Dunsmuir), Limited, during 1919. This consists of prospecting the territory, adjacent to the Tsaable river, which empties into Baynes sound about five miles southerly from Union Bay and opposite Denman island. In connection with this prospecting thirteen miles of wagon-road have been built and diamond-drill holes aggregating about 7,000 feet have been bored.

Within a comparatively short distance south-westerly and westerly from the town of Cumberland there occurs the Beaufort range of mountains, which forms the backbone of Vancouver island and is made up for the most part of rocks belonging to the Vancouver group, consisting chiefly of metamorphosed basic volcanic rocks, often with bands and lenses of limestone, usually fully crystalline, and argillites occurring as intercalations in the volcanics.

So far as can be ascertained, there has been very little systematic prospecting for metaliferous minerals done in this range of mountains in the Comox section of the Nanaimo Mining

Division, although it is only a comparatively short distance across the mountain range to the occurrences of copper-sulphide ores in the Buttle Lake subsection of the Nanaimo Mining Division on Myra and Price creeks, and the line of the Canadian National Railway is surveyed along the south shore of Comox lake en route from Alberni canal to Cumberland.

#### NANOOSE SECTION.

The Nanoose section of the Nanaimo Mining Division includes that part of the Division tributary to Nanoose bay, on the east coast of Vancouver island. The mining activity in this section is confined to the operations of the Nanoose-Wellington Coal Company, which succeeded the Nanoose Collieries Company, Limited, during August, 1919, and operates the Grant mine.

So far as at present known, the only mineral resource of the Nanoose section is the occurrence of the extreme north-westerly extension of the Wellington or lowest coal-seam in the Nanaimo coal-basin, as both the upper or Newcastle and Douglas seams are lacking. These seams are not found to the north-westerly from Newcastle island, about eight miles south-easterly from the Grant mine.

This company has its headquarters at 1010 L. C. Smith Building, Seattle, **Nanoose-Wellington Coal Co.** Wash., also at 607 Standard Bank Building, Vancouver. The officers of the company are: President, Louis Williams; secretary-treasurer, John A. Coleman; general manager, Frank H. Lantz; mine manager, John Johns, who has occupied the same position since 1917, or soon after the mine was opened. The property of the Nanoose-Wellington Coal Company is known as the Grant mine. It includes the Jack and Hinchman estates in Land Lot No. 27, also Land Lot No. 37, and four foreshore leases extending south-easterly four miles along the shore-line from a point a short distance north-westerly from Blunden point.

*Geology.*—The Wellington coal-seam on this property occurs between a sandstone floor and conglomerate roof. The sandstone is presumably Clapp's "East Wellington" sandstone, which is the usual floor of the seam. The conglomerate is apparently Clapp's "Extension" conglomerate. Such a roof is unusual with the Wellington seam; according to Clapp, "The roof of the seam varies, yet it is most commonly a sandy shale, carbonaceous and coaly in places." He only reports one other part of the Wellington seam where the roof is conglomerate; that is near Extension, at the farthest point south-easterly where any coal-mining has been done on that seam.

In structure the coal-seam in the Grant mine conforms with the usual structural characteristics of the Wellington seam at other points where mines have been opened, near the contact of the volcanic rocks with the coal-measures—namely, at Harewood, Wakesiah Farm, East Wellington, and Extension. The thickness of clean coal varies considerably, but the coal is of an excellent quality and carries as low a percentage of ash as any of the Vancouver Island coals.

*Development-work.*—The Grant mine is worked on the pillar-and-stall system. Since the coal rights on Land Lot No. 37 east of and adjoining Land Lot 27 have been secured through a lease from the Canadian Collieries (Dunsmuir), Limited, work on the slope that was being driven in a northerly direction under the sea from the bottom of the main shaft has been suspended, and the main East level and counter-level have been driven about 1,800 feet in 1919. These levels have opened a section of the coal-seam to the eastward, not before prospected by working-openings that are producing good coal. This work has also demonstrated that there is an anticlinal fold through the westerly part of the basin, and that on the top of the fold itself the coal is thin, but on the dips from the top of the fold the width of clean coal increases, and in the easterly part of the field now being developed the results are more satisfactory.

*New Equipment.*—The installation of a new surface plant has just been finished, so that in future the tippie, screens, belt-conveyors, and washer will have a capacity sufficient to handle 500 tons of coal a day. The plant consists of: Two return-tubular boilers, each 125 horse-power; one 750-foot Canadian Ingersoll-Rand compressor; one 150-kw. electric generator from Ross Engineering Works, Amherst, Nova Scotia; one electrically driven centrifugal pump for coal-washery and fire-protection, capacity 450 gallons a minute; two storage-tanks for coal-washery and fire-protection, capacity 25,000 gallons; one Elmore coal-washing plant, equipped with jig-washer, screening plant, picking-table, loading-boom, and bunkers for three grades of coal. The entire plant operated by electricity. One new office building; one stable to accommodate twenty head of horses; one power-house 46 x 52 feet.

There is bunker capacity for 1,000 tons of lump coal, rendered necessary because there is no well-sheltered harbour in the vicinity of the property; consequently when tugs tow scows to the wharf it is imperative to always have sufficient coal in the bunkers to load the scows with the least possible delay.

Each separate unit in the plant is operated by an individual motor. The coal is delivered from the mine-cars into a bin equipped with automatic feed, by which the coal is fed into a shaker-screen tippie. From the tippie the lump coal passes over a steel belt-conveyor about 20 feet long, so arranged that by lowering a section of it lump coal can be transferred directly into the cars, in which it is carried to the wharf and loaded into vessels or scows. If it is desired to carry the coal to the storage-bunkers, the movable section of the conveyor-belt is switched to one side, where it connects with a second steel belt-conveyor about 90 feet long built lengthwise over a bunker with capacity to store 1,000 tons. The last-named belt-conveyor is arranged so that it discharges from any one of the several sections or at the end, so that different grades of coal can be dumped into the bunkers under the belt and stored separately, or can be carried the entire length of the belt and dumped at the end.

The slack and nut coal which passes through the shaker screen is carried in an elevator to a bin near the top of the plant, from which it is discharged into the Elmore coal-washer, where the coal is washed and sized and passes through chutes and elevators to storage-bin. From the washer the rock and waste pass through a chute to the waste-dump at the back of the plant.

During the winter a supply of fresh water for the washer is secured from a spring on the property, stored in two tanks, with a capacity of about 25,000 gallons, from which it is drawn by gravity to the washer. During the summer months sea-water is pumped into one of these tanks and used in the washer.

#### NANAIMO SECTION.

The Nanaimo section of the Nanaimo Mining Division includes that part of the Nanaimo coal-basin between Departure bay on the north and Ladysmith harbour on the south. Within these boundaries are the collieries operated by the Canadian Western Fuel Company, known as the No. 1 or Esplanade shaft, Protection Island, Harewood, Reserve, and New Wakesiah mines; the collieries operated by the Canadian Collieries (Dunsmuir), Limited, known as the Extension Colliery and No. 5 mine at South Wellington; the Morden mine, about two miles easterly from South Wellington, operated by the Pacific Coast Coal Mines, Limited, and the Granby No. 1 Colliery at Cassidy, operated by the Granby Consolidated Mining, Smelting, and Power Company.

Each of the above-mentioned collieries is described in detail in the Inspector of Coal-mines' report in this Annual Report of the Minister of Mines; consequently the remarks by the writer will be very brief.

Two new producers are the No. 5 mine at South Wellington, the property of the Canadian Collieries (Dunsmuir), Limited, from which coal has been mined on a commercial scale since early in 1919, and the Wakesiah mine on the Wakesiah farm, the property of the Canadian Western Fuel Company, Limited, which began producing commercially about October, 1919.

Amongst new development or prospecting work to be recorded for 1919, there is the reopening of an old slope by the Canadian Western Fuel Company, Limited, on the Wellington seam southerly from the Harewood mine. The slope had been driven about 700 feet and abandoned by the former management. During the past summer the old workings were unwatered and examined, with the result that the general manager, George A. Bowen, ordered that the workings be reopened and extended and the mine placed on a producing basis. This may be worked as the Harewood No. 2 mine with a new railway connection, or the underground workings may be extended to connect with the haulage system on the Harewood mine and the coal be transported through that mine to the railway system now in use.

Some diamond-drilling was done by H. W. Treat, of Seattle, Wash., on a foreshore lease near the mouth of the Chemainus river during the spring of 1919, but has been suspended. In this connection it is interesting to note that the title to several foreshore leases obtained by Mr. Treat was attacked in the Courts by the Esquimalt & Nanaimo Railway Company, carried to the Privy Council in 1919, and the suits won by Treat.

The labour conditions in the coal-mines on Vancouver island have been excellent during 1919; the relationship between the companies and their employees was so harmonious that, despite the efforts made by some of the radical leaders in the Vancouver strike, it was found impossible to promote any discord in the Island collieries. A system of collective bargaining was introduced

after the big strike in 1914, by which the miners working for each company elect committees by a pit-head ballot from amongst the employees in the particular mines operated by the respective companies, which committees act as advisory and conciliatory boards between the miners and the company. In this way each individual company treats with its own employees, and new contracts were signed last fall satisfactory to all.

#### LADYSMITH SECTION.

In the 1918 Annual Report of the Minister of Mines the section now described under the above heading was considered under the heading of "Nanaimo River subsection of the Strathcona Park section," but the above is considered the most appropriate.

The boundary between the Nanaimo and Victoria Mining Divisions is a short distance south of the town of Ladysmith, and the Ladysmith section of the Nanaimo Mining Division embraces a comparatively narrow strip of country extending westerly from the coast of Vancouver island to the headwaters of the South fork of the Nanaimo river.

During recent years there has been but very little prospecting in this section of the Nanaimo Mining Division, but in the early history of the Division the country in the westerly part of this section was prospected to a considerable extent and several mineral claims were staked. Chief amongst these are the *Jubilee*, *Paterson*, and *Allies* groups, all of which are mentioned in the 1918 Annual Report of the Minister of Mines.

The present inactivity in the section is due mainly to the fact that it lies within the Esquimalt & Nanaimo Railway Belt, and that company has title to all coal and base metals occurring in the belt, leaving only the precious metals under the control of the Provincial Government. Under the Dunsmuir regime a fairly good arrangement could be made by locators of mineral claims within the belt, but under the present control of the Esquimalt & Nanaimo Land Grant, presumably the Canadian Pacific Railway Company, no arrangement considered to be equitable by prospectors can be perfected.

As no occurrences of ore carrying gold and silver values exclusively have been discovered in the Esquimalt & Nanaimo Railway Belt, there is no incentive to prospectors to explore within its boundaries unless an equitable arrangement can be made with regard to the copper values.

Lack of transportation facilities into this section of the Nanaimo Mining Division is another reason for inactivity in mining operations. There are three routes by old trails by which the section can be reached at present. One route is by way of Cowichan lake to the mouth of Cottonwood creek; thence up that creek to the headwaters of the North-west fork of the Chemainus river, and from there on to the divide between the North-east fork of Cottonwood creek and the headwaters of the South fork of the Nanaimo river, a distance of about twelve miles from Cowichan lake. Another route is from Ladysmith via the old Rineheart trail to the headwaters of the West fork of the Chemainus river near where it forms a junction with the trail from Cowichan lake. The third route is from Nanaimo via the wagon-road up the South fork of the Nanaimo river to the city dam across that river; thence by trail to the *Jubilee*, *Paterson*, and *Allies* groups of mineral claims, a distance of about thirty miles from Nanaimo, and across the mountains, where there is no trail, towards Cowichan lake, a further distance at present undetermined.

During the summer of 1918 the writer visited the groups of mineral claims mentioned, travelling the route from Nanaimo, and during June, 1919, he endeavoured to reach the same section to examine the *Mountain Ash* and *Silver Leaf* mineral claims, owned by Thos. Service, of Riverside, Cowichan lake, travelling via Cowichan Lake and Cottonwood Creek trail, but because of the depth of snow on the divide between the North-east fork of Cottonwood creek and the head of the South fork of the Nanaimo river was unable to make an examination. A sample obtained from Service, said to have been taken from a vein on the *Silver Leaf* mineral claim, assayed: Gold, 1.16 oz.; silver, 1.5 oz.; copper, 15.2 per cent.

The Ladysmith section of the Nanaimo Mining Division is recognized as important, because in it is located the copper blast-furnace of the Ladysmith Smelting Corporation, Limited, formerly the Tyee Copper Company's plant. This smelter has been closed down since 1912, except for a short time during the summer of 1917, after the present owners purchased the plant. There is a prospect, the writer is informed by officials of the company, that the smelter may be blown in during 1920, as the company has developed the *Girdwood* mine, also known as the *Blackbird*,

on Latouche island, Prince William sound, Alaska, up to a shipping stage, and claims a large tonnage of copper-sulphide ore blocked out available for early shipment.

The company has during the past year acquired several mineral claims on Mount Sicker in addition to the Tye mining property there, on which it has a crew of miners working; also the *Blue Bells* group of mineral claims on Frederick arm near Thurlow island, in Nodales channel, about 120 miles north-westerly from the smelter-wharf near Ladysmith.

#### VANCOUVER MINING DIVISION.

The Vancouver Mining Division occupies an area on the Mainland, as well as several small islands directly tributary to the city of Vancouver. The northern boundary follows the Coast range from north of the head of Jervis inlet south-easterly to Green lake, near Mons Station, on the Pacific Great Eastern Railway; the eastern boundary adjoins the western boundary of the New Westminster Mining Division and generally follows an irregular line southerly from Green lake to the head of Burrard inlet; the southern boundary is the North arm of the Fraser river and the coast-line of the Strait of Georgia to Point Grey, and thence to the west side of Jervis inlet, a distance of about thirty-five miles from Vancouver City; and the western boundary follows the watershed between Jervis inlet and Powell lake.

So far as metalliferous lode-mining is concerned, the Vancouver Mining Division is by far the most important Division in the Western Mineral Survey District, by reason of the fact that the *Britannia* mine is within its boundaries, and the further fact that its distributing centre is the largest city in the Province, which naturally attracts many mining men, as well as brokers and some prospectors.

In the Annual Report of the Minister of Mines for 1918, on pages 290-296, several prospects situated in the different sections of the Vancouver Mining Division were described by the writer. There has been but comparatively little activity in prospecting during 1919 in the Division, with the exception of the vicinity of Mount Diadem near Britain river, which empties into Jervis inlet at the north end of Prince of Wales reach, and on the westerly side of Howe sound.

On the properties described in the 1918 Report the usual assessment-work has been performed during 1919, but no extensive development-work has been reported; consequently it is unnecessary to repeat the descriptions in the present report.

#### BRITANNIA BELT SECTION.

**Britannia.** The Britannia Mining and Smelting Company, Limited, has continued during 1919 pursuing its progressive policy of the past with regard to new development-work in the mines, and although, when the final results of the production during the year were definitely ascertained, the figures did not reach those given in Bulletin No. 1, 1919, Provincial Bureau of Mines, "Preliminary Review and Estimate of Mineral Production, 1919," yet the production is satisfactory when the scarcity of water resulting from an unusually dry summer is considered, together with the uncertainty in the market and fluctuations in prices. As compared with 1918, the monthly averages in prices in cents per pound for electrolytic copper in New York are shown in the following table, taken from the *Mining and Scientific Press* of San Francisco:—

#### Monthly Averages.

	1918.	1919.
January .....	23.50	20.43
February .....	23.50	17.34
March .....	23.50	15.05
April .....	23.50	15.23
May .....	23.50	15.91
June .....	23.50	17.53
July .....	26.00	20.82
August .....	26.00	22.51
September .....	26.00	22.10
October .....	26.00	21.66
November .....	26.00	20.45
December .....	26.00	18.55

The *Britannia* mine was visited during the latter end of October, 1919, when the information contained in the following report was obtained.

*Britannia Beach.*—There have been several improvements made in the camp at Britannia Beach, the most important being the tearing-down of the old concentrating and vanner building and the erection of a recreation-hall building, 36 feet wide by 72 feet long, of two stories. On the second floor of this building is a large dance-hall, which is also used for moving-picture entertainments. On the first floor is a very modern billiard-hall, furnished with an English billiard-table and three pool-tables, also a barber-shop. This building was erected at the expense of the company, and illustrates in a practical way the interest the company shows in the welfare of its employees.

*Development-work.*—In the main adit or tunnel, with its portal near the grizzly floor of the concentrating-mill, there has not been much progress during 1919. This adit is driven 4,221 feet long, 9 feet high, 13 feet wide, with an upraise 12 x 7 feet, started at a point 4,053 feet from the portal, where a station 15 x 10 x 9 feet has been made. The upraise is 100 feet high, but will eventually reach the 2,700-foot level, and will then be over 1,300 feet high, as it is being driven on an incline, or the difference between 250 feet above sea-level, the elevation at the portal, and about 1,550 feet above sea-level, the elevation at the 2,700-foot level. The various levels are measured from the summit of the outcroppings at the glory-hole downwards instead of from sea-level upwards.

New work is on the 3,100-foot level, where an adit is driven 659 feet, with a crosscut 325 feet, prospecting for suitable ground for the upraise from the 4,100-foot or main adit level to be made through to the 2,700-foot level. This adit is 400 feet below the level of the upper terminal of the incline tramway. In addition to prospecting for ground for upraise, the adit and crosscut will also prospect ground heretofore unexplored at depth.

On the 2,700-foot level, near the head of the incline tramway, the crosscut adit known as the Armour crosscut has been driven in a southerly direction 502 feet to October 24th, 1919. This adit is 10 feet wide by 12 feet high.

The productive mine-workings are at present reached from the main haulage level, known as the 2,200-foot and being about 2,100 feet above sea-level. The adit on this level is 4,712 feet long, 9 feet high, by 13 feet wide. It is equipped with electric haulage and connected with the levels above by a vertical raise reaching to the 1,000-foot level; from that level direct connection is made by a vertical raise to the 500-foot, which is connected with the 250-foot level by another vertical raise.

The three raises mentioned are equipped with hoists and cages for transporting men, timbers, and supplies only. The mined ore is transported by passing down a series of rock-raises and transfer rock-raises to the crusher on the 1,800-foot level, and thence to the ore-bins on the 2,200-foot level. The economy of this system is recognized by the fact that about three-quarters of the ore mined is only handled once between the stopes and the main haulage level, while the remainder is only handled twice, so that the cost of transportation is minimized to the lowest possible figure.

In the present report reference will only be made to the development-work done during 1919, as the work done previous to that year is fully described in the Annual Report of the Minister of Mines for 1917, pages 271-275, and for 1918, pages 291-292. In describing the development-work in this report the mine-workings will be considered in descending order, starting from the glory-hole at the summit of Britannia mountain, about 4,300 feet above sea-level.

For convenience the *Britannia* mine is subdivided into four divisions known as the *Fairview*, *Bluff*, *Jane*, and *Empress* mines, all of which are connected by underground workings. The ore-bearing zones are called veins and numbered from 0 to 11, from N. to S., with 0 vein being the most northerly.

*Fairview Mine.*—The glory-hole covers an area of about 1,100 feet from W. to E. and 400 feet from N. to S., mostly on the *Fairview* mine, but a part of it on the westerly end extends on to the *Bluff* mine. The glory-hole working has practically levelled off the top of the mountain down to the 250-foot level. Ore is mined from veins Nos. 8 to 11 in this working. Northerly from the glory-hole surface work has been done on veins Nos. 4 and 6. The extreme width from vein No. 4 to vein No. 11 is 800 feet.

On the 250-foot level the veins worked are Nos. 4 to 11, inclusive, and the work done during 1919 aggregates 600 feet of drifts, 300 feet of crosscuts, and 400 feet of raises. The raises were

made to draw the ore mined from the glory-hole when, because of the great depth of snow that accumulated in it, some ore was mined by stoping up from the 250-foot level instead of by quarrying. Some of the ore so mined was passed down a rock-raise to the 500-foot level, the remainder to the 850-foot level, and about three-quarters of the tonnage was only handled once before it reached the crusher on the 1,800-foot level; the remainder was only handled twice in transit to the crusher.

On the 500-foot level the veins exposed are from veins Nos. 3 to 11. Above this level all of No. 3 vein has been left for pillars. Stopes above the 500-foot level up to the 250-foot level are on veins Nos. 4, 5, 6, 7, 9, 10, and 11, with most of the work done on veins Nos. 9, 10, and 11, on the main hanging-wall side of the mineral-bearing zone, which dips about 75 degrees to the south. The work done during 1919 on the 500-foot level aggregates 400 feet of drifts, 100 feet of crosscuts, and 1,500 feet of raises.

The stopes above the 500-foot level to the 250-foot have up to the present time been one of the most productive sections of the mine, and the continuity of the No. 5 vein above the 500-foot level has been almost phenomenal, as shown in the Brandon stope, which is 1,300 feet long by 35 feet wide. The stope on the No. 9 vein is 500 feet long, but the vein has been drifted along on the 500-foot level for a distance of 1,150 feet. The stopes on veins Nos. 10 and 11 on the 500-foot level are amalgamated into one stope 650 feet long by 30 feet wide.

The ore stoped from above the 500-foot level is dropped to bins in the 1,000-foot level by a system of transfer rock-raises. From the bins the ore is transported by an electric train to the top of the No. 68 or main rock-raise, down which it is dropped to the crusher floor on the 1,800-foot level.

On the 600-foot level there are stopes on veins Nos. 3, 4, 5 foot-wall, 5, 6, 7, and 10. Between No. 5 foot-wall and 5 there is a barren zone averaging about 20 feet wide, but the No. 5 foot-wall vein does not continue below the 600-foot level. The work done on the 600-foot level during 1919 has been 125 feet of crosscuts and 200 feet of raises. The following is a synopsis of work being done in the stopes between the 600- and 500-foot levels, together with the general dimensions: Stope on No. 3 vein, robbing pillars, stope 450 feet long by 30 feet wide; stope on No. 4 vein measures 120 feet from W. to E. by 15 feet wide; stope on No. 5, robbing pillars, stope measures 600 feet long; stope on No. 6 vein measures 120 feet W. to E. by 20 feet wide; stope on No. 7 vein, robbing pillars, stope measures 200 feet long by 35 feet wide. On No. 10 vein prospecting-work was done and the vein was exposed about 50 feet below the 500-foot level.

On the 850-foot level there are stopes on veins Nos. 3, 4, 5, 6, and 7. The development-work done during 1919 on the 850-foot level has been 200 feet of crosscuts and 300 feet of raises. On the No. 3 vein the stope is 450 feet long by 30 feet wide. This stope has now been carried through to the 600-foot level. On No. 4 vein the work has been robbing pillars in the stope, which is 750 feet long by 15 feet wide. The stope on No. 5 vein measures 400 feet W. to E. by 30 feet wide; the stope on No. 6 vein measures 480 feet W. to E. by 20 feet wide; the stope on No. 7 vein measures 700 feet W. to E. by 25 feet wide.

On the 1,000-foot level there are stopes on veins Nos. 1, 3, 4, 5, 6. The development-work done during 1919 on the 1,000-foot level is 50 feet of drifts, 200 feet of crosscuts, and 300 feet of raises. On the No. 1 vein the stope is 150 feet from W. to E. and work of robbing the pillars has been carried on during 1919. The stope on No. 3 vein is 400 feet long W. to E. by 15 feet wide; the stope on No. 4 vein is 750 feet long W. to E. by 20 feet wide; the stope on No. 5 vein is 450 feet long W. to E. by 20 feet wide; the stope on No. 6 vein is 600 feet long W. to E. by 27 feet wide. All stopes, except those on Nos. 3 and 6 veins, are opened through to the 850-foot level. No. 8 vein is not exposed below the 1,000-foot level.

On the 1,200-foot level veins Nos. 1, 3, and 5 have been drifted on and vein No. 7 has been exposed in crosscutting to the south. No. 1 vein is drifted on for 400 feet and raises made preparatory to stoping. No. 3 vein is 1,150 feet long from W. to E. and 30 feet wide. Below the 1,200-foot level veins Nos. 3 and 4 amalgamate. Vein No. 5 is 700 feet long on the 1,200-foot level and about 15 feet wide. No stoping has yet been done on this vein above the 1,200-foot level, but during 1919 chutes have been cut, aggregating 400 feet, preparatory to beginning to stope.

On the 1,400-foot level during 1919 there has been 270 feet of crosscuts driven south from vein No. 3 to No. 5 vein, and crosscutting is being continued to expose veins Nos. 6 and 7.

On the 1,600-foot level during 1919 there has been 650 feet driven on No. 5 vein to the easterly from the *Fairview* mine to complete connection from the main shaft to open air in south valley. The total length of this tunnel is one mile.

On the 1,800-foot level the drift on the No. 3 vein has been advanced 260 feet during 1919.

On the 2,000-foot level the drift on No. 2 vein has been advanced 150 feet during 1919.

*Bluff Mine.*—This mine is westerly from the *Fairview*, which it adjoins. The name is derived from the fact that the earliest development-work done on the *Britannia* group was on what is now known as the 1,000-foot level, where the surface is a comparatively flat bench from which rises a precipitous bluff, called by the miners the "Mammoth" bluff. The precipitous northerly slope of this bluff showed considerable mineralization, being heavily stained by the oxidization of iron pyrite, associated with which there occurred sufficient chalcopyrite in a siliceous gangue to make a valuable body of concentrating-ore. A long adit driven into the bluff in 1900 crosscut diagonally an extensive body of this ore.

Until within a few years ago the 1,000-foot level was the main haulage level, the site of the chief mine camp and upper terminal of the aerial tramway; but since the 2,200-foot level has been developed and made the main haulage level, upper terminal of the electric railway, and the site of the chief mining camp, comparatively little attention has been paid to the "Mammoth" bluff until within the past two years, for the reason that the *Fairview* mine has been the principal productive part of the property above the 1,000-foot level. Since then a glory-hole has been opened on the "Mammoth" bluff, an average height of 125 feet above the 1,000-foot level, 200 feet long from W. to E. and 90 feet wide. The ore from this glory-hole is delivered on the 1,800-foot level at the crusher by one handling. The product is approximately 300 tons a day.

On the 1,200-foot level in the *Bluff* mine three stopes have been opened during 1919, with pillars between them. These are known as the foot-wall, centre, and hanging-wall stopes for convenience. The foot-wall stope is 450 feet long by 60 feet wide, the centre stope is 300 feet long by 50 feet wide, and the hanging-wall stope is 150 feet long by 40 feet wide. Raises are being made from which to work the stopes on the shrinkage system. The hanging-wall stope only reaches to a vertical height of about 150 feet above the 1,200-foot level, where the hanging-wall country-rock is exposed.

The total development-work in the *Bluff* mine done during 1919 consists of 1,500 feet of drifts, 450 feet of crosscuts, and 2,000 feet of raises. This work is all between the 1,600- and 1,000-foot levels. The 1,600-foot level is the lowest opened in the *Bluff* mine.

*Jane Mine.*—This mine adjoins the *Bluff* on the west. The earliest work done on the original *Britannia* group of mineral claims was on the *Jane* claim, consisting of that done by the prospectors who staked the claims in 1898 and did prospecting-work on the 1,000-foot level. During 1919 all the work in the *Jane* mine has been done on the 1,200-foot level. This consists of 150 feet of drifts and 400 feet of raises.

*Empress Mine.*—The portion of the *Britannia* property known as the *Empress* mine comprises the original *Empress* group of mineral claims in the territory known as South valley, drained by the waters of Furry creek, which empties into the east side of Howe sound about three miles southerly from Britannia Beach.

The *Empress* mine-workings are connected with the workings on the other mines described above by a series of drifts on the 500-, 1,000-, and 1,600-foot levels, that on the 1,600-foot level measuring one mile in length. This new connection on the 1,600-foot level was completed during 1919, when 660 feet of it was driven. From this main drift the management purposes making crosscuts to develop the ore-bodies in the *Empress* mine, which have a general strike N. 70° W. and dip from 60 to 65 degrees to the south.

The work done in the *Empress* mine during 1919 is confined to the 850-, 1,000-, 1,200-, and 1,600-foot levels.

On the 850-foot level, at an elevation of 3,500 feet above sea-level, no new development-work was done in 1919, but stoping on No. 2 vein was continued. This stope is 250 feet long, 30 feet wide, and 110 feet high, but has not been driven through to the 700-foot level, which is 120 feet above the 850-foot level, or 3,620 feet above sea-level.

On the 1,000-foot level veins Nos. 1 and 2 are being stoped. No. 1 vein stope is 230 feet long and 20 feet wide; No. 2 vein stope is 260 feet long and 40 feet wide.

On the 1,200-foot level an ore-body is being developed by a diagonal drift 900 feet long, 650 feet of which has been driven during 1919. There are also 400 feet of crosscutting from the portal which overlooks South valley to the diagonal drift.

Outside work in the South Valley part of the *Britannia* property consists of the *Victoria* tunnel, driven 45 feet in 1919, and diamond-drill boring to the east, but on the *Victoria* mineral claim. The diamond-drilling exposed an ore-body heretofore unknown, estimated by J. W. D. Moodie, the general manager, as containing approximately 3,000,000 tons of ore of commercial value by concentration that can be classed as "actual" ore, developed by diamond-drilling.

Mr. Moodie, in describing this work and the results, is of the opinion that the strike of the main ore-body in the *Empress* mine may have been diverted into the valley of the West branch of Furry creek on to the *Victoria* mineral claim. The ore-body occurs under a heavy overburden of gravel and debris, so that diamond-drilling was the only practicable method of determining its occurrence.

Driving on the Hillside crosscut adit west of the *Jane* mine is being continued to prospect ground on the same level as the 1,000-foot on the *Jane*. This adit was driven 600 feet during 1919.

In the foregoing summary of the measurements of raises made during 1919 the footage driven in stopes for ventilation and exits are not given, because such measurements are included in the dimensions of the stopes.

During 1919 the Britannia Company shipped several hundreds of tons of gypsum from the *Fairview* mine. This mineral is associated with the Britannia schist-zone. It was discovered on the 1,000-foot level in the *Fairview* workings, more than 500 feet easterly of the glory-hole and northerly from any known copper-ore bodies. The gypsum was first exposed in the Mammoth bluff adit about 700 feet from the portal. The stope from which the gypsum was mined is 50 feet long and 30 feet wide.

*Water-power.*—There has been practically no change of note in the water-power plants during 1919. Some ditching has been done to supplement the intake on Furry creek from Marion lake. The several storage-reservoirs have fully demonstrated their usefulness, because during the dry season in the autumn these reservoirs saved the day. The total water horsepower under use at present is 6,000.

*Indian River Properties.*—The Britannia Mining and Smelting Company has expended about \$75,000 during 1919 in the purchase and development of properties acquired in the vicinity of Indian river, about twelve miles easterly from Britannia Beach. Some adits were driven and diamond-drilling for prospecting was carried on, but all of this work has been suspended since peace was declared, because of the excessive cost for labour and supplies and the decreased price of copper, together with the uncertainty of demand.

*Ore Reserves.*—The tonnage of ore reserves in the *Fairview*, *Bluff*, *Jane*, and *Empress* mines, exclusive of the ore-body recently discovered on the *Victoria* mineral claim, is reported by the management as being 9,000,000 tons of "actual" ore, averaging 2 per cent. in copper, in addition to low gold and silver values. No estimate is made of ore reserves that may be considered as "probable" and "possible," but have only been exposed by diamond-drilling.

#### PACIFIC GREAT EASTERN SECTION.

The section of the Vancouver Mining Division described as the Pacific Great Eastern includes the territory traversed by the Pacific Great Eastern Railway from Squamish, the terminal at the head of Howe sound, to the divide between Alta and Green lakes, about 40 miles from Squamish.

This section, together with several groups of mineral claims, was described in the Annual Report of the Minister of Mines for 1918 on pages 293-296; therefore in the present report reference will only be made to the mineral claims examined during September, 1919, which were not included in the 1918 Report.

This group consists of four mineral claims—*Bruce*, *Bruce No. 1*, *Bruce No. 2*, and *Bruce No. 3*. The group is owned by Duncan McKinnon, D. A. McKinnon, G. D. Martin, and D. McCallum, of Vancouver. The property is located in the mountains at an elevation of about 3,000 feet. The claims are a short distance back from the Staamus river on the easterly side, about five miles above its mouth at the head of Howe sound. Ray creek, a tributary of the Staamus, flows through the group of claims in a deep box

canyon nearly its entire length of about three-quarters of a mile, in which it falls about 1,400 feet. The *Bruce* camp is on Ray creek at an elevation of about 1,200 feet above sea-level.

*Geology.*—The prevailing rocks on the *Bruce* group of mineral claims and vicinity are schists occurring in a belt about one mile wide and of undetermined length. The line of strike is in a north-westerly direction nearly parallel to the course of the narrow Staamus River valley, and the dip is 63 degrees to the south-west. This schist-belt is apparently surrounded by granodiorite of the Coast batholith intrusion. The schists are very much metamorphosed and mineralized to a very considerable extent, principally with iron pyrite, with which is associated some chalcopyrite.

*Characteristics of Mineral-deposits.*—The mineralization in the schists is so generally distributed through the entire width of the belt and shows such low values that the difficulties and expense of thoroughly prospecting for zones of enrichment must of necessity be great. Several open-cuts made in the belt of schist at points varying from about 1,500 to 3,000 feet above sea-level were examined and sampled by the writer, but assays of these samples failed to show any commercial values.

This group consists of nine mineral claims owned by Duncan McKinnon and **McKinnon Group**, associates, of Vancouver. The group is located along the Staamus valley, one claim (or 1,500 feet) wide and nine claims (or 13,500 feet) long, nearly parallel to the course of the Staamus river. Two of the claims in the *McKinnon* group are located between the river and the *Bruce* group already described.

*Geology.*—The belt of schists which occurs on the *Bruce* group is found to extend over on to the *McKinnon* group. The contact between the granodiorite of the Coast batholith and the schists is well defined on Ray creek on the *Maud* mineral claim, one of the *McKinnon* group.

*Characteristics of Mineral-deposits.*—The mineralization in the schists consists chiefly of disseminations of iron pyrite, chalcopyrite, and a little zinc-blende. Similar conditions to those surrounding the occurrences of mineral on the *Bruce* group of mineral claims are found on the *McKinnon* group. The future value of these properties rests on the results from thoroughly prospecting the belt of schists with a view to finding, if possible, a zone or zones of enrichment, where the values have been so concentrated as to be sufficiently high to yield satisfactory results on a commercial scale.

Several samples taken from open-cuts and short adits, which represent assessment-work, when assayed failed to yield satisfactory values.

#### WEST SIDE OF HOWE SOUND SECTION.

Ever since the success of the operations by the Britannia Mining and Smelting Company has been assured, efforts have been made by prospectors to locate a westerly extension of the Britannia mineral-belt adjacent to the west side of Howe sound, but up to the present, time these efforts have not been followed by any marked degree of success. The country is a very difficult one to prospect thoroughly owing to heavy growth of underbrush, precipitous cliffs, deep gulches and canyons that are practically impassable owing to the almost vertical sides.

From time to time reports are given out relative to the discovery of so-called extensions to the Britannia belt, but up to the present time there have not been any material results apparent or any discoveries made that have proved sufficiently attractive to capitalists to encourage any to invest sufficient money to develop such claims as have been staked.

The latest proposition to receive attention is a group of claims located by a prospector and miner named Mike Johanson on a small creek named McDonald creek, about five miles in a south-westerly direction from Britannia Beach, which was examined by the writer on March 22nd, 1920.

This group contains twelve mineral claims—*Horseshoe*, *Horseshoe No. 2*, **Horseshoe Group**, *Horseshoe No. 3*, *Horseshoe No. 4*, *Horseshoe No. 5*, *Horseshoe No. 6*, *Frank*, *John*, *Joe*, *Tom*, *Viva*, and *Viva No. 2*—owned by Mike Johanson, who lives on the property, and associates. The group is staked from the beach on Howe sound back into the mountains to the vicinity of Mount Ellesmere for a distance of about 7,500 feet, or the length of five claims. Along the beach there is a tier of three claims staked from south to north; to the west of and adjoining these claims there is another tier of three claims, followed up the creek by three tiers with two claims each. The claims are reached by travelling in a westerly direction a good but steep trail across three claims and a part of a fourth, where work on the

trail had ceased within about the length of a claim from a steep bluff which in appearance somewhat resembled the Mammoth bluff on the *Britannia* property previous to any development having been done on it.

*Geology.*—There is a belt of schists and altered argillites occurring on the property with its line of strike in a westerly direction, and apparently this belt extends through three or four of the claims in that direction, but its width is at present undetermined. On both the north and south sides the belt of schists, some of which are micaceous, is flanked by granodiorite of the Coast batholith.

*Characteristics of Mineral-deposits.*—There are two prominent outcroppings of mineralized schist on the group of claims so far as has been exposed to date. One of these is on the *Joe* claim, the third claim westerly from the beach, through which McDonald creek flows. The outcrop occurs at an elevation of about 1,400 feet above sea-level and about 500 feet in a northerly direction from McDonald creek. A sample was taken from a small open-cut in the bluff, which assayed: Gold, trace; silver, trace; copper, trace.

The mineralization occurs at the contact between granodiorite and micaceous schist. The outcrop is made up of iron-stained schist, in which occur lenses of quartz carrying iron pyrite, pyrrhotite, and apparently some chalcopyrite. It is impossible to form any estimate as to the extent of the mineralization until more work is done.

Another outcropping that is heavily iron-stained and evidently mineralized with iron pyrite occurs on the *Horseshoe* claim, which adjoins the *Joe* on the north-west. This outcrop can be seen from a point about half a mile distant. It forms a prominent landmark, and the reddish colour resulting from the oxidation of iron pyrite in the gangue tends to make the bluff in which the outcrop occurs more conspicuous, as well as giving it some resemblance to the Mammoth bluff on the *Britannia*.

The outcropping could not be examined closely because the trail had not been built to it, and the writer had no guide to show the way through the dense forest-growth nor time to cruise out a trail. As he was reliably informed that no work had been done on the outcropping, but little information could have been obtained from an examination, as samples from the weathered face of the bluff would not have proved satisfactory so far as ascertaining an average value of the mineralized rock.

#### BOWEN ISLAND SECTION.

Bowen island was visited by the writer on March 23rd, 1920. It is situated at the entrance to Howe sound, and although considerable prospecting has been done on it, chiefly around the shore, and quite a number of mineral claims located and Crown-granted, there is at present only one group being operated. This is on the east coast of the island and known as the *Emerald* group of mineral claims, owned by the Bowena Copper Mines Limited, Company, of Vancouver, of which Charles M. Oliver is the managing director. The property is being worked under a lease by Clarence W. Tipping, of Vancouver.

This group of mineral claims contains the *Emerald* and *Emerald No. 1*. Both **Emerald Group.** of these are Crown-granted. The prevailing rocks in the vicinity of the *Emerald* group of mineral claims belong to the Vancouver series of volcanics, which are very much sheared, fractured, and fissured. Intruding into the volcanics are some well-defined igneous dykes, classified by Victor Dolmage, of the Geological Survey of Canada, as fine-grained, light-grey, quartz porphyry.

*Characteristics of Mineral-deposits.*—Copper minerals occur as deposits similar to those described by Clapp in Memoir No. 13, Canada Department of Mines, 1912, page 176, and classified as the Sooke type of deposit with "disseminated chalcopyrite in shear-zones." The deposits, of which there are two occurring nearly parallel to each other, have a vein-like structure, are from 8 to 10 feet wide, and can be traced on the surface for some considerable distance. The walls are fairly well defined. The general line of strike of the veins is about N. 35° W. and dip about 80 degrees to N. 55° E.

The ore-bodies for convenience are designated as the "shaft" and "adit" veins. These veins occur within a distance of about 100 feet from each other. The "adit" vein has been the most extensively developed. It outcrops in the face of a precipitous bluff overlooking deep water. An adit has been driven in a N. 55° W. (mag.) direction 230 feet. From near the portal copper ore is exposed in the roof of the adit for a distance of 75 feet, at which point a sample was taken

across 7 feet. From that point for about 75 feet there is no ore exposed in the adit, but in a crosscut driven towards the south-west (mag.) from the adit, and at the point of junction, the vein-matter which was sampled is about 10 feet wide. Apparently the adit is driven parallel to the vein for about 75 feet, or for the distance between the points sampled. From the junction of the adit and crosscut the former is driven about 80 feet, with no ore exposed, to the face, where there is a narrow stringer of ore. The crosscut beyond the part sampled at its junction is driven about 50 feet long in barren country rock. This was done with the intention of intersecting the "shaft" vein on the same level as the adit, or about 125 feet vertically below the outcrop of the vein, but has not yet been driven sufficiently far to accomplish the purpose.

A vein which is apparently the "adit" vein is exposed on the surface by an open-cut about 8 feet deep and 8 feet wide. The "shaft" vein is prospected by a shaft with drift at the bottom, which could not be examined because of being full of water. The shaft is said to be 30 feet deep and drift 10 feet long. A sample was taken from the dump at the collar of the shaft.

*Assays.*—Samples taken from point 75 feet in adit assayed: Gold, trace; silver, trace; copper, 0.3 per cent. Sample taken from point 150 feet in adit assayed: Gold, trace; silver, trace; copper, 0.4 per cent. Sample taken from collar of shaft assayed: Gold, trace; silver, trace; copper, 15.2 per cent.

*Development-work.*—The development-work in the mine consists of a main drift-adit 230 feet long, with a crosscut 50 feet long driven from it; a shaft reported to be about 30 feet deep, with drift at bottom, but not examined because full of water; and an open-cut about 8 feet deep north-easterly from shaft.

On the surface there is a milling and concentrating plant with an estimated crushing capacity of about 100 tons a day. This plant is equipped with a 120-horse-power boiler; engine; Eureka crusher, 10 x 12 inches; tube-mill, 6-foot Hardinge; set of six Mineral Separation cells and agitator for oil-flotation process; bins for ore and concentrates. The plant is erected on a bluff which forms the shore of Howe sound, where a vessel can load during calm weather, but with no shelter in case of storms.

The mill was being run on an experimental trial the day the examination of the property was made, and it is expected will be in continuous operation in future.

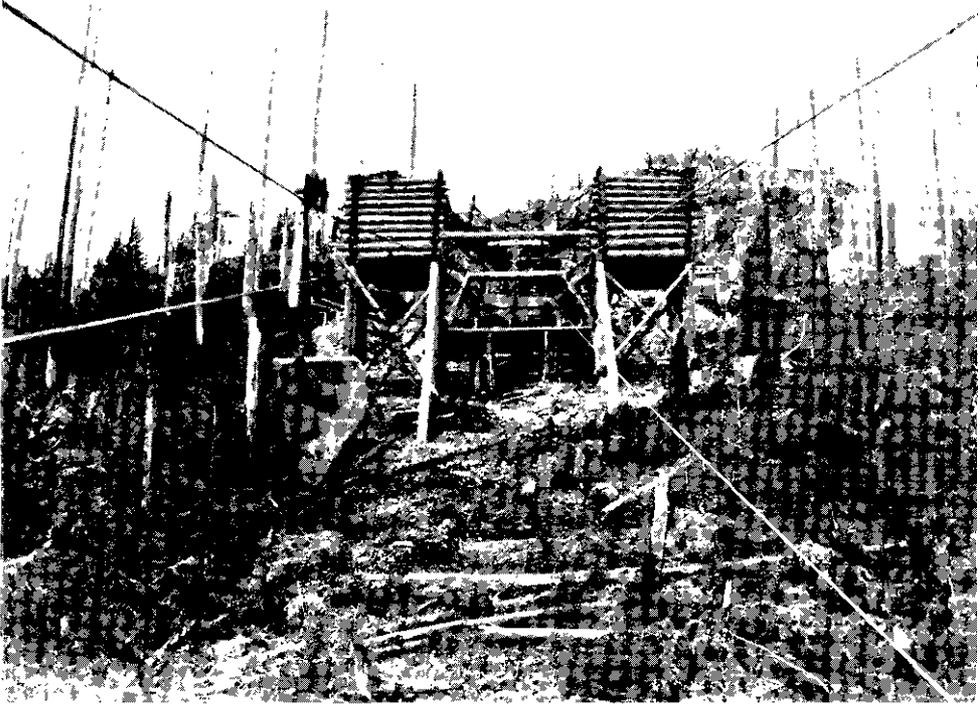
The property of the Snug Cove Copper Company consists of several mineral claims which adjoin the property of the Bowena Copper Mines, Limited, on the north. The rock formation prevailing on the claims of the Snug Cove Copper Company is the Vancouver series of volcanics. In this occur several shear-zones which are being prospected by a crosscut adit that has been driven 160 feet without exposing any deposits of ore of commercial value.

*Characteristics of Ore-deposits.*—On the surface of one of the claims of the Snug Cove property, near the north line of the *Emerald* claim of the Bowena Copper Mines, Limited, there occurs an outcropping of copper-sulphide ore of the shear-zone type. This is exposed in an open-cut, and it is hoped that it will be intersected by the long crosscut adit just mentioned when that adit is driven somewhat farther.

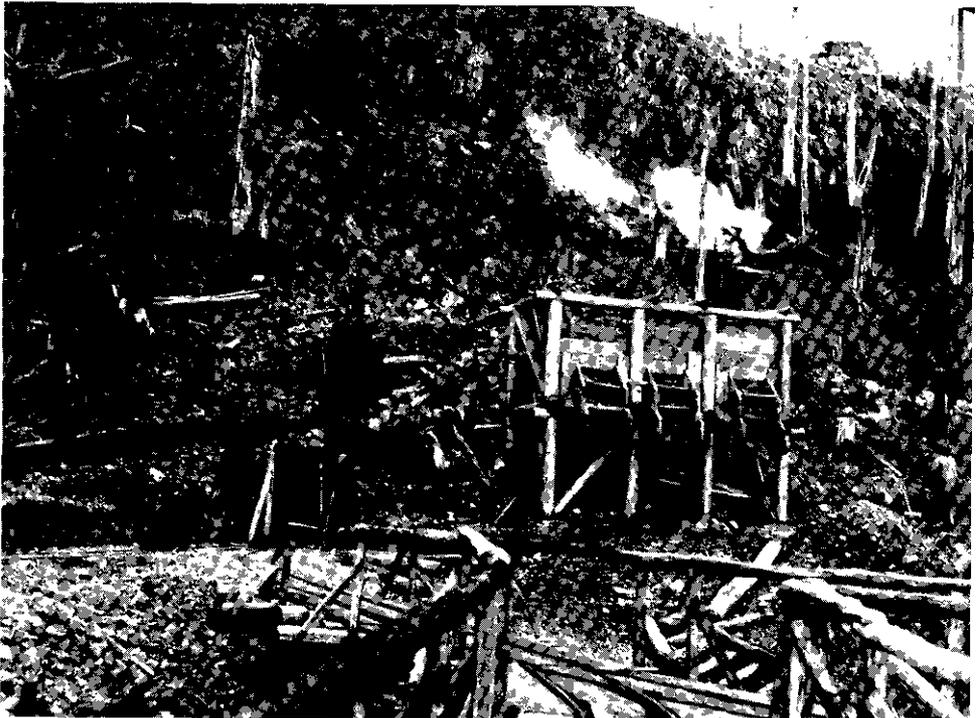
*Development-work.*—The development-work consists of the crosscut adit mentioned, which has been driven 160 feet, with about 200 feet of backs at the present face of the adit. If driven about 80 feet farther, this adit should intersect the "adit" vein on the *Emerald* claim at a depth of about 270 feet below its outcropping, providing that vein maintains its continuity to such depth.

This group contains several mineral claims owned by Thos. Newman, of **Opporcol Group.** Vancouver, and associates. The group is located on the easterly side of Howe sound, about five miles northerly from Whytecliff, the present terminus of that portion of the Pacific Great Eastern Railway built from North Vancouver through West Vancouver. For several reasons the writer has been unable to make an examination of this property, on which it is reported considerable development has been done during 1919; consequently no description is given in this report. Mention is merely made of the property to show that more or less attention is being paid to prospecting in the mountains on this side of Howe sound, southerly from the Britannia belt.

This group contains fourteen mineral claims—*Covenanter, Alastor, Attorney Attorney Group.* No. 6, *Missing Link, Attorney No. 5, Attorney No. 4, Attorney No. 3, Attorney No. 2, Attorney No. 1, O.K., Canyon, Wedge Fraction, Orator, and Imperator*—



B.C. Manganese Co.—Upper Terminal, Tramway, Victoria B.C.



B.C. Manganese Co.—Quarry and Old Bunkers.

owned by the Attorney Copper Gold Syndicate, of Vancouver. Wm. Savage, trustee; J. C. Fisher, superintendent. The group is located in the mountains adjacent to Alberta bay, east side of Howe sound, about half-way between Point Atkinson and Britannia Beach. The group is reached by a trail from Alberta bay. During 1919 some work is reported to have been done on this group, but it was not examined owing to the inability of the writer to arrange for an examination when the work was progressing, because of his absence in a distant part of District No. 6 at the time. Later he was unable to locate any guide to show him the property.

#### NEW WESTMINSTER MINING DIVISION.

The New Westminster Mining Division occupies an area on the Mainland roughly triangular in shape with a somewhat acute angle as the northerly boundary. The base is the International Boundary-line along the 49th parallel from the Strait of Georgia on the west to the summit of the Cascade range of mountains on the east. The easterly boundary follows that summit from near the head of Chilliwack lake to the line of the Lillooet Mining Division near Skookumchuck Indian village on the Lillooet river. The westerly boundary follows the summit of the Coast range of mountains from the southerly boundary of the Lillooet Mining Division to the 49th parallel and point of beginning.

It is only within the past few years that the New Westminster Mining Division has received a revival of attention by prospectors for metalliferous lode mines. During 1897 and 1898 there was quite a stampede into the Harrison Lake section of the Mining Division, which resulted in the location of several mineral claims on Fire mountain at the head of the lake. Since about 1900, however, there has been no activity in either prospecting or operating in the neighbourhood of Harrison lake, but some work has been done near Agassiz on the *Empress* group and on Hurling's mountain, which was described in the 1918 Report.

Some of the old locations about twenty-five miles from the head of Harrison lake in a northerly direction are still valid, notably a group owned by C. O. Wickenden, of the Terminal City Club, Vancouver. This group comprises the *Ogema*, *Staticum*, *Azimuth*, *Bear*, *Marten*, and *Port Douglas* mineral claims. The property has not yet been examined because of lack of opportunity to make the trip.

That portion of the New Westminster Mining Division which borders on the shores of Chilliwack lake, as well as the mountains bordering the International Boundary-line south of the Chilliwack river, has received some attention from prospectors resident in and near the town of Chilliwack during 1919, and late in the fall there were reports that some prospects with very promising possibilities had been discovered. This section will be examined during 1920 as the reports were received too late for examinations to be made in 1919.

The prospectors who discovered these occurrences of copper-sulphide ore were incited to select the section mentioned as attractive prospecting-ground because of the results of prospecting on the *Lucky Four* and *Merry Widow* groups of mineral claims in the Cheam range of mountains, between the Fraser and Chilliwack rivers.

Prospecting for oil has been carried on in the New Westminster Mining Division by the Boundary Bay Oil Company at Boundary bay; the Pitt Meadows Oil Company on Pitt Meadows; the Surrey Oil Company near the International Boundary, east of Semiahmoo bay; the National Oil Company near Hazelmere; the Empire Oil and Gas Company near Aldergrove; and the Spartan Oil Company near Burnaby lake; but up to the present time there has been no production of oil. The companies mentioned have all been carrying on drilling operations to a more or less extent during 1919, and in that way are giving the stockholders a run for their money.

In connection with oil, it might be noted that several oil companies have been organized in addition to those mentioned. Some of these are selling stock on the strength of having obtained leases to parcels of land in the Fraser River delta.

#### CHEAM RANGE SECTION.

The Cheam Range section of the New Westminster Mining Division embraces the mountainous territory easterly from the town of Chilliwack to the eastern boundary of the New Westminster Mining Division. This section takes in the summit and slopes between the Fraser river to the north and Chilliwack river to the south. So far as the New Westminster Mining Division is concerned, the section did not attract much attention until 1915, when prospectors located the *Lucky Four* group of mineral claims at the head of Wahleach (Jones) creek.

Since then several other prospectors have been exploring the range of mountains, but paying most attention to the northerly slope, which is easily accessible since the Canadian National Railway has been operating trains on the south side of the Fraser river.

In the Annual Report of the Minister of Mines for 1918 the writer reported on some occurrences of molybdenite ore discovered on the northerly slope of the Cheam range, and during the past summer he was called upon to examine some mineral claims on Jones hill about fifteen miles easterly from Chilliwack, as well as the extension of the development-work on the *Lucky Four* group of mineral claims.

So far as regards other mineral claims in the section located on Ford creek and in Granite basin, on the southerly slope of the Cheam range of mountains, the examination had to be postponed until 1920 because the locations were not reported until too late in the season.

**Lucky Four Group.** This group of mineral claims was very fully described in the Annual Report of the Minister of Mines for 1918, pages 284-286, and it is unnecessary to repeat the description of the conditions with regard to location, accessibility, ownership, geology, and characteristics of the ore-deposit in the present report.

*Development-work.*—During 1919 the development-work carried on has been driving an adit on the southerly slope of the Cheam range to determine the continuity at depth of the ore-body exposed in an open-cut sampled in 1918 and described in that report. This adit has been driven 200 feet long, and it is expected that by driving about 75 feet farther the question of maintenance of continuity of the ore at depth will be solved. There has also been a crosscut made at a point about 300 feet below the level of the adit just referred to. This crosscut is 15 feet long, with indications of ore showing in the face.

A new trail has been built a mile and a half long from the northerly summit of the range to the mine cabin on the southerly slope, about 1,200 feet lower elevation than the summit. The pack-trail from near Laidlaw Station, on the Canadian National Railway, has been repaired and reconstructed in places. The Provincial Government assisted in the trail-work to the extent of 50 per cent. of the cost.

**Last Chance Group.** This group contains four mineral claims known as the *Last Chance No. 1*, *Last Chance No. 2*, *Last Chance No. 3*, and *Last Chance No. 4*, and is owned by Henry Cooper and associates, R. R. No. 2, Chilliwack. The group was examined on August 8th, 1919. It is situated on Jones hill about fifteen miles easterly from Chilliwack, and can be reached from the Canadian National Railway by wagon-road either from Popcum or Cheam View by a short trail up the mountain-side.

*Geology.*—The rock formation generally in the vicinity of the *Last Chance* group is granodiorite of the Coast Range batholith, but on a portion of the property there is a belt of very much altered sedimentary rocks. In these rocks are shear-zones with fissures, the walls of which are slickensided. Some of the wider fissures are filled with quartzose-talcose vein-filler. Where some work has been done the width of this vein material is fully 3 feet. The fissure has its line of strike in a N. 20° E. (mag.) direction and dip about 80 degrees to the west (mag.).

The main fissure on the group, which can be traced on the surface for a long distance, has suffered so much from erosion that on the slope of the mountain it is really a deep narrow gulch, with the bed filled with the quartzose-talcose vein material already referred to.

*Characteristics of Ore-deposits.*—From the appearance of the fissure filled with the quartzose-talcose vein material one would judge that there was a possibility of the vein material, which is heavily stained with iron oxides, being mineralized and possibly carrying gold and silver values. Samples were taken from the face of a short drift-adit across 18 inches wide, also from near the portal of the adit. These were assayed, but showed only traces of gold and silver.

*Development-work.*—The development-work on the group has been done on the *Last Chance No. 1* claim. It consists of an open-cut about 60 feet long as an approach to an adit about 15 feet long. This adit is a drift along one wall of the fissure.

*Possibilities.*—Although the vein material where it was sampled showed unsatisfactory assay values, it would appear from the persistency of the fissuring, the heavy iron-stain, and general character of the vein material that the group of claims merits further and more thorough prospecting than has yet been done.

#### VICTORIA MINING DIVISION.

The Victoria Mining Division embraces the southerly end of Vancouver island; it extends northerly to the summit of the divide between the Chemainus and Nanaimo rivers on the easterly

side of the island, and to the summit of the divide between the Nitinat river and Alberni canal on the westerly side of the island.

The history of the Division so far as metalliferous mining is concerned dates back to about 1864, when placer gold was discovered in the Sooke and Leech rivers. Since then prospectors have worked more or less continuously and have been rewarded from time to time by the discovery of deposits of ore carrying commercial values, but it was not until the discovery of the Mount Sicker deposits of copper-gold-silver ore about 1896 that mining operations were carried on to a sufficient extent to command attention from the outside world. After the *Tyee, Lenora*, and *Richard III.* mines on Mount Sicker were closed down about 1907 it appeared for a time as though the Victoria Mining Division would pass into history. The introduction of the oil-flotation concentration process for treating low-grade copper-bearing ore revived activity in prospecting, developing, and operating properties on which this class of ore had been discovered in various sections of the Division, until at the present time the Victoria Mining Division shows very promising possibilities and indications that it will in future take its rank with the leading metalliferous-mining divisions in the Province.

During 1919 there has been activity in metalliferous mining in the Jordan River, Cowichan Lake, Mount Sicker, and Koksilah River sections, while in the Leech River section mining talc marks the introduction of a new industry so far as the Victoria Mining Division is concerned. Another new industry, the shipment of manganese ore from the Cowichan Lake section, was established during 1919.

#### JORDAN RIVER SECTION.

Full descriptions of the *Sunloch* mine were published in the Annual Reports of the Minister of Mines for 1917, pages 265-267, and for 1918, pages 300-303.

In the present report the development-work carried on during 1919 only will be described. During 1919 the majority ownership of the *Sunloch* mine has been acquired by the Consolidated Mining, Smelting, and Power Company of Canada, through the purchase of the majority of the stock of the Sunloch Mines, Limited. At present W. M. Archibald, chief consulting engineer for the Consolidated Company, is general manager of the *Sunloch* mine, with John Hanna as superintendent, under whose supervision all the development-work on the mine has been carried on since it was bonded as a prospect in the spring of 1917.

*Development-work.*—But little additional work was done on the Cave and Archibald zones in 1919. The River zone has, up to this writing, been developed by additional driving on the River adit on the easterly side of the Jordan river to a point where the ore-body has been proven to maintain continuity for more than 700 feet in length, as shown in the accompanying plan of that part of the mine-workings. Assays from samples taken about every 5 feet as the work progressed show that the values in copper vary from about 1 per cent. to a maximum of 7.07 per cent. The face of the River adit is about 500 feet vertically below the surface.

On the westerly side of the Jordan river, some little distance down the river from opposite to the River adit, a new adit had been driven 700 feet at the time the writer made an examination, and is to be continued to crosscut the River mineralized zone if such maintains its continuity for any appreciable distance on that side of the river. This adit started in ore at the portal; was driven through 11 feet of ore carrying about 1.5 per cent. in copper; then through country-rock for 40 feet, where a stringer of ore 18 inches wide was crosscut; then country-rock to a point about 80 feet from the portal, where a body of ore 18 feet wide was exposed. At the point where the ore last mentioned is exposed the course of the adit is changed towards the right at an angle of 45 degrees, or in the direction which would intersect the River zone, if continuous on the westerly side of the river, in about 150 feet beyond the present face of the adit.

No ore is exposed farther in the adit than the body 18 feet wide, but near the face the shearing of the country-rock, which appears to be a basalt, is very pronounced, and from the experience of the superintendent as gained from work in other parts of the mine is an indication of approaching a mineralized zone.

Adjoining the *Sunloch* group of mineral claims is the *Gabbro* group, owned **Gabbro Group.** by Geo. Winkler, of Victoria, and associates. This group has not yet been examined, but the owners report that good showings of copper ore have been exposed by surface prospecting and that arrangements are completed to enable them to carry on systematic development during 1920, the results of which work will be examined and reported on.



COWICHAN LAKE SECTION.

The Cowichan Lake section of the Victoria Mining Division has been in the limelight during 1919 by reason of the establishment of a new industry in British Columbia, that of shipping manganese ore for manufacture into ferro-manganese, and one that, judging from the high commendations expressed by the purchasers of the ore as to its quality, promises to develop into an important factor of the mineral industry of the Province.

This group contains *Hill 60*, *Hill 60 No. 1*, and *Hill 60 No. 2* mineral claims, **Hill 60 Group**, which were examined on June 6th, 1919. The property was fully described in the Annual Report of the Minister of Mines for 1918, pages 296-298, but is again referred to in the present report because very important work was done during 1919 and shipments of manganese ore were made to the Bilrow Alloys Company, Tacoma, where it is manufactured into ferro-manganese, for which the demand is excellent. During 1919 the ownership of the *Hill 60* group was organized into a limited liability company registered as the British Columbia Manganese Company, Limited (Non-Personal Liability), of which C. H. Dickie is managing director and E. J. Miller is secretary, with head office at Duncan.

*Development-work.*—The open-cut a short distance north-westerly from the No. 1 post of the *Hill 60 No. 1* claim has been considerably enlarged, and 530 long tons (2,240 lb.) of manganese ore quarried from the cut, hauled to the Cowichan Lake extension of the Esquimalt & Nanaimo Railway, and shipped to Tacoma. This ore averaged 50 per cent. manganese and about 19 per cent. silica.

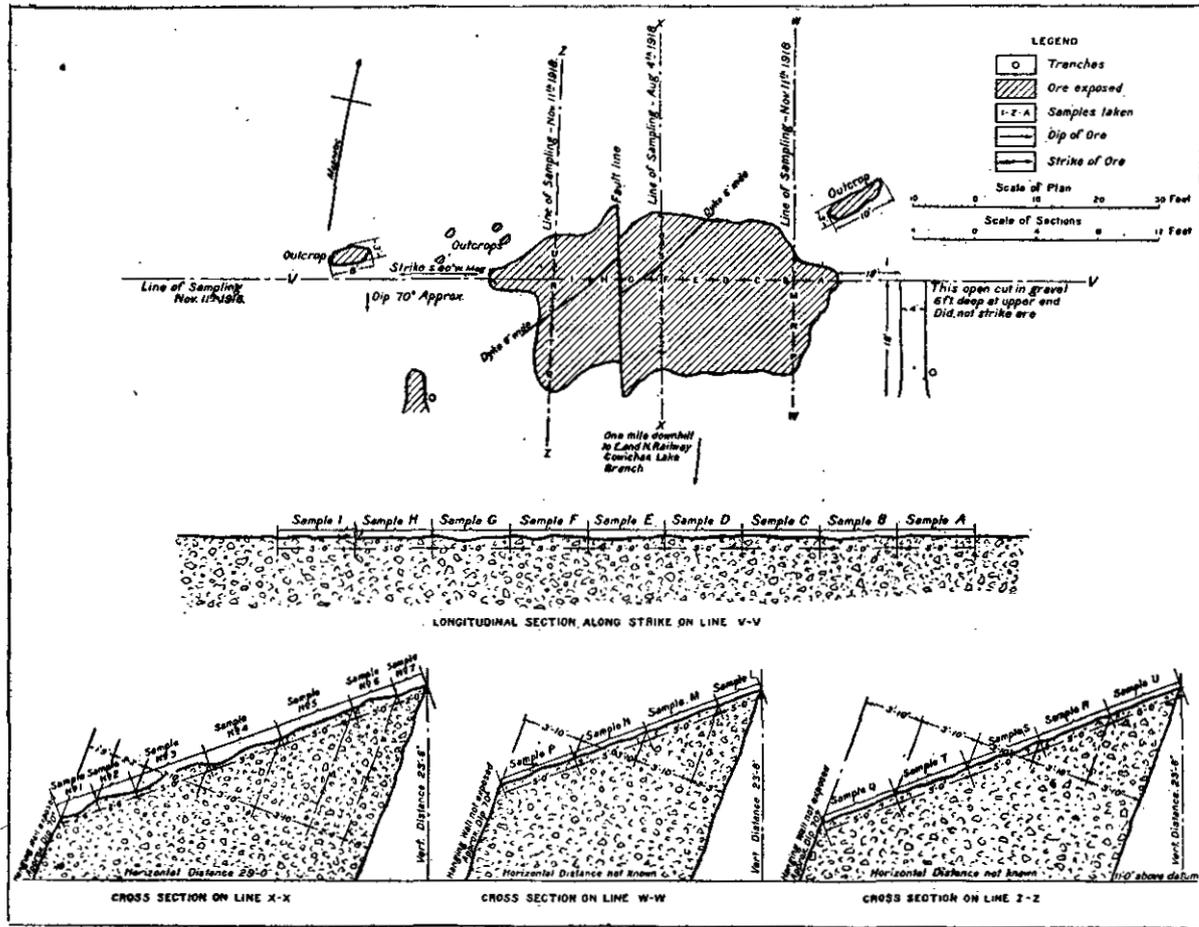
A wagon-road about four miles long was built during 1919 to connect the mine-workings with the ore-bunker on the railroad. This road was built on a fifty-fifty basis as to cost by the Government and Manganese Company. Late in the autumn it was found impracticable to continue hauling heavy loads over the road; consequently shipments were suspended and arrangements made to erect an aerial tramway which is expected will be in operation early in May, 1920, when shipments will be continued.

*Note by Provincial Mineralogist.*—The following plan and section of the manganese property at Cowichan lake and the table of analyses of the samplings are taken from the Final Report of the Munition Resources Commission of Canada:—

ANALYSES OF COWICHAN MANGANESE ORE.

(Made by Ore Dressing and Metallurgical Laboratories, Mines Branch, Department of Mines, Ottawa.)

Sample No.	Section.	Width of Samples Feet.	METALLIC MANGANESE.		SILICA.		METALLIC IRON.		PHOSPHORUS.		SULPHUR.		LIME.		ALUMINA.	
			Per Cent.	Foot per Cent.	Per Cent.	Foot per Cent.	Per Cent.	Foot per Cent.	Per Cent.	Foot per Cent.	Per Cent.	Foot per Cent.	Per Cent.	Foot per Cent.	Per Cent.	Foot per Cent.
1	X—X	1.75	15.88	27.79	62.84	109.97	2.82	4.93	0.048	0.084	0.073	0.127	.....	.....	.....	.....
2	"	2.16	23.15	50.00	49.60	107.13	2.80	6.04	0.046	0.099	0.068	0.125	.....	.....	.....	.....
3	"	3.83	52.25	200.11	13.12	50.24	0.84	3.21	0.058	0.222	0.066	0.214	.....	.....	.....	.....
4	"	3.83	57.15	218.88	10.04	38.45	0.87	3.33	0.047	0.180	0.085	0.325	.....	.....	.....	.....
5	"	3.83	62.20	199.92	18.38	64.65	0.90	3.44	0.041	0.157	0.167	0.689	.....	.....	.....	.....
6	"	2.83	53.50	124.65	16.92	39.42	1.17	2.72	0.041	0.095	0.107	0.249	.....	.....	.....	.....
7	"	1.66	45.90	76.19	25.66	42.59	1.83	3.03	0.048	0.079	0.122	0.202	.....	.....	.....	.....
A	V—V	5.00	41.64	208.20	22.32	110.00	0.99	4.95	0.030	0.400	0.080	0.400	0.05	0.25	1.10	5.50
B	"	5.00	32.90	164.50	41.60	208.00	1.50	7.50	0.077	0.355	0.110	0.500	1.20	6.00	0.58	2.90
C	"	5.00	46.12	230.60	23.05	115.25	0.89	4.45	0.051	0.255	0.074	0.370	0.05	0.25	1.02	5.10
D	"	5.00	38.55	192.75	24.18	120.90	1.01	5.05	0.059	0.295	0.103	0.515	0.08	0.40	0.67	3.35
E	"	5.00	43.18	215.90	30.19	150.95	1.50	7.50	0.073	0.365	0.095	0.475	0.98	4.90	0.58	2.90
F	"	5.00	48.59	242.95	21.60	108.00	1.24	6.20	0.053	0.265	0.090	0.450	0.80	4.00	0.50	2.50
G	"	5.00	46.79	233.95	18.20	91.00	1.68	8.40	0.081	0.408	0.070	0.350	0.70	3.50	1.08	5.40
H	"	5.00	50.32	251.60	14.56	72.80	1.52	7.60	0.057	0.287	0.085	0.425	0.23	0.15	0.96	4.80
I	"	5.00	48.20	241.00	15.50	77.50	1.38	6.90	0.060	0.300	0.100	0.500	1.60	8.00	1.20	9.00
L	W—W	2.25	48.00	108.00	21.70	48.82	2.80	6.30	0.066	0.148	0.090	0.202	0.70	1.57	0.87	1.95
M	"	3.83	43.35	166.03	24.30	94.98	1.14	4.36	0.075	0.287	0.068	0.260	Trace	.....	0.58	2.22
N	"	3.83	53.37	204.40	6.00	22.98	1.00	3.83	0.075	0.287	0.072	0.275	0.60	2.29	0.82	3.14
P	"	3.83	55.46	212.41	8.40	32.17	1.48	5.66	0.061	0.233	0.082	0.314	0.70	2.68	1.17	4.48
Q	Z—Z	3.83	21.82	83.57	53.50	204.90	2.28	8.73	0.037	0.141	0.140	0.536	0.90	3.44	2.38	9.11
R	"	3.83	46.50	178.09	18.90	72.38	2.10	8.04	0.056	0.214	0.170	0.651	1.00	3.33	0.56	2.14
S	"	3.83	51.80	198.39	10.65	40.78	1.78	6.81	0.070	0.268	0.160	0.612	1.40	5.36	0.69	2.64
T	"	3.83	25.30	96.89	29.35	112.41	3.07	11.75	0.070	0.268	0.103	0.394	2.00	7.66	2.13	8.15
U	"	3.83	34.68	132.82	32.00	122.56	2.62	10.08	0.133	0.509	0.176	0.674	1.80	4.97	1.12	4.28
Averages..	.....	3.89	.....	43.78	.....	23.28	.....	1.649	.....	0.064	.....	0.101	.....	0.77	.....	1.02



This group contains the *Blue Grouse* and *Kitchener* mineral claims, owned **Kitchener Group.** by L. A. Sherk, of Oak Bay, Victoria. The group is located on the divide between the East fork of Cottonwood creek and the Chemainus river. The property was examined on June 9th, 1919. It is reached by a trail, in bad condition, from Deep bay, near the mouth of Cottonwood creek, which flows into the northerly side of Cowichan lake about twelve miles above the outlet of the lake. The distance by trail from the lake to Sherk's cabin on the *Kitchener* group is about eight miles. The cabin is on the headwaters of a fork of the Chemainus river, but the outcroppings of mineral on the claims occur near the summit of the divide, a few hundred feet higher elevation than the cabin.

*Geology.*—The rock formation on the *Kitchener* group is classified by C. H. Clapp in Memoir No. 13, Southern Vancouver Island, Canada Department of Mines, 1912, as belonging to the Sicker series, made up of: "Andesitic volcanic flows and tuffs with interbedded tufaceous, slaty, and quartzose sediments metamorphosed into schists and intruded by quartz-feldspar and gabbrodiorite porphyrite. Conformable with the Vancouver volcanics, and distinguished from them chiefly by their schistose character, greater mineralization, and by the presence of sedimentary members."

*Characteristics of Ore-deposits.*—The ore-deposits on both the *Kitchener* and *Blue Grouse* mineral claims occur on the northerly slope and near the summit of the divide overlooking the headwaters of the Chemainus river. There are several outcroppings of pyrrhotite, with some molybdenite and chalcopyrite in a gangue made up of garnet and other contact-metamorphic minerals. Some of the outcroppings are of considerable superficial extent. They occur as isolated lenses along a general line of strike towards the south-east (mag.), and where the dip can be determined it is about 40 degrees to the south-west (mag.).

Samples from two of these outcroppings, one from the *Blue Grouse* and the other from the *Kitchener*, assayed:—*Blue Grouse* sample: Gold, trace; silver, trace; copper, 1.2 per cent. *Kitchener* sample: Gold, trace; silver, trace; copper, 0.8 per cent.

*Development-work.*—There are several open-cuts and three adits on the *Blue Grouse* claim and some open-cuts and one adit on the *Kitchener* claim. The adits on the *Blue Grouse* claim are respectively about 20, 50, and 70 feet in length, while that on the *Kitchener* claim is about 10 feet long.

There may be more development-work on these and adjoining claims which was not examined by reason of the fact that neither Mr. Sherk nor any representative was on the ground at the time the examination was made, so that the writer had to depend on the knowledge of the guides with him, who only knew the property in a general way.

This group consists of the *Mountain Ash*, *Silver Leaf*, *Arbutus*, and *Wiz Bang* mineral claims, owned by Thomas Service, of Riverside, and associates. The **Silver Leaf Group.** group is located near the head of the North-east fork of Cottonwood creek, about four miles beyond the *Kitchener* group already described. This property was not examined because of the quantity of snow that still remained covering the ground on June 8th, when an examination was attempted, and also because when, later in the season of 1919, it was proposed to make a trip to the group no guide was available who thoroughly knew the property.

From information received from G. H. Kilbourne, a consulting engineer from the Consolidated Mining, Smelting, and Power Company of Canada, who examined the *Silver Leaf* group about August, 1919, the prospects are very promising and merit thorough prospecting and development, but are handicapped at present because of lack of transportation from the group to the Canadian National Railway track on the shore of Cowichan lake, a distance by trail of about twelve miles.

This group contains the *Black Prince*, *Black Bess*, and *Lumber Jack* mineral claims, owned by M. Hemmingsen and C. Ryan, of Riverside, Cowichan lake. **Black Prince Group.** The property was examined on June 10th, 1919. The group is located on the north-easterly side of Cowichan lake, about fifteen miles up the lake from the Riverside Hotel, and at an elevation of about 400 feet above the water-level. The property is bordered by the grade of the Canadian National Railway.

*Geology.*—According to Clapp there is a narrow fringe of the Cowichan group of rocks skirting the north-easterly shore-line of Cowichan lake. This formation is made up of unmetamorphosed conglomerate, sandstone, and arenaceous shale. The fringe of the Cowichan group of rocks is flanked by a wide belt of Vancouver volcanics, which are the prevailing rocks on the

*Black Prince* group of mineral claims. The volcanics are very much sheared and in places have a schistose structure, so pronounced as to resemble the Mount Sicker schists.

*Characteristics of Ore-deposits.*—In the shear-zones in the country-rock there occur outcroppings of iron-stained rock, associated with which there is some pyrrhotite and iron pyrite. Samples from several outcroppings were taken and assayed, but the results showed only traces of gold, silver, and copper. The extent of the shear-zones is very considerable and the outcroppings so numerous that there is a possibility of pay-ore being found if systematic prospecting and some development-work are attempted. At the time of the examination no work had been done on the property, which had only been staked a few weeks previous.

#### KOKSILAH RIVER SECTION.

The Koksilah River section of the Victoria Mining Division has been inactive since work was suspended on the *King Solomon* and *Bluebell* mineral claims about 1909, except for some work done in 1916 by Joe Gallo on the *Viva*, *Elsie D.*, and *Comet* claims near the *King Solomon* claim, when he shipped about 250 tons of copper ore carrying about 4 per cent. copper with low gold and silver values. This ore was hauled about four miles to Cowichan Station, on the Esquimalt & Nanaimo Railway, and the length of wagon transportation proved too costly to warrant continuing operations.

At present the Canadian National Railway has steel laid to within half a mile of some of the old properties, which will possibly revive activity in the camp, which was visited on June 24th, 1919, when the *Finlay* mineral claim was examined.

This mineral claim is located about half a mile northerly from the Canadian National track on Land Lot No. 18, Helmcken District. The property is reached by motor or wagon from Cowichan Station until the Canadian National Railway commences operations, when it will be easy of access.

*Geology.*—The country-rock in the vicinity of the *Finlay* claim belongs to the Vancouver series of volcanics, in which respect this claim differs from the *King Solomon* and *Bluebell*, in both of which the ore-bodies are of the contact-metamorphic type as classified by Clapp in Memoir No. 13, Southern Vancouver Island, Canada Department of Mines, 1912.

*Characteristics of Ore-deposits.*—In shear-zones in the volcanic country-rock there occur outcroppings of copper and iron minerals, with iron pyrite and pyrrhotite prevailing, but with sufficient chalcopyrite associated in places with the other minerals to render some of the ore of a commercial grade, providing oil-flotation concentration is adopted for treatment process. A sample across 3 feet on the north-westerly side of a shaft about 16 feet deep assayed: Gold, trace; silver, 0.2 oz.; copper, 2 per cent.

As shafts have been sunk on three outcrops and each shaft is close-timbered and contains considerable water, no detailed examination of the workings could be made.

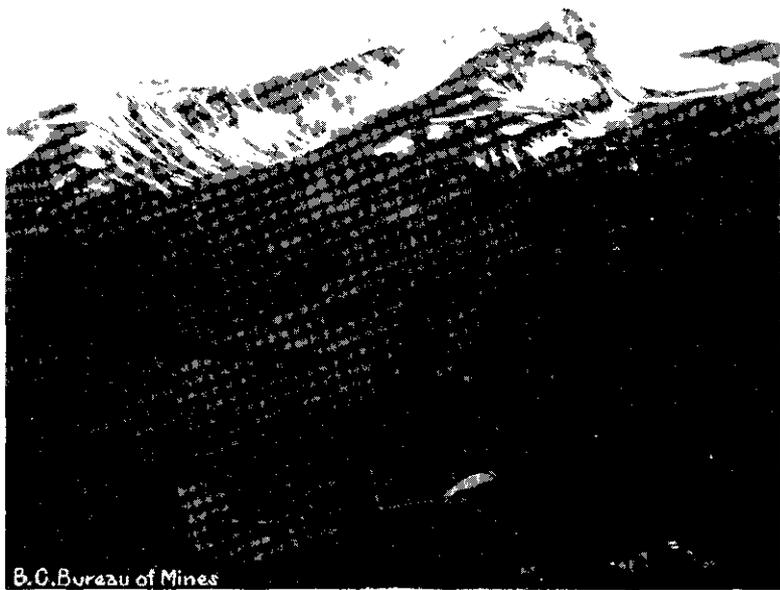
The location, about half a mile westerly from the Koksilah river and the same distance from the Canadian National Railway, is very favourable for the erection of a concentrating plant and for shipment of concentrates, providing further and systematized development results in determining that the body or bodies of ore are sufficiently extensive and of a grade that can be concentrated profitably.

#### LEECH RIVER SECTION.

The Leech River section of the Victoria Mining Division includes all of the area occupied by the Leech River formation, and occupying an area extending across Vancouver island from Goldstream river, in the south-eastern corner of the island, to Port Renfrew on the south-western side of the island. This formation is described by Clapp as being made up of: "Slate schist and greywackes, closely folded and possibly extensively faulted; with intrusive granite rocks and many gold-bearing quartz veins of very low-grade."

It is several years since there has been any pronounced activity in mining in the Leech River section, but during 1919 active operations were commenced by W. G. Dickenson, of Victoria, to mine talc on Wolf creek, a tributary of the Leech river. An examination was made on June 27th, 1919, and the property is described in the following report:—

This claim is situated on Wolf creek about half a mile from Leech river and the same distance from the track of the Canadian National Railway. The mill for treating talc mined is at Sidney, Vancouver island, also on the Canadian National Railway, as well as being a deep-water harbour. Consequently the trans-



B. C. Bureau of Mines

Junction of Taseko River and Iron Creek.



Iron Mountain, Taseko River.

portation problem is easily solved, both for hauling the raw material to the mill and carrying the finished products to the markets of the world.

*Geology and Mineral-deposit.*—The prevailing rocks on the *Eagle* claim belong to the Leech River formation already mentioned. Wolf creek flows between steep banks, and in the westerly bank there occurs an extensive deposit of talc which contains a comparatively small quantity of impurities besides withstanding heat to a high temperature, and therefore being adapted for the manufacture of talc firebricks.

The deposit when examined in June, 1919, had been prospected only by an open-cut and short adit. The open-cut is about 12 feet wide and 30 feet long with the strike of the formation. The adit, to which the open-cut is an approach, is about 15 feet long, crosscutting the deposit of talc, but with talc still in the face, so that the full width of the deposit is undetermined, but at this particular point it is evidently more than 30 feet wide. The extent of the talc-deposit along the strike in a north-westerly direction cannot be stated accurately, because good talc is found to occur in places for a distance of about 600 feet along the creek-bank, which appears to be practically parallel with the strike of the mineral.

This discovery of a good quality of talc on Vancouver island opens up a new industry entirely, and for that reason is of considerable importance. At the present time the industry is merely in its experimental stage and on a small scale, but it has been determined that the talc is valuable and commands a market for pigment for paints, for stucco wall-board, and for firebrick.

A plant at Sidney has been equipped with machinery for treating the crude talc rock, grinding it and separating the pure talc from the grit in the rock. The process so far is not perfectly satisfactory, but Mr. Dickenson is adopting practical methods to perfect the machine to enable him to prepare a commercial product on a sufficiently large scale with regard to quantity produced to place the industry on a paying basis.

## TASEKO VALLEY IRON-ORE DEPOSITS.

REPORT BY W. M. BREWER, RESIDENT ENGINEER, No. 6 DISTRICT.

These deposits of iron ore occur in the Lillooet and Clinton Mining Divisions, a part of Mineral Survey District No. 3. This special report was made under the provisions of the "Iron-ore Supply Act, 1919."

### CONCLUSIONS.

After a careful examination of the iron-ore deposits of the Taseko (Whitewater) River section of the Clinton Mining Division, made between August 14th and September 10th, 1919, the writer has arrived at the following conclusions:—

There are five principal factors necessary to be determined, which are at present practically unknown, in order to enable an engineer to make a report in which his conclusions as to the value of the occurrences of iron ore in the district can be classed other than rough estimates. These are: Origin of the ore; extent of the rock formations from which the ore derives its source; thickness of the beds of ore and quality to be proven either by test-pits, trenches, or drilling, and systematic sampling; feasibility and cost of constructing transportation facilities; cost of mining and transporting ore.

#### *Origin.*

In the following report theories with regard to the origin of the iron-ore deposits are suggested, but it must be remembered that the geologic conditions surrounding the deposition of the ore-beds, which are considered in the report as being chiefly composed of the limonite variety of iron rather than the bog variety, are different to those associated with the same variety of ore occurring in other parts of Canada or the United States. Consequently, so far as the writer's information extends, no conclusions can be drawn by comparisons between the geologic conditions surrounding the various occurrences until after a detailed geological examination has been made and the conditions studied and carefully worked out.

*Extent of Rock Formation responsible for Origin.*

The question of the extent of the rock formations responsible for the origin of the limonite-deposits is very important, and another reason why a detailed geological survey should be made. Up to date no such survey has been attempted.\*

*Quantity of Iron Ore.*

So far as the available quantity of ore actually determined as occurring in the various deposits is concerned, it is impossible to estimate tonnage, because, except in two or three places, there are no openings made either by nature or artificially by the aid of which the cubic volume of this iron-ore deposit can be measured. The superficial area covered by the various exposed deposits examined in this section is roughly estimated at 400 acres, but there is a possibility of this extent being much larger, because in places there are indications of ore-deposits at present covered by talus, grassy hummocks, or hidden by timber.

In estimating tonnage of *actual ore*, meaning thereby such quantity as development has exposed as measurable and immediately available, the only method to adopt in the absence of development-work is to credit the various deposits with an estimated average thickness judged from experience in mining similar deposits. There is a total of approximately 400 acres covered by known exposures of merchantable iron ore in the valleys examined, and allowing 3,000 tons of iron ore in-place to the acre, providing the ore averages 1 foot in thickness. The result obtained is 400 multiplied by 3,000 equals 1,200,000 tons of ore for every foot in thickness. The only openings seen show that at those points the thickness of the ore exceeds 6 feet, which is considered a reasonable thickness to estimate. This would allow for 7,300,000 tons. However, suppose that because of the lack of actual development it is considered that it is only safe to estimate "probable" and "possible" ore, meaning thereby: *Probable ore*, meaning such ore as is only partially developed, not sufficiently so to admit of definite measurement, but of the occurrences of which the indications are sufficiently strong to warrant an assumption that such ore probably occurs; *possible ore*, meaning such ore as is undeveloped, but which may possibly be and is hoped to be found by further prospecting and development; the only indications of which are surface outcrops and which may be postulated as possible from a knowledge of the geological conditions.

With the foregoing explanations, the writer presents as an approximate estimate the following quantities:—

"Actual ore," 7,200,000 tons carrying above 40 per cent. metallic iron.

"Probable ore," 15,000,000 tons carrying above 40 per cent. metallic iron.

"Possible ore," 50,000,000 tons carrying above 40 per cent. metallic iron.

No consideration is given to samples of partly mineralized rock which assayed 20.2 and 16.4 per cent. iron.

*Quality of Ore.*

The assays of samples taken during the examination, and which are given in detail in the following report under the head of "Ore-deposits," show that the material classed as ore contains from 41 to 50 per cent. metallic iron; that four out of nine of these samples contained only traces of phosphorus, one sample 0.04 per cent. and the remaining four 0.23 per cent., 0.21 per cent., 0.85 per cent., and 0.52 per cent. respectively. These results place five of the samples within the Bessemer limit, with the remaining four above the Bessemer limit, but not in excess for the basic or open-hearth process of making steel. These results show that the ore can be either used in a blast-furnace as the entire charge of iron ore or will make a most desirable mixture for combination with the magnetite ore of the Province. The following paragraphs, extracted from page 252 of the book entitled "The Principles, Operation, and Products of the Blast Furnace," by J. E. Johnson, Jr., are quoted to substantiate the foregoing statement:—

"In order, therefore, to produce an iron containing a given amount of phosphorus we must provide a charge which contains just that amount. This sounds simple enough, but when the phosphorus limits desired are very low it becomes a matter of great difficulty to secure a raw material so free from that element that the iron will not contain more than the amount specified. In the case of specially low phosphorus or extra Bessemer iron described later with specification

\* The Geological Survey of Canada will have, during the season of 1920, a geological party and a topographical party at work in this field.

of 0.035 per cent. and under, this difficulty becomes extreme. For instance, if 2 tons of ore, 1 ton of coke, and  $\frac{1}{2}$  a ton of limestone be required per ton of iron, and each of these materials contains 1.01 per cent. of phosphorus, the result in product will contain the maximum permissible amount of phosphorus, 0.035 per cent. Such raw materials are extremely rare, and in consequence iron of this kind commands a premium of several dollars per ton over iron exactly similar in other respects, but a trifle higher in phosphorus."

But later on, on page 435, in describing standard Bessemer iron, the author says with regard to phosphorus:—

"In particular material of this kind the phosphorus specifications are always low, generally around 0.04 per cent. and not to exceed 0.05 per cent. The iron for this process, therefore, must be down to about 0.03 or 0.035 per cent. in phosphorus to make the class of steel desired."

For iron for basic steel-making, on page 438, the following paragraph with regard to phosphorus is quoted:—

"The specifications with regard to phosphorus for basic open-hearth iron are very broad. Iron with Bessemer phosphorus is sometimes used, and, on the other hand, iron with phosphorus to 1.85 per cent. is successfully converted into good steel. In this country many of the irons made in the South contain from 0.85 to 1.0 per cent. These are successfully used in the basic open-hearth furnaces, but they are not regarded so favourably by steel-makers as iron containing 0.3 to 0.4 per cent. phosphorus or lower, since when the phosphorus rises above these limits the heats are apt to require longer for complete dephosphorization. This runs up the cost of conversion and so is very objectionable to the steel-maker."

For foundry iron the same author, on page 500, says with regard to phosphorus:—

"Phosphorus was formerly considered to be a detriment to foundry-casting and it was considered desirable to keep it as low as possible, or at least below 0.3 per cent., but we know now that phosphorus imparts fluidity to the metal and also increases the strength up to certain limits, so that in machinery-casting phosphorus commonly runs from 0.4 to 0.75 per cent. In some specially thin castings it runs even higher up to 1.0 per cent. In order to obtain the fluidity necessary to pour these thin shapes, while in automobile cylinders, as noted earlier, it is necessary to keep the phosphorus under 0.3 per cent. in order to prevent spongy spots in the castings."

For malleable castings, on page 502, the author says:—

"Phosphorus: The specifications for this element are much closer in the case of malleable castings than in most others. If the phosphorus be too low the metal has not sufficient fluidity, and if it be too high the metal is brittle and unreliable when annealed. The phosphorus is therefore generally kept between 0.12 and 0.25 per cent."

So far as the assays show, the sulphur contained in the ore varies from 0.44 to 2.46 per cent., which of course, is considered high, but the same author, already quoted, says, on page 19, with regard to sulphur in the ore:—

"In general, if an ore is rich and pure enough in other respects to be worth the treatment, it can be so roasted as to lower the sulphur within easily usable limits."

#### *Cost of Mining.*

All of the deposits of limonite described in this report are so located and made up of such comparatively friable material that they can be mined with steam-shovel, and the cost of mining would therefore be very low, not to exceed, at any rate, 25 cents per ton.

#### *Transportation.*

The logical location for a railroad would be up the valley of the Taseko (Whitewater) river, with which connections could be made from the various valleys in which the iron-ore deposits occur by either gravity or aerial tramways.

Of course, at the present time, there are no railway transportation facilities nearer than Mission, on the Pacific Great Eastern, at least sixty miles distant from the occurrences of iron ore described, and before any statements can be made relative to the future facilities surveys are necessary to determine the most feasible route as well as the location of the manufacturing plant where the ore would be treated. For these reasons the subject of transportation is not further discussed in the foregoing report.

## INTRODUCTION.

From August 14th to September 9th, 1919, was occupied by the writer in making a trip from Vancouver to the Taseko (Whitewater) Lake and River section of the Clinton Mining Division in order to examine the occurrences of limonite or bog-iron ores reported to occur in that vicinity. The trip was made after special instructions had been received from the Hon. Wm. Sloan, Minister of Mines, and under the provisions of the "Iron-ore Supply Act, 1919," in order to ascertain the extent, quality, and accessibility of the deposits, which had never been examined for the Department of Mines.

The route followed to reach the Taseko (Whitewater) Lake section was via Pacific Great Eastern Railway from Squamish to Lillooet, where horses and supplies were secured; thence by launch via Seton lake to the foot of Mission mountain, where there is a station on the Pacific Great Eastern, from which place the main Bridge River wagon-road was followed to about five miles westerly from the crossing at Tyaughton creek, where is located the junction of the wagon-road and new trail constructed in 1919 up Gun creek. This trail was followed to its north-westerly terminus, about twenty-five miles, at the foot of Copper mountain, at the lower end of Green lake, about five miles below the head of the main fork of Gun creek. From Green lake a blazed trail was followed to the head of Gun creek; thence across the summit through Taylor's pass to the head of one of the tributaries of the Taseko (Whitewater) river. The elevation of the summit at this pass is about 7,500 feet above sea-level. The trail was blazed by E. J. Taylor, a pioneer prospector and veteran of the Canadian Overseas Forces, because it followed the only route across the summit by which crossing a glacier of any considerable size could be avoided.

From the headwaters of the Taseko (Whitewater) river the writer travelled through the adjacent country under the guidance of Indians, as there are no well-defined trails other than those used by hunters and trappers. An examination was made of the valleys tributary to the Taseko (Whitewater) river, in which occur the deposits of limonite or bog-iron ore to which the attention of the Hon. Minister of Mines had been directed, and which are located in the Clinton Mining Division of British Columbia. The distance travelled by the route described is about eighty miles from Lillooet or about 200 miles from Vancouver, but apparently the most desirable route by which to construct a railway would be via Hanceville from William lake, the proposed end of steel this fall on the Pacific Great Eastern Railway, which route would place the deposits of iron ore about 380 miles from the city of Vancouver.

## GEOGRAPHY.

The Taseko (Whitewater) river has its source in glaciers on the west side of a range of mountains that reach elevations from about 6,000 to 9,000 feet above the sea-level, and which form the dividing line between the Lillooet and Clinton Mining Divisions. The same range also forms the watershed between the waters flowing into Tyaughton and Gun creeks on the easterly side of the mountains and those flowing into Taseko (Whitewater) river and Whitewater lakes, also into Big creek, on the westerly side. In a rough way a part of this range of mountains forms a portion of the easterly boundary of the Coast range and the southerly border of the Interior plateau, but the section of which the following report treats lies between the Coast range and the Interior plateau.

The area examined is roughly about five miles square and embraces a part of the valley of the Taseko (Whitewater) river, together with Schwartz, Frank Gott, and Iron Creek valleys. Schwartz valley is named after a pioneer prospector and hunter, the Frank Gott valley after an Indian guide who, although far beyond military age, succeeded in enlisting as a scout and sniper in a Canadian battalion in the recent war, and Iron creek is so named because of the discovery of deposits of limonite or bog-iron ore in that valley previous to the discoveries in other parts of the Taseko (Whitewater) section.

Schwartz, Frank Gott, and Iron Creek valleys are U-shaped and situated nearly parallel to each other, separated by high mountain ranges with glaciers covering the highest points along the summits, and the streams that flow along these valleys have cut out deep canyons as the waters approach the Taseko (Whitewater) river, to which all of the valleys are tributary from the eastern side. The valleys are consequently at a much higher elevation than that of the Taseko (Whitewater) river.

## HISTORY.

It is only within comparatively quite recent years that the Taseko (Whitewater) River and Lake section of the Clinton Mining Division has attracted the attention of white men. About 1911 appears to be the earliest date, when two or three prospectors, including Henry Schwartz, from the Bridge River section made a trip across the summit by way of Warner's pass into the valley now known as Schwartz valley, previous to which time the country was known only to the Indians. In 1912 A. M. Bateman, of the Geological Survey of Canada, made an exploratory trip into the section, crossing the summit near the head of Big Creek into the headwaters of Iron creek and travelling down that creek to its junction with the Taseko (Whitewater) river, and from there, after crossing the Whitewater, travelled to Chilko lake via the Nemiah valley. A report of this exploratory trip is published in the Summary Report, Geological Survey, Department of Mines, 1912. Reference to Bateman's report shows that he only made a very superficial examination, as he mentions no occurrence of minerals other than the deposits of bog-iron in the valley of Iron creek, down which he travelled from the summit.

In 1912 a mining engineer named Crossland made a rather exhaustive examination, for private clients, of the section examined by the writer during his recent trip. After Crossland's report was made a number of mineral claims were staked by his principals, surveyed, and some surface prospecting-work done, but since then, until the present year, little attention has been paid to the section owing to the war and lack of transportation facilities.

## GEOLOGY.

Bateman classifies the rocks in the section he examined—that is to say, along Iron creek and the Taseko, formerly the Whitewater river—as belonging to the volcanic series of the Tertiary age. They consist of basalts, augite andesites, andesites, rhyolites, and andesitic tuffs, breccias, and agglomerates. He states that the bog-iron ore deposits on Iron creek are of local origin and derived from disseminated pyrite contained in a bed of rhyolite which outcrops on the adjacent hillside.

The effects of glaciation are very pronounced, and some of the glaciers are still active in producing changes in the higher portions of the mountainous area, though, of course, on a much smaller scale than was the case during the glacial period.

The volcanic rocks are so heavily stained with iron oxide as to present the appearance of huge masses of limonite ore, but on a close examination it is seen that the mountains which form the walls of the valleys and reach upward several hundred feet above the floors are made up to a large extent of breccia and agglomerate, with the rock fragments cemented together with iron oxide.

Much of the oxidation appears to have taken place in the volcanic rocks while in-place, and while Bateman's theory of the origin is correct to a certain extent, yet there does not appear to be evidence of a sufficient quantity of pyrite in the country-rock to account for the very extensive beds of limonite, much of which is gravelly ore, that have accumulated on the floors of the valleys. On the other hand, the breaking-down of the steep mountain-sides and summits, made up of volcanic rocks, cemented agglomerates, and breccia, which have been for long periods in the past and are still subjected to more or less glacial action, erosion, and consequently disintegration, could be counted on to have furnished a very large percentage of the ore found in the deposits on the floors of the valleys.

One very noticeable feature of the valleys is the immense size of the beds of talus, which slope down from the surrounding mountains and often reach from near the summits 1,000 or more feet above the level of the valley-floor down to the floor itself.

The examination made by the writer convinced him that there occurs a zone of volcanic rocks on the north-easterly side of the Taseko (Whitewater) river which extend from near the head of the river and roughly parallel to the stream in a north-westerly direction. This zone appears to be bounded on the north-easterly side by a high rugged range of mountains made up for the most part of basaltic rocks having the usual columnar structure and forming a very prominent landmark, locally known as the "Battlement mountain range." The south-westerly boundary of the zone of volcanics is apparently the eastern boundary of the Coast Range granite batholith.

The occurrences of limonite ore appear to be confined to the zone of volcanic rocks, which is approximately two miles wide. The extent to the north-westerly along the strike has not been determined, but it is interesting to note that similar occurrences of deposits of limonite are reported to occur on Chilko lake, also near the headwaters of the Kltnakltni river, about 100 miles distant in about a N. 60° W. direction from the deposits examined in the Taseko (Whitewater) River section.

In order to show to what extent the theory suggested by the writer as to the origin of the limonite-deposits may be convincing, grab samples of the cemented breccia and agglomerate were taken from the exposed portions of some of the mountain-sides and summits. These were assayed in the Provincial Government Laboratory, with the following results:—

Sample.	Iron.	Phosphorus.	Sulphur.	Insoluble.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
From Iron mountain .....	5.4	0.5	Nil	81.8
From mountain north-east of Iron mountain .....	20.2	0.06	"	62.5
From Iron ridge, Frank Gott creek .....	16.4	Trace	"	74.6
From bluff on Iron creek .....	2.5	Trace	"	94.0
From head of Iron creek .....	5.2	0.22	"	73.3
From head of Iron creek .....	4.4	0.5	"	86.5
Clay resulting from disintegration of country-rock .....	1.0	Trace	"	91.0
Bluff on northerly bank of Taseko (Whitewater) river near head of lake	4.2	Trace	0.65	86.1

#### ORE-DEPOSITS.

The limonite-deposits examined by the writer occur in the valleys formed by the Taseko (formerly called Whitewater) river, Schwartz, Frank Gott, and Iron creeks, tributaries of the Taseko river. These deposits will be described in the following report in the order in which they occur in the mineralized zone, from a south-easterly to north-westerly direction.

#### *Taseko (Whitewater) Valley.*

About three or four miles down the Taseko valley from the Taylor pass, between the head of Gun creek and the Taseko river, there occurs the first exposure of limonite ore examined. This has been exposed by a big snowslide which had swept away all timber and vegetation on the easterly side of the river for a width of about 500 feet and a distance of about half a mile from the foot of the high mountain range to the river. The main exposure of limonite ore is near the top of the course of the snowslide and measures about 500 feet from the east to west and 150 feet from north to south. In addition to this main exposure, there are also several smaller exposures only a short distance northerly from it and nearer to the foot of the same mountain, locally called "Whale mountain." The rocks in the slope and summit of this mountain are very heavily stained with iron oxides, so much so as to suggest at a casual glance the occurrence of a mountain of limonite, but the talus which covers the slope of the mountain and has resulted from the breaking-down of the rock forming the mountain contradicts any such presumption.

The exposed beds or deposits of limonite contain a large percentage of gravelly ore which covers solid ore for a thickness, in places, from 6 inches to a foot. Under the gravelly ore there occurs a bed of solid and more massive limonite of undetermined thickness, as testing in several places with a small prospecting-pick failed to bore through the ore-body.

Grab samples taken from near the foot of the mountain and near the head of the exposure, as well as near the lower end towards the river, assayed as follows:—Near the head: Iron, 41 per cent.; phosphorus, trace; sulphur, 2.24 per cent.; insoluble, 3.2 per cent. Near the lower end: Iron, 41.4 per cent.; phosphorus, trace; sulphur, 2.46 per cent.; insoluble, 2.2 per cent. From mound of ore on north side of exposure: Iron, 46.6 per cent.; phosphorus, trace; sulphur, 0.88 per cent.; insoluble, 4 per cent.

No samples were taken from the smaller near-by exposures of limonite, because the mineralization appeared to be so homogeneous that sampling was not considered necessary, especially when it is considered that the samples had to be taken to the railroad on pack-horses, the number of which was limited.

*Schwartz Valley.*

Schwartz valley is separated on the southerly side from Taseko (Whitewater) valley by the huge mountain locally called "Whale mountain," around the northerly slope of which the stream flows which has its source, a glacier, in Warher pass at the head of Schwartz valley, and is used as a route of travel between the head of Tyaughton creek and the Taseko valley. Schwartz valley lies at an angle from the Taseko valley, having nearly south-easterly trend, while the Taseko valley at this point is from nearly east to west, and the junction between the waters flowing through Schwartz valley and Taseko valley is near the foot of the northerly slope of Whale mountain.

The creek that flows along Schwartz valley has very little grade from the foot of the glacier for about two miles and a half, but between that point and the Taseko river the water flows through deep canyons, so that the part of Schwartz valley in which the iron-ore deposits occur lies at a considerably higher elevation than the Taseko valley. It is U-shaped, bounded on the northerly and southerly sides by high mountains, with small glaciers at and near the summits.

There are several deposits of limonite ore in the upper part of the valley. These are more or less detached, with natural exposures covering the floor of the valley for a distance of about a mile and a half.

The *McCallum* group of ten mineral claims is located on the floor of the upper part of the Schwartz valley. Exposures of limonite ore occur on each of these claims, with the utmost extensive occurring on the *McCallum Nos. 3, 4, 5, and 6* claims, which adjoin each other and form a square block. On these claims a large proportion of the surface area, possibly about 100 acres, is covered with more or less detached exposures of limonite ore, of which gravelly ore forms a considerable percentage, but this gravel, a sample of which assayed: Iron, 44 per cent.; phosphorus, 0.23 per cent.; sulphur, 1.38 per cent.; insoluble, 7 per cent., is usually only a few inches thick and is underlaid by a bed of harder or massive ore of undetermined thickness. The hard ore is exposed by the ground-slucing operations carried on by nature, where small streams have sluiced through the gravelly ore as the waters flow from the slopes of the surrounding mountains across the ore-deposits. A fair sample of the more solid ore picked out with a small prospecting-pick from about a foot below the surface assayed: Iron, 45 per cent.; phosphorus, trace; sulphur, 1.03 per cent.; insoluble, 8 per cent. Another sample of the hard ore assayed: Iron, 50 per cent.; phosphorus, 0.21 per cent.; sulphur, 1.06 per cent.; insoluble, 2.1 per cent.

The rocks in the mountain range on the north-easterly side of Schwartz valley, as well as the steep rocky banks of the creek flowing through the lower end of the valley north-westerly from the *McCallum* group of mineral claims, are very heavily stained with iron oxides, so much so as to give the impression of huge masses of limonite ore, but examination showed that while portions of this country-rock might be classed as ironstone and carries from 10 to 20 per cent. of metallic iron as shown by the assays of the writer's samples, yet the main bulk of the rocks are only covered with a film of oxide along the cleavage-planes, and some examples of the oxidation of pyrite in the volcanic rock were found where the gradation from unaltered pyrite to limonite was plainly seen with the naked eye.

*Frank Gott Valley.*

From Schwartz valley camp was moved around the north-westerly foot-hill of the range of mountains that form the north-easterly boundary of Schwartz valley into a valley lying almost parallel to the latter. This is named the Frank Gott valley after a returned Indian soldier who distinguished himself at the Front as a scout and sniper, although several years beyond military age. This valley has the same U-shaped structure generally noticeable in this part of the country. Unlike most of the other valleys, there is no pass or outlet at the upper end, which is encircled by the summit of the unbroken mountain range, with elevation reaching more than 6,000 feet above sea-level, that forms the south-easterly, southerly, and northerly boundaries of the valley, with glaciers of considerable extent on the northerly slope of the mountain range. This range averages about 1,000 feet elevation above the floor of the valley, which at the upper end is several hundred feet above the main Taseko (Whitewater) valley, and is connected with it by a creek carrying considerable volume of water which flows through a deep box canyon for about a mile from the lower end of the Frank Gott valley before it forms a junction with the Taseko (Whitewater) river. This canyon is made up of very heavily ironstained rocks.

Across the summit to the east the mountain called Iron mountain is located. The southerly slope of this mountain terminates in a creek called Hæmatite, which flows in a westerly direction towards the foot-hills of the mountain range lying between Schwartz and Frank Gott valleys.

The *Peterkin* group of mineral claims, containing nine claims, is located on the south-westerly slope of Iron mountain and in the upper part of the valley of Hermatite creek. On the *Peterkin* Nos. 3, 5, and 6 there occur exposures of limonite ore which extend from near the foot of Iron mountain across the valley of Hæmatite creek, and are crosscut by the creek between the *Peterkin* Nos. 5 and 6 claims, where it flows between steep banks nearly 50 feet high. The creek crosscuts one exposed bed of limonite for a distance of about 600 feet measured by pacing up the bed of the creek. At the lower or westerly end of the deposit for about 200 feet ore occurs in the bed of the creek, but above that the bed of rock exposed in the bed of the creek is a greenish-coloured igneous rock resembling diorite, which on the southerly creek-bank is overlaid by agglomerate and breccia cemented with iron oxide that apparently forms the slope and summit of the mountain range on the southerly side of the creek, with some exposures of beds of limonite of varying extent on benches. The main exposure of limonite that is crosscut by Hæmatite creek forms the northerly bank of the creek, which rises from the water at an incline of about 30 degrees for about 100 feet. From the top of the creek-bank the limonite-deposit extends for about 300 feet, by pacing, towards the foot of Iron mountain. The width on the floor of the valley is about the same as it measures by pacing up the section crosscut by this Hermatite creek, or about 600 feet. The thickness of this deposit is undetermined, as no effort has been made to prove it by test-pits, and although the creek-banks where the deposit is crosscut are so steep as to give a vertical depth of nearly 50 feet below the surface of the outcropping and the bed of the creek, no reliable estimate of the extent of the ore can be made in the absence of crosscut trenches or drilling to prove the thickness of the deposit.

A short distance westerly from the deposit of ore there is a tributary of Hæmatite creek which flows from the north and separates the westerly foot-hill of Iron mountain from the easterly slope of Iron ridge, situated along the northerly side of Frank Gott creek. This tributary creek flows between steep banks made up principally of agglomerate and breccia cemented to a greater or lesser degree with iron oxide, a proportion of which might be classed as iron ore and mined in bulk. These creek-banks are about 15 feet high in places. The bed-rock in the creek is a granitic rock, and the extent of the cemented material is undetermined, as the tops of the creek-banks are deeply covered with talus from the mountain range to the westerly from Iron mountain, which is chiefly granitic in character.

Crossing the summit of the mountain westerly from Iron mountain, the headwaters of Frank Gott creek are reached, where the *Iron Ridge* group of ten mineral claims is located. Eight of these claims occupy both sides of the creek for a distance of 6,000 feet, as well as part of the southerly slope of a range of mountains which is practically a continuation of Iron mountain towards the west. The *Iron Ridge* Nos. 1 and 2 claims are located across the summit of this mountain, with the north-westerly post of *Iron Ridge* No. 2 claim situated on Iron creek near the foot of a large glacier.

On the *Iron Ridge* Nos. 5, 7, 8, 9, and 10 claims there are fairly extensive beds of limonite ore exposed in Frank Gott valley on the northerly side of the creek, while the mountain range which divides this valley from the valley of Iron creek lying north from Frank Gott are made up to a great extent of the cemented agglomerate and breccia, a grab sample of which assayed: Iron, 20.02 per cent.; phosphorus, 0.06 per cent.; sulphur, *nil*; insoluble, 62.5 per cent. This sample was taken in order to determine to what extent a proportion of the country-rock which forms so much of the mountain range had been mineralized.

Near the foot of the mountain range there occur the extensive beds of limonite, the actually exposed ore on one of which measures about 1,500 feet by nearly 200 feet. Grab samples from this deposit assayed:—Hard ore from knoll at upper end of deposit: Iron, 48 per cent.; phosphorus, 0.85 per cent.; sulphur, 0.60 per cent.; insoluble, 4.1 per cent. Gravelly ore from same deposit: Iron, 44.2 per cent.; phosphorus, 0.52 per cent.; sulphur, 1.05 per cent.; insoluble, 13.3 per cent. This exposure occurs on parts of *Iron Ridge* Nos. 5, 7, and 8 claims.

The other exposures of limonite on this group of claims occur covering parts of *Iron Ridge* Nos. 7, 8, 9, and 10 claims, and although the outcroppings actually exposed appear to be detached there are indications that the beds have continuity, and if such proves correct they would cover

an area approximately 1,500 feet along the creek by a maximum length towards the foot of the mountain of nearly 1,000 feet.

#### *Iron Creek Valley.*

The valley formed by Iron creek is separated from Frank Gott valley by the range of mountains called Iron ridge, with the distance between the creeks being about a mile. The two creeks flow parallel to each other; the valley of Iron creek is U-shaped, but narrower than either Schwartz or Frank Gott valleys, with the mountains forming the northern boundary ascending more abruptly than those which form the boundaries of the other valleys referred to in the foregoing report. The range called the Battlement mountains, with the typical columnar structure peculiar to the basaltic rocks and with the strike in a north-westerly direction, forms the northern boundary of Iron Creek valley, and appears to also form the north-easterly boundary of the mineralized zone in which the limonite-deposits described occur.

The *Iron Creek* group of sixteen mineral claims is located along the floor of the valley for 12,000 feet in length by 3,000 feet in width. At the upper end of the valley near the glaciers the No. 2 claim of the *Iron Ridge* group has its north-west corner, and above that the *Peterkin No. 10* claim is situated, with the *Black Knight Nos. 1 and 2* located east and north-east from the *Peterkin No. 10* claim.

The headwaters of Iron creek rise in a pass much used by Indians for travelling through to the headwaters of Big creek and the Chilcotin plains, and there is a dim trail up Iron creek from the Taseko (Whitewater) river.

Exposures of beds of limonite ore occur on the *Iron Creek* group, chiefly on *Iron Creek Nos. 5, 6, 7, 8, 13, 14, 15, and 16*. The exposure on *Nos. 13, 14, 15, and 16* is the most important, as it is actually exposed for about 750 feet by about 300 feet as a continuous bed, with indications of its extent being considerably greater, but partly covered by moss and grassy hummocks. This is the only occurrence of ore seen by the writer where there remains any evidence of prospecting-work having been done, although he was informed trenches and prospecting-pits had been made at other points, but such had all been filled by recent slides of snow and rock.

On *Iron Creek No. 16* claim there are two trenches made into the iron-ore deposit; each of these trenches is about 20 feet long by 6 feet deep. They show hard massive limonite ore throughout the work, with the same character of ore in the floors of the open-cuts, indicating a greater depth as yet undetermined. A sample of the hard ore which represented a fair average of the face of one of the cuts assayed: Iron, 47 per cent.; phosphorus, 0.04 per cent.; sulphur, 0.44 per cent.; insoluble, 4.1 per cent.

Other exposures of limonite ore occur on *Iron Creek Nos. 5, 6, 7, and 8*, which show considerable extent, especially the occurrences on *Iron Creek Nos. 7 and 8* claims, where a goodly proportion of the surface of claim No. 8 is covered by the exposures.

#### McCLURE'S CLAIMS.

There are some deposits of limonite on the western side of the Taseko river about six miles below the mouth of Iron creek and in a north-westerly direction from there, but no examination could be made of them because of high water, it being impossible to ford the river. However, the outcroppings could be readily seen from a bluff on the eastern side of the river nearly opposite to the locations. A trip was made from the Iron Creek camp to examine the properties, with the results mentioned. Apparently, the deposits of ore are situated in the same mineral-zone as those previously described in this report.

A group of mineral claims was staked several years since by a prospector named McClure, who is said to visit the property every year and do his assessment-work. He had already been there and left earlier than the writer's visit to this section. From the persistent manner in which he keeps up his assessment-work, it would appear that at least he considers he has a valuable property.

#### MAD MAJOR GROUP.

The *Mad Major* group consists of twelve mineral claims, named *Mad Major* and *Mad Major Nos. 1 to 11*.

*Location.*—The *Mad Major* group of mineral claims is located near the head of the Taseko river, at an elevation of about 5,000 feet above sea-level and about eight miles from its confluence with Taseko lake. The claims cover the surface of the westerly slope of a high mountain locally

known as "Taylor mountain." The boundaries of the group of claims extend from the summit, down the slope across a wide basin at the foot of a glacier at an elevation of about 1,000 feet above the Taseko river; thence across the river and up the easterly slope of the range of mountains opposite to Taylor mountain.

*Ownership.*—The *Mad Major* group of mineral claims is owned by E. J. Taylor and associates, of Rexmount.

*Accessibility.*—There are several routes by which the *Mad Major* group can be reached. The shortest and most direct is from Lillooet down Seton lake to Shalalth Station, on the Pacific Great Eastern Railway; thence across Mission mountain to Bridge River wagon-road, up that to a point about six miles westerly from Tyaughton creek, where the new Gun Creek trail branches off from the Bridge River wagon-road; follow that trail to the head of Green lake at the head of Gun creek, near McKinnon's *Copper Mountain* group of mineral claims; then cross the summit through Taylor pass to the head of Taseko river and Taylor mountain.

*Geology.*—Taylor mountain is near the eastern border of the Coast granodiorite batholith. The prevailing country-rock on the *Mad Major* group is granodiorite. It has been very much altered, weathered, and sheared. The slopes of all of the mountains in the vicinity are covered with deep beds of talus that has been broken and ground down by glacial action in the past and which is continuing on a limited scale at the present time.

There appears to be a series of wide fissures in the shear-zones which are filled chiefly with quartz and often with brecciated country-rock.

*Characteristics of Ore-deposits.*—The quartz vein-filling in the fissures in the shear-zones in the granodiorite country-rock is generally mineralized with chalcopyrite and iron pyrite. In places this mineralization extends into the wall-rocks, and it is not very unusual to find specimens of the granitic rock which show very considerable mineralization in the form of impregnations of particles of chalcopyrite and iron pyrite.

Mineralization indicating low-grade ore occurrences appears to extend over quite extensive areas, but the limitations of these areas have never been determined; indeed, to thoroughly prospect the *Mad Major* group of mineral claims necessitates the expenditure of a large sum of money far beyond the ability of the present owners, who have had to content themselves with the performance of the regular annual assessment-work.

One interesting feature is the fact that so much mineralization has impregnated the granodiorite to such a noticeable extent, but whether assays of large samples will show that the values are of a commercial grade is a query that can only be solved by extensive and systematic sampling after further prospecting-work is done.

The following assay results were obtained from grab samples from places where stripping had been done:—Sample No. 1 assayed: Gold, *nil*; silver, *nil*; copper, 0.7 per cent. Sample No. 2: Gold, trace; silver, trace; copper, 1.6 per cent. Sample No. 3: Gold, trace; silver, trace; copper, 2 per cent. Sample No. 4: Gold, trace; silver, trace; copper, 0.5 per cent.

#### COPPER KING GROUP.

There are ten mineral claims in the *Copper King* group, known as the *Wonder, Cougar, Olive, Strand, Copper Queen No. 1, Copper Queen No. 2, Copper King No. 1, Copper King No. 2, Heather, and Greenwich.*

*Ownership.*—The *Copper King* group of mineral claims is owned by E. J. Taylor and associates, of Rexmount.

*Location.*—The *Copper King* group of mineral claims is located adjoining the *Mad Major No. 10* mineral claim, with the boundaries of the group extending in a north-westerly direction down the Taseko river to the canyon, a distance of about two miles below Taylor mountain.

*Accessibility.*—The *Copper King* group is reached by travelling over the same route as to the *Mad Major* group, just described.

*Geology.*—The geologic conditions on the *Copper King* group appear to be similar to those already described as occurring on the *Mad Major* group.

*Characteristics of Ore-deposits.*—Up to August 23rd, 1919, the time when the examination was made, there had not been as many mineralized outcroppings found containing chalcopyrite as on Taylor mountain, but the walls of the canyon on the Taseko river show stains from copper and iron oxides, indicating the occurrence of low-grade copper ore. These walls are too steep to

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climb around on, and it is not possible to secure samples of the ore-outcroppings unless one is provided with ropes or finds the water very low in the river. When the writer made his examination the water was high in the river and he had no ropes.

For these reasons only one sample was taken from an outcropping near the top of the westerly wall of the canyon. This assayed: Gold, trace; silver, trace; copper, 0.2 per cent.

It would appear as though both the *Mad Major* and *Copper King* groups of mineral claims show sufficiently promising possibilities to warrant thorough prospecting. As many of the claims were only staked recently, the owners have not had an opportunity to do more than superficial work. Only a hurried examination was made owing to lack of time and importance of conserving all time possible to complete a thorough examination of the iron-ore deposits in the vicinity.

A detailed geological survey of the *Mad Major* and *Copper King* groups of mineral claims would apparently demonstrate the occurrence of similar conditions as occur on the *Copper Mountain* mineral-deposit on Copper creek, near the head of Gun creek, described by Charles Camsell in Summary Report, 1918, Part B, Canada Department of Mines Geological Survey.

*Copper Mountain* deposit is about eight miles in a south-easterly direction from the head of the Taseko river.

## ALBERNI DISTRICT.

## ALBERNI MINING DIVISION.

REPORT OF A. G. FREEZE, GOLD COMMISSIONER.

I have the honour to submit a brief annual report on mining in the Alberni Mining Division during the year ending December 31st, 1919.

*Monitor Group.*—No shipments have been made and no development-work has been done on this group during the year.

*Big I. Group.*—Other than the required annual assessment-work, little has been done on this group during the year. The Consolidated Mining and Smelting Company, Limited, of Trail, is now interested in these claims, which are situated in the Big Interior basin, ten miles from Great Central lake, and it is anticipated that development-work will be started as soon as conditions permit, the depth of snow at this time of year being a great handicap. Fourteen new claims have been staked adjoining this group.

The accompanying office statistics show that very little prospecting has been done in this district during the year, and except for the annual assessment-work there has been no actual mining development.

## OFFICE STATISTICS—ALBERNI MINING DIVISION.

Mineral claims recorded .....	32
Certificates of work recorded .....	16
Free miners' certificates issued (ordinary) .....	19
Free miners' certificates issued (special) .....	3
Bills of sale, etc., recorded .....	3
<i>Revenue.</i>	
Mining receipts, general .....	\$144 30
Free miners' certificates .....	133 75
Total .....	\$278 05

## CLAYOQUOT MINING DIVISION.

REPORT OF WALTER T. DAWLEY, MINING RECORDER.

I have the honour to submit the annual report on mining operations in the Clayoquot Mining Division for the year ending December 31st, 1919.

Assessment-work has been recorded as follows :—

*White, Norman, Dunlop, Walton, and Alpha* mineral claims, known as the *White* group, owned by W. N. Walton and D. McMillan, situated on the west side of Tofino creek. Making trail giving easy access to the claims, stripping earth, clearing trees and scrub, rock-work, etc.

*Lucky Jim.*—Situated on Elk river and owned by Wm. Spittal. Six feet of tunnel and open-cut, stripping, etc.

*Dixie.*—Owned by William McKay and situated on Tofino inlet. Open-cut giving entrance to a tunnel 6 feet high, 10 feet wide, and 3 feet deep; another open-cut 4 x 4 x 4 feet and other prospecting-work.

*Ex, Ten, You, and Eight.*—Situated on the Big Interior mountain, Bear river. These claims were surveyed last July (1919) by Kenneth L. Burnet, B.C.L.S., of Vancouver.

*Contact.*—Situated at Muchalat arm, Nootka, and owned by W. F. Poole and T. T. Gardhouse. Open-cut, with 7-foot face in rock, 25 x 7 feet.

*Colorado.*—Situated at Head bay, Nootka, and owned by W. F. Poole. Open-cut 10 x 6 feet, with 3-foot face, and considerable stripping and uncovering ore-body.

*Northern Crown*.—Situated at the mouth of Clayoquot river and owned by J. E. Martin. Some 9½ feet of 4 x 6 rock tunnelling.

*Gordon, Solor No. 1, and Great Central No. 7*.—Known as the *Laura* group, situated at the Big Interior mountain, Bear river, and owned by Wilber Johnston, of Vancouver. Considerable work in open-cuts and sinking and uncovering ore.

*Empress*.—Situated at Bear river and owned by John W. McIntosh, of Vancouver. Considerable stripping, uncovering ore-body, and taking out ore.

*Ivanhoe and Double Standard*.—Property of Wm. Wilson, of Victoria. These claims were surveyed in August, 1919, by G. A. Smith, B.C.L.S.

*L. Grant and Wanderer*.—Known as the *Wanderer* group, situated at the outlet of Elk river, and owned by Lachlan Grant. Tunnel 10 x 4 x 6 feet, 15 feet heavy open-cut, and 12 feet stripping.

#### OFFICE STATISTICS—CLAYOQUOT MINING DIVISION.

Free miners' certificates (individual) .....	24
Mineral claims recorded .....	18
Certificates of work recorded .....	23
Other receipts issued .....	2
Transfers, etc., recorded .....	7

#### Revenue.

Free miners' certificates .....	\$107 75
Mining receipts, general .....	121 95
Total .....	\$229 70

### QUATSINO MINING DIVISION.

#### REPORT BY ED. EVENSON, MINING RECORDER.

I have the honour to submit the annual report on the mining operations in the Quatsino Mining Division for the year ending December 31st, 1919.

Except the regular assessment, no work has been done on mineral claims in this Division.

*Old Sport Group*.—Development-work has been vigorously carried on by the Coast Copper Company under the supervision of William Clancy. The actual development-work has been confined to diamond-drill boring along the outcrop.

*Millington Group*.—Located at Spruce river, about three miles from Holberg, at the head of West arm, Quatsino. Considerable prospecting-work has been done and the showing is very promising.

#### OFFICE STATISTICS—QUATSINO MINING DIVISION.

Mining claims recorded .....	102
Certificates of work recorded .....	158
Certificates of improvement .....	10
Powers of attorney, transfers, etc. ....	39

#### Revenue.

Mining receipts .....	\$ 837 45
Free miners' certificates .....	314 25
Total .....	\$1,151 70

## NANAIMO DISTRICT.

### NANAIMO MINING DIVISION.

REPORT OF S. MCB. SMITH, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the mining operations in the Nanaimo Mining Division for the year ending December 31st, 1919.

Conditions of the metal-mining industry in this Division have improved somewhat over the previous year, from the fact that about forty new locations have been made on Myra and Price creeks, at the head of Buttle lake, Strathcona Park.

Considerable prospecting was done on Quadra island, and some shipments of copper ore were made from the *Senator* mineral claim of the *Copper Mountain* group, near the head of Gowlland harbour, Quadra island.

Development-work on the *Marble Bay* mine on Texada island was continued to the 1,700-foot level.

The Ladysmith Smelting Corporation, Limited, has been developing the *Dawn* group of mineral claims on Thurlow island. The same corporation took a bond on the old *Blue Bells* mine, Frederick arm, on the Mainland across from Thurlow island.

A small shipment of magnetite-iron ore was made from the *Lake* mine on the west coast of Texada island for experimental treatment in the electric furnace at Vancouver.

*Cornell*, *Copper Queen*, and *Little Billie* mines on Texada island, the property of the Van Anda Copper Gold Company, were bonded during 1919 to the Calumet Arizona Copper Company, of Arizona. That company proposes during the coming year to extend the underground workings, also to do considerable prospecting-work by diamond-drilling.

The *Nigger Baby* group on Texada island, which has been held for several years by an old-time prospector, R. C. Miller, was acquired during 1919 by Harvey Wells and associates, of Tacoma, Wash., who have started new development-work and are thoroughly prospecting the property.

On the *Red Robin* claim, Texada island, W. S. Planta, of Vananda, has been doing some development-work.

During the year Wm. M. Brewer, Resident Engineer of the Western Mineral Survey District (No. 6), which includes the whole of the Nanaimo Mining Division, has examined a great many properties in this Mining Division. His report will contain descriptions and details of the important properties in this Mining Division, so I shall not attempt detailed descriptions.

With the exception of the above, very little has been done, other than the annual assessment-work, which has been recorded on a number of claims, as shown by the accompanying office statistics.

#### OFFICE STATISTICS—NANAIMO MINING DIVISION.

Mineral claims recorded .....	122
Certificates of work .....	188
Bills of sale, etc. ....	45
Free miners' certificates .....	244

#### Revenue.

Free miners' certificates .....	\$1,472 25
Mining receipts .....	2,562 40
Total .....	\$4,034 65

## VICTORIA DISTRICT.

### VICTORIA MINING DIVISION.

REPORT OF HERBERT STANTON, GOLD COMMISSIONER.

I have the honour to submit the annual report on the mining operations in the Victoria Mining Division for the year ending December 31st, 1919.

As the Resident Engineer of the District, W. M. Brewer, has fully covered the mining activities of this Division for the past year, I will not attempt to further report on these matters, and beg to submit the office statistics of this Division for the year 1919.

I am glad to be able to report that the revenue derived from mining this year shows an increase over that of preceding year of over 25 per cent.

#### OFFICE STATISTICS—VICTORIA MINING DIVISION.

Free miners' certificates issued .....	560
Free miners' certificates issued (special) .....	14
Mineral claims recorded .....	89
Placer claims recorded .....	8
Certificates of work recorded .....	104
Bills of sale recorded .....	29
Certificates of improvement issued .....	7
Placer-mining leases issued .....	1
Reverted Crown-granted claims leased .....	8

#### Revenue.

Free miners' certificates .....	\$3,770 75
Mining receipts, general .....	965 25
Total .....	\$4,736 00

### VANCOUVER MINING DIVISION.

REPORT OF A. P. GRANT, MINING RECORDER.

I have the honour to submit the following report of mining operations in the Vancouver Mining Division, from August 1st to December 31st, 1919:—

The following list gives the number and localities of the recorded claims in this Division:—

McNabb creek .....	17
Bowen island .....	4
Howe sound (east side) .....	5
Potlatch creek .....	6
Narrows arm .....	62
Howe sound (west side) .....	10
Indian river .....	8
Staamus river .....	13
Cypress creek .....	5
Queens reach .....	12
Lynn creek .....	3
Jervis Inlet (head) .....	9
Seymour lake .....	14
Salmon arm .....	7
Skookumchuck .....	16

Along Pacific Great Eastern Railway .....	21
Egmont point .....	8
Bargain harbour .....	1
Gambier island .....	5
Total .....	
	226

As will be seen by the above list, the majority of the new claims are located in the Jervis Inlet district.

C. J. West, secretary of the Baramba Mining Company, whose claims are on Hotham sound, states that on their property an open-cut has been made following the vein for 100 feet in length by 6 feet in width. A tunnel 150 feet long has been driven 135 feet below the surface and open-cut, crosscutting the ore-zone, which is 23 feet in width. From this place, in addition to other values, copper assaying up to 4 per cent. has been found. Another tunnel has been commenced 50 feet above high-water level and has been driven to a depth of 90 feet.

**Bowena Copper Mines, Ltd.** C. M. Oliver, secretary, states that the development-work on this property during 1919 consisted of short drifts from the bottom of the shaft and open-cuts on the different veins for the purpose of securing an average grade of ore for a milling test, the ore being trammed down to the concentrator, which was practically completed at the end of the year. In addition to building the concentrator, the lessee, C. W. Tipping, has equipped the property with water system, electric-light plant, a 10 x 10 x 14 Canadian Rand drill, steam-driven compressor, machine-drills, etc., and expects to begin steady mining and milling operations early in 1920.

**Snug Cove Copper Co., Ltd.** J. E. Fitzgerald, secretary, states that on the *Snug Cove* group of claims, Bowen island, adjoining the *Bowena* mine on the north, development-work in 1919 consisted of surface cuts made in tracing the extensions of the *Bowena* veins into and through the *Snug Cove* group, and the driving of a crosscut to expose the most northerly of these veins at a depth of about 200 feet below the surface. This crosscut has been driven 135 feet, and it is estimated will have to be driven 50 or 60 feet farther to cut the vein. Several stringers have been passed through, samples from which, when assayed, show small values in gold, silver, and copper.

**Britannia Mining and Smelting Co., Ltd.** E. J. Donohue, secretary-treasurer, has given me the following statement of his company's operations for the year just ended: "As all of our December production has as yet not been forwarded to the smelter, definite figures covering mineral-output are not available, but the following approximations will undoubtedly serve your requirements:—

Ore mined (actual) (tons) .....	642,635
Ore transported to Beach mill and stock-piles (actual) (tons) .....	645,910
Ore treated in Beach mill (actual) (tons) .....	615,300
Approximate contents of ore treated—	
Copper (lb.) .....	17,250,000
Gold (oz.) .....	4,200
Silver (oz.) .....	98,600
"The classification of development-work done in the mine is as follows:—	
Drifts .....	4,113 Feet.
Crosscuts .....	2,562
Raises .....	5,239
Chutes .....	850
Winzes .....	62
Total .....	
	12,826

"In the *Fairview* mine the operation was carried on as in former years—namely, the extension of mine drifts for stoping operations on veins previously opened.

"Mining at the upper glory-holes above the 250-foot level was not carried on as extensively as at the *Bluff* glory-hole, the latter being worked on a large scale for approximately nine months of the year, we being forced to discontinue it on account of unfavourable weather conditions.

"The 1,600-foot level was driven to connection through Britannia mountain during the year, this being the fifth tunnel to pierce the mountain, having portals on both the north and south side. On the south side, at the mouth of the 500-, 1,000-, and 1,600-foot levels, bunk-houses have been erected during previous years for the accommodation of employees working in those sections of the mine.

"The Victoria tunnel (8 x 8 feet), to the east of the *Empress* workings, at an elevation corresponding to the 1,800-foot level, advanced during the year to a total of 485 feet, from which point we are carrying on extensive diamond-drill prospecting.

"The Hillside tunnel (8 x 8 feet), to the west of the *Jane* mine on the 1,000-foot level, was advanced to a total of 480 feet.

"The raise, which is being driven on a 65-degree slope, with dimensions 7 x 12 feet, for transportation purposes between the 4,100-foot level and the 3,100-foot level tunnels, and which was commenced in the previous year, was driven for a short period only and advanced to a total of 120 feet.

"The 3,100-foot level, East drift, advanced 113 feet, work on it continuing but a short time.

"In addition to the foregoing and exclusive of the work on the 1,800-foot level, above mentioned, the diamond-drill footage for the year amounted to 3,922 feet, being distributed between the *Bluff*, *Jane*, and *Empress* sections of the mine.

"Eight hopper-bottom cars, 3-foot gauge, 20-ton capacity, and two 3-foot gauge, 20-ton, all-steel flat cars were added to our outside ore-haulage equipment for the transportation of ore between the rock-raise and the tramway and incline ore-bins.

"The welfare of the Beach community was further considered during the year by the erection of a building 64 feet long by 36 feet wide, two stories high. The ground floor is occupied by barber-shop, billiard and pool hall, and reading-room, while the upper floor is fitted up as a dance-hall, which is much in requisition during the winter months. The building is heated by steam and provided with Brasco lights throughout.

"On account of upset market conditions resulting in a very low price for copper, it was necessary to carry the operation on a reduced basis throughout practically the whole of the year, with the result that our programme in connection with transportation tunnels and raises and other construction-work was greatly curtailed."

The Lynn Creek Zinc Mines, Limited, have Crown-granted the balance of their claims in Lynn valley.

OFFICE STATISTICS—VANCOUVER MINING DIVISION.

Free miners' certificates issued .....	1,860
Free miners' certificates (special) .....	17
Free miners' certificates (company) .....	49
Claims recorded .....	226
Abandonments recorded .....	1
Certificates of work issued .....	487
Surveys recorded as work .....	90
Receipts issued for money in lieu of work .....	19
Grouping notices filed .....	49
Documents filed .....	10
Conveyances recorded .....	117
Certificates of improvements recorded .....	130

*Revenue.*

Free miners' certificates .....	\$12,352 05
Mining receipts .....	4,744 35
Total .....	\$17,096 40

## NEW WESTMINSTER MINING DIVISION.

## REPORT OF IRVING WINTEMUTE, MINING RECORDER.

I have the honour to submit the following report of mining operations in the New Westminster Mining Division for the year ending 1919:—

The claims recorded during the year were distributed as follows:—

Chilliwack river .....	8
Harrison lake .....	5
Jones creek .....	6
Pitt lake .....	50
Stave river .....	2
Jones lake .....	4
<hr/>	
Total .....	75

The office statistics show an increase of revenue over the previous year, there being more free miner's certificates issued, although the record of mineral claims and certificates of work show a slight falling-off. There has been a great deal of prospecting at Pitt lake and vicinity, and I expect that considerable development-work will be done during the year 1920.

Annual assessment-work has been kept up on practically all the old properties, a few of the important of which are *Last Chance*, on Hurling's mountain; the *Empress* and *Contact*, situated near Agassiz; and *Cedric*, on upper Stave river.

The most important property on which development has been done is the *Lucky Four Group*. *Four* at the summit of Cheam range, overlooking Jones lake. The group comprises eleven mineral claims and is owned by Sperry & White, formerly on the staff of the Pacific Great Eastern Railway. A tunnel of 150 feet was driven on the south side when operations had to be closed down on October 31st on account of heavy snow, winter quarters having not yet been established. A sample gave values of: Gold, trace; silver, 2 oz.; copper, 7.6 per cent. A trail has been constructed from the Canadian Northern Railway fifteen miles to the summit of the range. This trail will be of great assistance to the opening-up of the surrounding country for prospectors. Two cabins have also been built on the trail, which will facilitate transportation to the property in the early spring, when extensive operations are intended to be carried on.

## OFFICE STATISTICS—NEW WESTMINSTER MINING DIVISION.

Free miner's certificates issued (individual) .....	180
Free miners' certificates issued (company) .....	1
Free miners' certificates issued (special) .....	5
Mineral claims recorded .....	75
Certificates of work issued .....	64
Conveyances, etc., recorded .....	15
Grouping notices filed .....	6
Receipts issued for money in lieu of work .....	5

*Revenue.*

Free miners' certificates .....	\$ 918 25
Mining receipts, general .....	1,098 10
<hr/>	
Total .....	\$2,016 35

## INSPECTION OF MINES.

### REPORT OF GEORGE WILKINSON, CHIEF INSPECTOR.

I have the honour to submit my third annual report as Chief Inspector of Coal and Metaliferous Mines covering the year ending December 31st, 1919.

The reports of the District Inspectors relative to production of coal and coke, the number of persons employed, list of accidents and prosecutions, and brief description of the mines in the several inspectorates, and also reports of the Instructors in Mine-rescue Work and First Aid, are hereto appended.

#### PERSONNEL OF STAFF OF INSPECTORS AND INSTRUCTORS.

The personnel of the staff of Inspectors and Instructors is as follows:—

##### *Inspectors.*

George Wilkinson .....	Chief Inspector, Victoria.
James McGregor .....	Inspector, Vancouver.
Robert Strachan .....	Senior Inspector, Nelson (Kootenay and Boundary Districts).
H. H. Johnson .....	Temporary Inspector, Nelson.
William Lancaster .....	Inspector, Fernie.
Henry Devlin .....	Inspector, Nanaimo.
Thomas J. Shenton .....	Inspector, Prince Rupert.
Thomas R. Jackson .....	Inspector, Nanaimo.

##### *Instructors, Mine-rescue Stations.*

John D. Stewart .....	Instructor, Nanaimo.
J. T. Puckey .....	Instructor, Fernie.
John Thomson .....	Instructor, Cumberland.

##### *Organizer and Instructor in First Aid.*

Dudley Michell .....	Victoria (for the first nine months of the year).
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By amendment to the "Coal-mines Regulation Act" during 1919 the Board of Examiners for coal-mine officials and miners was placed under the jurisdiction of the Inspection Branch. The personnel of the Board of Examiners for coal-mine officials is as follows:—

George Wilkinson, .....	Chairman.
James Dickson .....	Member of Board and Acting Inspector of Mines.
Harry E. Miard .....	Member of Board and Acting Inspector of Mines.

Messrs. Dickson and Miard and the District Inspector for the district in which they are holding the examination form the Board for granting Certificates of Competency to coal-miners. The Inspector of Mines is empowered to grant provisional certificates to miners for a period not exceeding sixty days between regular examinations.

#### CHANGES IN THE STAFF DURING THE YEAR.

There have been several changes in the inspection staff during the year. On February 4th, 1919, J. H. McMillan, Inspector for the Northern District, resigned, and the vacancy created was filled by the appointment of T. J. Shenton on February 27th.

On July 1st Donald McLean, a returned soldier, was appointed to fill the vacancy in the Nicola-Princeton District made by the transfer of Robert Strachan to the Crowsnest Pass District. After accepting the position, but before really taking on his duties, Mr. McLean reconsidered and decided not to join the staff. This district was therefore inspected during the whole of the year by Inspectors Strachan and Lancaster covering the coal-mines, and Inspector McGregor covering the metalliferous mines.

The Inspection Branch suffered a loss on December 8th by the death of Inspector John Newton, an efficient and faithful official. Mr. Newton had been failing in health for some time. Acting-Inspector Dickson was deputized to assist him and relieve him of the heaviest of his duties in August, and covered the district for the balance of the year.

In September Dudley Michell, Organizer and Instructor in First-aid Work, resigned, and as the most of the work was completed for the season no appointment was made for the balance of the year.

Beginning January 1st, 1920, several changes were made in the inspection districts. Inspector McGregor was moved from Nelson to Vancouver and took over all the mines in the Nicola-Princeton District, and also the *Britannia* and Texada Island mines, which was formerly covered by the Inspectors from Vancouver island. Inspector Strachan was moved from Fernie to Nelson and made Senior Inspector in charge of the Kootenay and Boundary Districts.

T. R. Jackson, formerly mine manager of No. 1 mine, operated by the Canadian Western Fuel Company at Nanaimo, was appointed to fill the vacancy created by the death of Inspector Newton.

#### TONNAGE OF COAL PRODUCED.

The total gross tonnage produced by the coal-mines of the Province for the year ending December 31st, 1919, was 2,408,948 long tons, a decrease of 171,848 long tons under the production of 1918.

The output would have been considerably larger had not the production been cut down by the following causes: On May 24th a strike was called at the mines of the Crow's Nest Pass Coal Company demanding recognition of the O.B.U. The strike lasted three months. The mines were opened without the demand being granted. It is estimated that some 160,000 tons was lost in production by the Vancouver Island mines through the slack time during the months of May, June, and July, caused by a falling-off in trade.

The Vancouver Island collieries had an increase in their production from 1,666,214 tons in 1918 to 1,699,348 tons in 1919, an increase of 33,134 tons.

The Crowsnest Pass collieries had a decrease in their production from 732,864 tons in 1918 to 558,806 tons in 1919, a decrease of 174,058 tons.

The Nicola-Princeton District had a decrease in its production from 179,179 tons in 1918 to 149,042 tons in 1919, a decrease of 30,137 tons.

The Telkwa mine in the Northern District increased its production from 470 tons in 1918 to 1,752 tons in 1919, an increase of 1,282 tons.

#### ACCIDENTS IN COAL-MINES.

The fatalities in and around the coal-mines during the year totalled twelve. There were 5,966 persons employed in and around the coal-mines.

The ratio of fatal accidents per 1,000 persons employed was 2.013, compared with 5.159 for 1918 and 8.51 for 1917. The ratio for the last ten-year period was 4.831.

The following table shows the collieries at which fatal accidents occurred during 1919, and their relation to accidents which occurred at the colliery for 1918:—

Name of Company.	Name of Colliery.	1919.	1918.
Canadian Collieries (D.), Ltd. ....	Comox Colliery .....	5	2
Canadian Collieries (D.), Ltd. ....	Extension Colliery .....	2	1
Canadian Western Fuel Co. ....	Nanaimo Colliery .....	4	18
Pacific Coast Coal Mines, Ltd. ....	South Wellington Colliery .....	..	..
British Columbia Coal Mining Co. ....	East Wellington Colliery .....	..	..
Nanoose Collieries, Ltd. ....	Nanoose Colliery .....	..	..
Middlesboro Collieries Co. ....	Middlesboro Colliery .....	..	..
Fleming Coal Co. ....	Coal Hill Colliery .....	..	2
Princeton Coal & Land Co. ....	Princeton Colliery .....	..	..
Coalmont Collieries, Ltd. ....	Coalmont Colliery .....	..	..
Crow's Nest Pass Coal Co. ....	Coal Creek Colliery .....	1	2
Crow's Nest Pass Coal Co. ....	Michel Colliery .....	..	3
Corbin Coal & Coke Co. ....	Corbin Colliery .....	..	..
Telkwa Collieries, Ltd. ....	Telkwa Colliery .....	..	..
Totals .....	.....	12	28

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for the previous year:—

Cause.	1919.		1918.	
	No.	Per Cent.	No.	Per Cent.
Fall of rock .....	4	33.333	6	21.428
Fall of coal .....	4	33.333	1	3.572
Haulage .....	4	33.333	4	14.286
Explosion .....	..	.....	..	.....
Breaking of ropes and chains .....	..	.....	16	57.143
Falling timber .....	..	.....	1	3.571
Totals .....	12	100.000	28	100.000

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1919 and 1918:—

Cause.	1919.		1918.	
	No. of Fatal Accidents.	No. Tons mined per Fatal Accident.	No. of Fatal Accidents.	No. Tons mined per Fatal Accident.
Fall of rock .....	4	602,237	6	429,687
Fall of coal .....	4	602,237	1	2,578,724
Haulage .....	4	602,237	4	644,681
Explosion .....	..	.....	..	.....
Breaking of ropes and chains .....	..	.....	16	161,170
Falling timber .....	..	.....	1	2,578,724

The number of tons of coal mined per fatal accident during 1919 was 200,745, compared with 92,098 tons for 1918 and an average of 87,837 tons for the past ten years.

#### TONNAGE OF METALLIFEROUS MINES.

The output from the metalliferous mines for 1919 was 2,112,975 tons, being a decrease of 779,874 as compared with the tonnage for 1918. This tonnage was produced from 142 shipping mines, of which sixty-four shipped over 100 tons.

#### ACCIDENTS IN METALLIFEROUS MINES.

There were six fatal accidents in and around the metal-mines during the year, causing the death of six persons, being a decrease of six in number of accidents and a decrease of six in the number of fatalities compared with 1918.

There were 3,778 persons employed in and around the metalliferous mines, a decrease of 612 persons compared with the figures of 1918.

The ratio of fatal accidents per 1,000 persons employed was 1.588, compared with 3.66 for 1918. The ratio for the last ten-year period was 3.54.

The mines at which the fatalities occurred are:—

Mining Division.	Mine.	No. of Accidents.
Nass River .....	Anyox .....	1
Vancouver .....	Britannia .....	3
Skeena .....	Surf Inlet .....	1
Fort Steele .....	Sullivan .....	1
Total .....	.....	6

The following table gives the cause and percentage to the whole of the fatal accidents with the corresponding figures for 1918:—

Cause.	1919.		1918.	
	No.	Per Cent.	No.	Per Cent.
Fall of ground .....	..	.....	6	50.000
By falling into chutes, raises, winzes, &c. ....	4	66.666	4	33.334
By mine-car and haulage .....	..	.....	1	8.333
Material falling in shaft .....	..	.....	1	8.333
By cage in shaft .....	1	16.666	..	.....
By air-pipe breaking (surface) .....	1	16.666	..	.....
Total .....	6	100.000	12	100.000

There were no fatal accidents from falls of ground during 1919, which speaks well for the care being exercised in making the roof and sides secure. Falling down chutes, raises, etc., caused four fatalities, this being the same number as last year from this cause. One fatality was caused by a cage in shaft and one on the surface by a compressed-air pipe breaking.

There were no accidents from the use of explosives during 1919, this making two years straight free from accidents of this class. There were no fatal accidents occurring during the year in the West Kootenay and Boundary Districts, which is the first year in the history of mining in these districts that there has been no fatal accidents reported.

#### EXPLOSIVES.

During the year one supplementary order was issued and added to the permitted list of explosives contained in the previous explosives orders. The full list of explosives now on the permitted list are as follows:—

Monobel A1 .....	British List.
Monobel No. 1 .....	"
Dynobel No. 2 .....	"
Polar Permittite .....	"
Monobel .....	United States List.
Monobel No. 4 .....	" "
"Giant" Coal-mine Powder No. 5 .....	" "
"Giant" Coal-mine Powder No. 6 .....	" "
"Giant" Coal-mine Powder No. 7 .....	" "
"Giant" Coal-mine Powder No. 8 .....	" "
Polar Brushite .....	" "
Vigorite No. 1 .....	" "
Vigorite No. 2 .....	" "
Vigorite No. 3 .....	" "
Vigorite No. 4 .....	" "
Miner's Friend No. 1 .....	" "
Miner's Friend No. 2 .....	" "
Miner's Friend No. 3 .....	" "
Miner's Friend No. 6 .....	" "
Miner's Friend No. 7 .....	" "
Viking No. 1 .....	" "

The following table shows the quantity of explosives used in coal-mines during 1919, together with the number of shots fired, how shots were fired, tons of coal produced per pound of explosive used, and the average pounds of explosive per shot fired:—

District.	Quantity of Explosives used in Pounds.	Tonnage of District.	No. of Shots fired by Electricity.	No. of Shots fired by Fuse.	Total No. of Shots fired.	Tons of Coal per Pound of Explosive.	Average Pounds of Explosive per Shot fired.
Vancouver Island.....	487,332	1,699,348	585,240	350	585,590	3.5	0.83
Nicola-Similkameen.....	35,687	149,042	51,743	...	51,743	4.2	0.69
East Kootenay.....	10,250	558,806	16,504	120	16,624	54.5	0.61
Northern District.....	438	1,752	976	...	2,628	4.0	0.50
Totals.....	533,707	2,408,948	654,463	470	656,585	4.51	0.81

The production of coal per pound of explosive used is 0.31 less than that of the previous year.

The Crowsnest Pass District showed an increase of 1.23 tons per pound of explosive used, the yield being 41.6 tons, compared with 39.37 tons for 1918.

The Nicola-Princeton District showed a decrease of 0.8 tons per pound of explosive used, the yield being 4.2 tons, compared with 5 tons for 1918.

The Vancouver Island mines showed an increase of 0.14 ton per pound of explosives used, the yield being 3.5 tons, compared with 3.46 tons for 1918.

The estimated yield at Telkwa for the year is 4 tons per pound of explosive used.

#### MACHINE-MINED COAL.

During the year mining-machines produced 114,910 tons of coal, or 4.75 per cent. of the whole. This is a decrease under the figures of 1918, when the percentage of machine-mined coal was 7.4 per cent.

Of the total machine-mined coal, the Canadian Western Fuel Company produced 51,895 tons, or 45.17 per cent.; the Canadian Collieries (D.), Limited, 48,115 tons, or 41.55 per cent.; the Princeton Coal and Land Company, 7,000 tons, or 6.1 per cent.; and the Crow's Nest Pass Coal Company, 7,900 tons, or 6.8 per cent.

The following table gives the district, number of machines, how driven, tons of coal produced, and type of machine used:—

District.	No. DRIVEN BY		TONS OF COAL PRODUCED.		Total in Tons.
	Compressed Air.	Electricity.	Electricity	Compressed Air.	
Vancouver Island.....	11	4	48,115	51,895	100,010
Nicola-Similkameen.....	4	..	.....	7,000	7,000
Crowsnest Pass.....	3	..	.....	7,900	7,900
Totals.....	18	4	48,115	66,795	114,910

#### Types of Machines in Use.

Type.	DISTRICT.			Totals.
	Vancouver Island.	Nicola-Similkameen.	Crowsnest Pass.	
"Percussive" Post.....	8	4	3	15
"Bar" Longwall.....	3	..	..	3
"Chain" Shortwall.....	4	..	..	4
Totals.....	15	4	3	22

## SAFETY-LAMPS.

There were 5,015 safety-lamps in use in the coal-mines of the Province during 1919, an increase of 651 over the previous year. Of this number, 1,422 were flame-lamps of the Wolf type and 3,593 were electric lamps, mostly Edison electric cap-lamps. There was an increase of 928 in the number of electric lamps in use during the year.

The following table shows the distribution of lamps by districts, method of locking, and the illuminant used:—

District.	Magnetic.	Screw or Automatic Clip.	Naphtha.	Electricity.
Crowsnest Pass.....	111	1,089	114	1,086
Nicola-Similkameen.....	74	188	89	173
Vancouver Island.....	1,193	2,360	1,219	2,334
Totals.....	1,378	3,637	1,422	3,593

The Edison cap safety-lamp is finding very much favour with both operators and workmen and is proving very efficient. In several instances since this type of lamp has been in use in the Crowsnest mines it is claimed it has been the means of saving life when blow-outs of gas have occurred. Over 71 per cent. of the lamps now in use in the Province are electric lamps.

## MINE-AIR SAMPLING.

During the year numerous mine-air samples were taken in the coal-mines of the Province, and much valuable information has been obtained and added to that obtained in previous years relative to the flow of methane from the various coal-seams mined.

The Burrell gas-detector has been used extensively during the year for testing for smaller quantities of methane than can be detected with a safety-lamp. All the mines are now equipped with these detectors, and the Inspectors on each monthly visit test all the return air of the various splits and main return airways. The officials of the company also have them in daily use.

During the year a descriptive chart in booklet form was issued to the officials and workmen by the Hon. William Sloan, Minister of Mines. This chart shows the length of flame-cap showing by the Wolf safety-lamp for the different percentages up to 2½ per cent., which is the standard withdrawal-point set by the 1918 amendment to the "Coal-mines Regulation Act," and also gives instructions on the use of the safety-lamp for testing fire-damp. This chart was compiled from actual tests covering nearly two years. Flame-caps were measured and mine-air samples taken for analysis simultaneously. A ⅞-inch flame-cap represents 2.5 per cent. in the Crowsnest Pass mines and a ½-inch flame-cap the same percentage in the Coast and Nicola mines. This chart should prove of much value to the officials and workmen.

The following table shows the tabulated data obtained from the mine-air sampling in coal-mines during 1919:—

RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS COAL-MINES OF THE PROVINCE OF BRITISH COLUMBIA DURING THE YEAR 1919.

Coast District.

Sample No.	Date.	Mine.	Ventilating District.	Working or Idle.	Tonnage per Day.	CHEMICAL ANALYSIS.				Velocity of Air in Feet per Minute.	Quantity of Air in Feet per Minute.	Barometer.	HYGROMETER.			Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Lb. of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
						CO <sub>2</sub>	O.	CH <sub>4</sub>	N.				Wet Bulb.	Dry Bulb.	Humidity.				
230	Jan. 8	Comox No. 4.	Main return airway.	Working.	850	0.48	19.74	0.79	78.99	2,000	150,000	29.4	58	59	93	1,135	1,706,400	73,033	2,007
233	" 8	" 4.	West side of No. 2 slope.	"	850	0.64	18.96	2.28	78.12	365	15,330	30.6	65	68	76	348	501,120	21,447	2,505
239	" 9	" 5.	Main return airway.	"	900	0.11	20.60	0.21	79.08	1,370	168,300	29.12	53	54	93	353	508,320	21,756	564
243	" 15	" 7.	"	"	800	0.16	20.61	0.18	79.05	1,450	145,000	29.12	47	47	100	261	375,340	16,085	772
253	Feb. 28	" 5.	"	"	944	0.11	20.54	0.24	79.11	1,700	153,000	29.2	52	52	100	367	528,480	22,613	559
257	Mar. 1	" 7.	"	"	800	0.15	20.57	0.24	79.04	1,640	164,000	29.2	48	48	100	393	565,920	24,221	1,886
258	" 26	" 4.	"	"	950	0.44	19.84	0.87	78.85	2,200	168,400	29.5	58	58	100	1,378	1,984,320	84,923	2,088
264	May 7	" 4.	"	"	900	0.52	19.48	1.19	78.81	1,930	138,960	29.5	59	59	100	1,652	2,378,880	101,816	2,643
273	" 10	" 5.	"	"	944	0.11	20.47	0.21	79.21	2,170	195,300	29.4	53	54	93	410	590,400	25,289	625
274	July 23	" 4.	"	"	850	0.53	19.54	1.06	78.87	2,170	156,240	29.5	60	60	100	1,655	2,333,200	102,000	2,803
175	Feb. 4	Reserve	"	"	380	0.06	20.74	0.21	78.99	730	73,000	30.6	56	57	93	153	220,320	9,429	579
157	May 8	New No. 3.	Face of slope.	"	40	0.28	20.59	trace	79.13	150	2,400	27.9	42	42	100	.....	.....	.....	.....
71	Feb. 24	Princeton No. 1	Air-current from working-places.	"	100	0.23	20.34	1.06	78.37	none	.....	28.4	62	68	.....	.....	.....	.....	

Crowsnest Pass District, Corbin Colliery.

K	Jan. 6	No. 4, Corbin	Main return airway.	Working.	350	0.08	20.72	0.21	78.99	100	10,000	24.5	.....	27	.....	21	30,240	1,121	86
30	" 15	"	Outside stopping, fire area.	"	.....	0.27	20.60	0.04	79.09	.....	.....	24.5	.....	76	.....	.....	.....	.....	.....
60	Feb. 1	"	Main return airway.	"	.....	0.08	20.62	0.26	79.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
100	" 25	"	"	"	300	0.10	20.68	0.21	79.01	220	26,000	24.0	45	48	100	54	77,760	2,884	259
120	Mar. 7	"	"	"	300	0.10	20.63	0.22	79.00	150	13,500	24.0	45	45	100	29	41,760	1,549	139
140	June 17	"	"	Idle	.....	0.19	20.51	0.28	79.02	none	.....	24.2	.....	.....	.....	.....	.....	.....	.....

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—Continued.

Crowsnest Pass District, Coal Creek.

Sample No.	Date.	Mine	Ventilating District.	Working or Idle.	Tonnage per Day.	Tonnage of Split per Day.	CHEMICAL ANALYSIS.				Velocity of Air in Feet per Minute.	Quantity of Air in Feet per Minute.	Barometer.	HYGROMETER.			Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Lb. of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
							CO <sub>2</sub>	O.	CH <sub>4</sub>	N.				Wet Bulb.	Dry Bulb.	Humidity.				
444	Jan. 11	No. 1 South.	Main return airway	Working	450		0.19	20.09	1.73	77.99	550	25,750	25.0	57	58	98	444	639,360	23,720	1,420
450	Mar. 11	"	"	"	400		0.17	20.27	1.44	78.12	600	39,000	25.0	32	32	100	561	807,840	28,970	2,019
480	June 30	"	"	Idle			3.18	9.55	4.00	83.27	stagnant									
479	" 30	"	"	"			2.06	13.71	2.26	81.97										
465	" 7	"	"	"			1.23	17.42	2.38	78.97										
508	Nov. 10	"	"	Working	375		0.25	20.24	1.25	78.26	600	39,000	25.2	60	61	93	487	701,280	26,017	1,870
528	Dec. 16	"	"	"	375		0.09	20.80	0.26	78.85	600	39,000	25.5	59	60	93	101	145,440	5,395	387
447	Jan. 11	No. 2.	"	"	250		0.27	20.09	1.22	78.42	400	24,000	25.0	58	59	93	232	420,480	15,599	1,682
466	June 7	"	"	Idle			0.69	19.53	0.41	79.37										
478	" 20	"	Old travelling road	"			1.16	15.54	1.33	81.97										
477	" 20	"	"	"			1.38	14.58	1.61	82.43										
457	Jan. 14	No. 3.	Main return airway	Working	350		0.27	20.42	1.50	77.81	800	52,000	26.0	57	59	88	780	1,123,200	41,670	3,209
490	Sept. 25	"	"	"	350		0.30	20.32	1.92	77.46	800	52,000	25.6	58	58	100	998	1,437,120	13,114	4,106
501	Oct. 30	"	"	"	375		0.23	20.45	1.25	78.07	800	52,000	26.0	59	60	93	650	936,000	34,825	2,496
505	Nov. 7	"	"	"	375		0.25	20.35	1.56	77.86	800	52,000	25.8	59	60	93	811	1,087,840	40,858	2,900
534	Dec. 18	"	"	"	200		0.19	20.46	0.78	78.57	800	35,000	28.07	54	65	93	273	393,120	14,584	1,065
493	Oct. 16	No. 1 East.	South split	"	400	280	0.15	20.26	2.06	77.53	500	38,000	25.7	54	55	93	782	1,120,080	41,777	4,021
448	Jan. 11	"	Main return airway	"	380		0.13	20.43	1.11	78.33	1,500	162,000	25.5	49	51	90	1,798	2,589,120	96,058	6,815
539	Dec. 31	"	"	"	400		0.20	20.38	1.00	78.47	950	114,000	26.3	51	52	97	1,140	1,641,600	60,913	4,104
491	Oct. 16	"	"	"	400		0.23	20.26	1.27	78.24	1,400	112,000	25.7	55	56	93	1,422	2,047,680	75,968	5,179
464	May 23	"	"	"	380		0.18	20.31	1.16	78.37	1,000	108,000	25.9	48	50	86	1,252	1,802,880	66,884	4,744
511	Nov. 27	"	"	"	380		0.22	20.31	1.22	78.25	1,600	128,000	26.0	52	53	96	1,561	2,247,840	83,898	5,915
453	Jan. 14	B North.	"	"	200		0.14	20.57	1.02	78.27	760	41,040	26.0	45	45	100	418	601,920	22,331	3,069
485	Sept. 18	"	"	"	150		0.16	20.58	0.91	78.35	690	33,000	25.0	50	50	100	300	432,000	16,027	9,546
503	Oct. 30	"	"	"	200		0.15	20.59	0.87	78.39	650	35,100	25.9	46	47	92	305	439,200	16,324	2,196
531	Dec. 18	"	"	"	200		0.14	20.54	1.04	78.28	650	35,100	26.0	46	47	99	365	525,600	19,599	2,628

Crowsnest Pass District, Michel Colliery.

230	Jan. 7	No. 3.	Main return airway	Working	180		0.14	20.46	0.02	79.33	350	8,750	25.7	43	43	100	1	2,520	93	14
231	" 7	"	"	"	180		0.17	20.43	0.54	78.81	450	45,000	25.7	51	52	93	243	349,920	12,932	1,944
245	May 20	"	"	"	225		0.24	20.31	0.89	78.56	500	50,000	25.5	51	52	93	445	640,800	23,773	2,848
254	Sept. 19	"	"	"	200		0.42	20.13	0.87	78.53	450	45,000	25.4	48	48	100	301	563,040	15,998	2,815
263	Dec. 13	"	"	"	264		0.14	20.66	0.33	78.87	500	50,000	26.1	45	47	83	165	237,600	8,814	900
269	" 19	No. 3 East.	"	"	300		0.14	20.38	1.37	78.11	1,300	81,000	26.2	48	50	90	1,109	1,596,960	27,308	5,323
264	Nov. 19	"	"	"	300						1,200	75,000	25.5	50	51	93				
261	Oct. 21	"	"	"	200		0.16	20.38	1.30	78.16	1,200	72,000	25.3	51	52	93	936	1,358,840	43,825	6,794
253	Sept. 17	"	"	"	200		0.22	20.34	1.27	78.17	1,000	63,000	25.6	53	53	100	800	1,152,000	42,739	5,760
250	May 22	"	"	"	345		0.16	20.39	1.32	78.13	1,140	71,820	25.3	48	48	93	947	1,363,680	50,592	3,952
236	Jan. 7	"	"	"	300						1,500	94,500	25.7	49	49	100				
240	" 29	No. 3.	"	"	500						600	37,800	25.3							
246	May 21	"	"	"	500		0.19	20.52	0.12	79.17	700	44,100	25.7	64	64	100	52	74,850	2,778	149
256	Sept. 19	"	"	"	390		0.20	20.56	0.10	79.14	500	30,600	25.5	48	48	100	30	43,200	1,602	111

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**OUTBURSTS OF GAS.**

Several outbursts of gas occurred in the Crowsnest Pass mines during the year, the displacement of coal varying from a few tons to as much as 260 tons of very fine dust.

The most severe outburst occurred on December 1st, 1919, and occurred in No. 6 North room, off No. 10 East slope, No. 1 East mine. Fortunately sufficient warning was manifested to allow the workmen sufficient time to escape.

Drilling to relieve the pressure has been adopted in the Crowsnest Pass mines in suspected areas and met with encouraging results. Mr. Strachan gives some interesting details on this subject in his report.

**BUMPS.**

No severe bumps have occurred during the year, but a good many small jars have been felt without any serious results.

**MINE FIRES.**

There have been no serious mine fires during the year, although some of the old fire areas in the mines have needed very careful watching.

**EXPLOSIONS.**

No explosion occurred during the year 1919.

**MINE-AIR SAMPLING IN METALLIFEROUS MINES.**

During the year 1919 a number of mine-air samples were taken in the metalliferous mines of the Province. Much valuable information has been obtained in regard to the hydrogen, carbon-monoxide, and carbon-dioxide contents. I am much indebted to Dr. Eugene Haanel, Director of the Mines Branch at Ottawa, for co-operation in this work; the Dominion Department furnishing the sample-bottles, with franking privileges, and making all analyses without charge of any kind.

The following table shows the tabulated data obtained from mine-air sampling in the metalliferous mines:—

RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS METALLIFEROUS MINES IN THE PROVINCE OF BRITISH COLUMBIA, 1919.

*East Kootenay District.*

Sample No.	Date.	Mine.	Location in Mine.	CHEMICAL ANALYSIS.					HYGROMETER.			Remarks.
				CO <sub>2</sub>	O.	CO.	H.	N.	Dry Bulb.	Wet Bulb.	Humidity.	
8	June 4	Sullivan .....	No. 1,004 stope .....	0.21	20.62	.....	.....	79.17	50	49	92	
9	" 4	" .....	No. 1,185 stope .....	0.26	20.46	*	.....	79.28	50	50	100	
10	" 4	Lake Shore .....	No. 1,500 level .....	0.16	20.71	*	.....	79.13	62	56	67	
11	Nov. 19	Paradise .....	No. 2 tunnel .....	0.12	20.84	*	.....	79.04	Zero	Zero	.....	

\*Negligible.

*West Kootenay District.*

81	Jan. 30	Hewitt .....	Top of stope below No. 6 tunnel .....	.....	.....	.....	.....	.....	.....	.....	.....	
82	" 30	Van Roi .....	No. 2 stope above No. 7 level, 60 feet below No. 5 level .....	0.05	20.76	.....	.....	79.19	.....	.....	.....	
83	Feb. 6	Slocan Star .....	1,001 West drift .....	0.17	20.65	.....	.....	79.18	.....	.....	.....	
84	" 7	Wondertul .....	Face of Main drift, B level .....	0.19	20.63	.....	.....	79.18	.....	.....	.....	
85	" 8	Ivanhoe .....	Face of No. 8 East drift .....	0.11	20.81	*	.....	79.09	.....	.....	.....	
86	" 10	Noble Five .....	Top of raise, 750 up from Main tunnel .....	0.30	20.43	*	.....	79.27	.....	.....	.....	
87	" 11	Sovereign .....	Stope of No. 3 raise .....	0.05	20.84	.....	.....	79.11	.....	.....	.....	

\*Negligible.

*Northern District.*

1	April 25	Surf Inlet .....	North tunnel, No. 700 .....	0.09	20.85	.....	.....	79.06	63	61	85	
2	" 25	" .....	No. 6 stope, 626 level .....	0.20	20.50	.....	.....	79.30	63	62	93	
4	May 10	Hidden Creek .....	B drift, 385 level .....	0.05	20.88	.....	.....	79.07	59	57	88	
5	July 10	Telkwa .....	Face of No. 1 drift, 175 feet from surface .....	0.19	20.51	.....	.....	79.30	63	53	51	
6	" 14	Silver Standard .....	Level 253 .....	0.20	20.65	.....	.....	79.15	61	53	59	
6A	" 14	" .....	Level 254 .....	.....	.....	.....	.....	.....	61	53	59	
7A	Sept. 19	No. 7 .....	Face of tunnel .....	.....	.....	.....	.....	.....	63	61	88	
8	Nov. 5	Grouse Mountain .....	Main tunnel at face of level, 1,500 feet .....	0.09	20.59	.....	.....	79.32	46	45	92	

There was a trace of inflammable gas present, but sample was too small for identification.

Taken 1,000 feet from entrance of tunnel, the elevation being 2,000 feet.  
Taken 1,000 feet from entrance of tunnel,  
Taken 1,800 feet from entrance.

## MINE-RESCUE WORK.

During the year the Department installed four sets of Gibbs oxygen breathing apparatus in the Nanaimo Mine-rescue Station and two sets at Merritt. Six sets of Draeger at the Nanaimo Station were remodelled into Paul breathing apparatus. Two sets of Paul breathing apparatus were installed by the Canadian Collieries, Limited.

There were forty certificates of competency in mine-rescue work issued by the Department during the year. During the year it was suggested to the management of the different collieries that all certificated officials who are medically unfit should take a course of lectures making them fit to handle the apparatus and direct operations in cases of emergency. Thirteen officials took the necessary course of lectures and were granted a special certificate covering this course.

## LIST OF PERSONS WHO HAVE RECEIVED MINE-RESCUE CERTIFICATES DURING 1919.

Date.	Name.	Where trained.	Certificate No.
March	31 Scarpino, Francis	Fernie	419
April	8 Tolley, John	"	420
"	17 Taylor, Jonathan	Cumberland	421
"	17 Mullen, Patrick	"	422
"	17 Deans, George	"	423
May	15 Green, William	Fernie	424
July	2 John, John	Nanaimo	425
"	2 Muir, Joseph E. L.	"	426
"	2 Work, William L.	"	427
"	2 Mawhinney, Arthur	"	428
"	2 Brown, James S.	"	429
"	2 Kelly, Ernest	"	430
"	2 Webster, James S.	"	431
"	2 Smith, Thomas	"	432
"	2 McCrory, Alexander	"	433
"	2 Brown, George	"	434
"	2 Montgomery, John W.	"	435
"	2 Carroll, Henry	"	436
"	2 McGregor, John C.	"	437
"	2 McIntyre, Neil	"	438
"	2 Greenwell, Archibald	"	439
"	2 Donnachie, John	"	440
"	2 Webber, Chas. Frederick	"	441
"	2 Ford, Allan	"	442
"	2 Dawson, Joseph	"	443
"	2 Carruthers, Robert S.	"	444
"	2 Wilson, Robert	"	445
"	2 Banasky, Gerald	"	446
"	2 Cheetham, Benjamin	"	447
"	2 Stafford, Matthew	"	448
"	2 McMillan, Neil	"	449
"	2 Gillam, John	"	450
"	2 Devlin, Ernest Harry	"	451
Aug.	16 Hilton, Mathias	Fernie	452
Dec.	13 Simpson, David	Middlesboro	453
"	13 Dunnigan, Richard	"	454
"	13 Neilson, Walter	"	455
"	13 Fairley, William	"	456
"	13 Holdsworth, William	"	457
"	13 Anthony, William	"	458

LIST OF PERSONS WHO HAVE RECEIVED SPECIAL CERTIFICATES FOR COURSE OF LECTURES, 1919.

Date.	Name.	Where Lectures were given.	Certificate No.
July	2 Allsopp, Henry	Nanaimo	1
"	2 Smith, Ralph	"	2
"	2 Manifold, Albert	"	3
"	2 White, John	"	4
"	2 Battey, Richard	"	5
"	2 Hill, Isaac	"	6
"	2 Gray, James	"	7
"	2 Watson, William	"	8
"	2 Handlen, James	"	9
"	2 Bryden, Alexander	"	10
"	2 Young, Alexander	"	11
"	2 Ovington, John	"	12
"	2 Devoy, William	"	13

The following table shows the number, distribution, and type of mine-rescue apparatus and oxygen resuscitating devices maintained at the coal-mines of the Province during the year 1919:—

Company.	DRAEGER APPARATUS.		PROTO OR FLEUSS APPARATUS.		Gibbs.	Paul.	Total Apparatus.	RESUSCITATING DEVICES.			Total.
	2-hour.	4-hour.	2-hour.	4-hour.				Pulmotor.		Lung-motor.	
								Type A.	Type B.		
Canadian Western Fuel Co.	4	..	4	2	6	..	16	2	..	2	4
Canadian Collieries—											
Extension	4	..	..	..	..	..	4	..	1	..	1
South Wellington	..	..	..	..	..	2	2	..	1	..	1
Comox	4	..	..	..	..	..	4	..	1	..	1
Vancouver-Nanaimo Coal Co.	2	1	..	..	..	..	3	1	..	..	1
Pacific Coast Coal Mines, Ltd.	2	2	..	..	2	..	6	1	..	..	1
Granby C. M. S. & P. Co.	4	..	..	..	..	..	4	..	..	1	1
Middlesboro Collieries	2	1	..	..	..	..	3	1	..	..	1
Fleming Coal Co.	2	2	..	..	..	..	4	1	..	..	1
Merritt Colliery	..	2	..	..	..	..	2	..	..	..	..
Princeton Colliery	1	1	..	..	..	..	2	1	..	..	1
Crow's Nest Pass Coal Co—											
Coal Creek	5	6	..	..	..	..	11	2	..	..	2
Michel	5	5	..	..	..	..	10	1	..	..	1
Corbin Coal & Coke Co.	2	1	..	..	..	..	3	1	..	..	1
B.C. Government	16	10	..	..	12	6	44	4	4	..	8
Totals	53	31	4	2	20	8	118	15	7	3	25

There is one mine-rescue apparatus for every thirty-four persons working underground in coal-mines and one oxygen resuscitating device for every 166 employed underground.

The following table shows the number of mine-rescue apparatus and resuscitating devices in and around the metal-mines of the Province in 1919:—

Company.	DRAEGER APPARATUS.			PROTO OR FLEUSS APPARATUS.	Total Apparatus.	RESUSCITATING DEVICES.			Total.
	2-hour.	1-hour.	½-hour.			2-hour.	Pulmotor.		
				Type A.			Type B.		
Consolidated Mining, Smelting & Power Co.—									
Rossland.....	..	..	..	4	4	2	..	2	4
Kimberley.....	..	..	..	2	2	1	..	..	1
Nelson.....	..	..	..	..	..	2	..	..	1
Ainsworth.....	..	..	..	2	2	1	..	..	1
Granby Consolidated Mining, Smelting & Power Co.—									
Phoenix.....	..	3	..	..	3	1	..	..	1
Anyox.....	3	..	1	..	4	2	3	..	5
Britannia Mining & Smelting Co., Britannia.....	5	..	..	..	5	3	..	..	3
Standard Silver Lead Mining Co., Silverton.....	..	..	..	..	..	1	..	..	1
Montana Continental Development Co., Tramville.....	..	..	..	..	..	1	..	..	1
B.C. Copper Co.—									
Mother Lode.....	..	..	..	..	..	..	..	1	1
Copper Mountain.....	..	..	..	..	..	..	..	1	1
Totals.....	12	3	1	8	24	12	4	4	20

The number of persons employed in and about the coal and metalliferous mines was 9,744, giving one mine-rescue apparatus for every sixty-nine persons employed and one oxygen resuscitating device for every 216 persons employed.

#### TECHNICAL CLASSES ON MINING.

Considerable interest has been maintained in this work around the coal-mining centres. The correspondence course issued by the Education Department for firebosses and shotlighters, overmen and managers, and also mine surveyors, has found much favour.

#### SUPERVISION OF COAL-MINES.

During the year fourteen coal companies operated sixteen collieries, with thirty-six mines, employing 4,146 men underground. In the supervision of these underground employees there were twenty-one managers, thirty-three overmen, and 176 firebosses and shotlighters, a total of 230 officials, or one official for every eighteen persons employed underground. I desire to express my appreciation of the faithful co-operation and assistance afforded me throughout the year by the District Inspectors and Instructors in mine-rescue and first-aid work.

#### SUGGESTIONS REGARDING LEGISLATION.

Legislation was enacted during the year setting a standard withdrawal-point as suggested in last year's report, but the writer is still of the opinion that the other matters suggested should have attention—namely, that some limit should be set for the permissive percentage of gas in the air in which to allow blasting operations.

At present the requirements of the various Acts in different countries are very vague on this point, dealing more with permissive explosives than with percentages of gas; but the writer is of the opinion that even with the use of permissive explosives there ought to be a limit set for percentages of gas in the air when blasting is allowed.

The writer is also of the opinion that legislation should be enacted compelling certain lines of treatment of coal-dust in the mines. It has now been proved beyond doubt that coal-dust is the greatest menace in the mines for propagating an explosion. The modern ventilating equipment of the mines does not allow any large accumulations of gas, providing the conducting of the current is done in the proper manner, and it would be hard to find a case in the present day where there would be sufficient gas to propagate an explosion throughout the mine. But with a very small quantity of coal-dust added this becomes possible in the event of any primary explosion of gas; hence the need of laws compelling the removal and treatment of coal-dust.

The writer would also suggest that changes be made in the Act regarding the standardization of the ventilation in mines, as to what "an adequate amount of ventilation" means as stated, that the workings of the mine shall be in a fit state for working and passing therein. The British Columbia "Coal-mines Regulation Act" reads as follows: "An adequate amount of ventilation shall mean not less than one hundred cubic feet per minute for each man or boy and not less than three hundred cubic feet of pure air per minute for each horse or mule employed in the mine, and as much more as the Inspector of Mines may direct shall sweep the face of each working-place." This standard cannot be adopted generally, as there is such a variation of conditions in the various mines.

The British Act reads as follows: "A place shall not be deemed to be in a fit state for working or passing therein if the air contains either less than nineteen per cent. of oxygen or more than one and one-quarter per cent. of carbon dioxide, and an intake airway shall not be deemed to be normally kept free from gas, inflammable gas, if the average percentage of inflammable gas found in six samples of air taken by an Inspector in the air-current in that airway at intervals of not less than a fortnight exceeds one-quarter." The writer would suggest that a similar clause to the above should be adopted by British Columbia in the "Coal-mines Regulation Act."

A standard of the conditions allowed being set, then every mine would have to standardize to these conditions; whereas now in the existing clause the amount of ventilating is set in cubic feet per man, boy, and mule. This amount may be all right in non-gaseous mines and yet totally inadequate in gaseous mines.

In concluding this report, I beg to draw your attention to the system of inspection in British Columbia—namely, that an inspection must be made every month—which means that the inspections come at regular intervals, and becomes practically a formal inspection and can be prepared for by the mine officials. An Inspector starting off on his monthly inspection, having a fairly large district, cannot deviate much from a regular round if he has to visit each mine monthly, so that it can be told to a few days when he will be at a certain mine, and conditions are naturally made as good as possible for his visit. The result is easily seen; he makes an inspection under favourable conditions and posts his report, and the under-officials take refuge behind his report as being the standard for the month. The situation then develops almost making the Inspector manager of the mine, and thereby relieving the officials in this respect. In the writer's opinion the visit should be more of a surprise visit, even though he should only inspect a portion of the mine, and when negligence is in evidence stringent measures should be adopted.

Neither in Great Britain, France, Belgium, nor even in the neighbouring Provinces is the Inspector compelled to visit each mine and every part thereof monthly, but can make them oftener when necessary, or less when not necessary.

Frequent inspections in some cases may be very good, but in some cases too frequent inspection may be more harmful than otherwise, as it tends to encourage the officials to rely on the Inspector for seeing the requirements<sup>3</sup> of the Act carried out, and thereby neglecting their own duties in that respect.

### EXAMINATIONS FOR COAL-MINE OFFICIALS.

The "Coal-mines Regulation Act," as now consolidated and amended, provides that all officers of a coal-mining company having any direct charge of work underground shall hold Government Certificates of Competency, which are to be obtained only after passing an examination before a duly qualified Board, appointed for the purpose of holding such examinations, and known as the Board of Examiners.

The certificates granted on the recommendation of such Board and the requirements shall be as follows:—

"(a.) If a candidate for a manager, that he is a British subject and has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-five years of age; or, if he has taken a degree in scientific and

mining training, including a course in coal-mining at a university or mining school approved by the Minister of Mines, that he has had at least four years' experience in and about the practical working of a coal-mine:

"(b.) If a candidate for overman, that he has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-three years of age:

"(c.) If a candidate for shiftboss, fireboss, or shotlighter, that he has had at least three years' experience in and about the practical working of a coal-mine, is the holder of a certificate of competency as a coal-miner, and is at least twenty years of age:

"(d.) A candidate for a certificate of competency as manager, overman, shiftboss, fireboss, or shotlighter shall produce a certificate from a duly qualified medical practitioner or St. John or other recognized ambulance society, showing that he has taken a course in ambulance-work fitting him, the said candidate, to give first aid to men injured in coal-mining operations.

"For the purposes of this section the experience demanded by such section shall be of such character as the Board shall consider of practical value in qualifying the candidate for the position to which such class of certificate applies.

"Experience had in a mine outside of the Province may be accepted should the Board consider such of equal value."

Any certificate is considered ~~as~~ including that of any lower class.

## EXAMINATION FOR MINERS.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. By "miner" is meant "a person employed underground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery."

Examinations of applicants for certificates of competency as coal-miners shall be conducted and certificates of competency granted by a Board of Examiners, which shall consist of the Inspector of Mines for the district in which the examination is held, and two other members to be appointed by the Minister, one of whom shall be appointed to represent the mine-owners and one to represent the coal-miners. The two appointed members of the Board shall have jurisdiction in all districts throughout the Province. The Minister shall appoint one of the appointed members to be Chairman and the other to be Secretary of the Board, and they shall hold office during the pleasure of the Minister.

Where any member of the Board of Examiners is unable to act at any examination by reason of illness, absence, or other cause, the Minister may appoint a person to act in the stead of that member for that occasion, or until the termination of the disability, and any person so appointed may complete any unfinished business of the Board in which he has taken part, even if the member in whose stead he has acted has become able to act.

The proceedings of the Board of Examiners shall be in accordance with the rules in the Third Schedule to the Act.

Examinations of applicants for certificates of competency as coal-miners shall be held on at least one day in every period of sixty days at each colliery designated by the Minister as a place for the holding of examinations under this section.

The work of the Board of Examiners in examining candidates for coal-miners' certificates has been carried on in all mining districts at intervals of less than sixty days, as required by the amendment of the Act.

No certificates have been granted in any case where the candidate failed to satisfy the Board as to his general fitness, experience in a coal-mine, and a working knowledge of the English language.

**BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.****FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES.**

*Report of James Dickson, Secretary of Board.*

I have the honour to submit herewith the annual report of the transactions of the above Board for the year ending December 31st, 1919.

The Board of Examiners, which was formed on July 1st, 1919, consists of George Wilkinson, Chief Inspector of Mines, as Chairman; Harry Ernest Miard, member; and James Dickson, member and Secretary of the Board.

The meetings of the Board are held in the office of the Board, Mines Department, Victoria. The first work was the drafting of the following rules for the conduct of examinations for certificates of competency as mine officials:—

**RULES MADE BY THE PROVINCIAL BOARD OF EXAMINERS, JULY 16TH, 1919, AND APPROVED BY THE MINISTER OF MINES, JULY 16TH, 1919, UNDER SECTION 38 OF THE "COAL-MINES REGULATION ACT, 1911," AND AMENDMENT ACT, 1919, FOR THE CONDUCT OF EXAMINATIONS.**

1. No application for examination will be considered from any candidate unless it is received by the Department of Mines at least fifteen days previous to the date on which the examination is to be held.
2. The examination sittings shall begin at 9 a.m. and continue until 12.30 p.m.; they shall resume at 2 p.m., and continue until 5.30 each day until the conclusion of the examination.
3. The examinations shall be conducted by the Presiding Examiners appointed by the Board.
4. The Presiding Examiners shall be present in the examination-room at least fifteen minutes prior to the time at which the examination commences.
5. Before each examination the question papers shall be prepared by the Examiners appointed by the Minister, and the necessary copies forwarded to the Presiding Examiners, each set of papers being in a separate sealed package.
6. At the time of the commencement of each session of the examination, when the candidates are in their respective places, the seal of the package shall be broken in the examination-room in the presence of the candidates and the papers distributed punctually in accordance with the time-table on the package.
7. Candidates must present themselves punctually at the hours appointed for the commencement of the examination, and no candidate will be allowed to enter the examination-room later than forty-five minutes after the time set for the commencement of the examination, nor will any candidate be allowed to leave the room during a sitting unless in case of extreme necessity.
8. When the time allotted to each paper has expired, the papers shall be collected by the Presiding Examiners and immediately placed in a package and sealed. At the completion of the examination these papers shall be forwarded to the office of the Board of Examiners for Coal-mine Officials, Victoria, B.C.
9. The examination shall be conducted strictly in accordance with these rules, and the papers of any candidate who does not comply with these rules may be cancelled at the discretion of the Board.
10. The Presiding Examiners shall see that the room is clear of all possible aid to the candidates, and that no persons other than the Honourable the Minister of Mines, the Deputy Minister of Mines, the Provincial Mineralogist, members of the Board, Inspectors of Mines, and Examiners be allowed in the examination-room during sessions.
11. All stationery required for the purpose of the examination shall be supplied by the Board. All surplus stationery shall be collected by the Presiding Examiners at the completion of the examination. Each candidate shall be supplied with pens, ink, pencils, and blotting-paper.
12. The papers shall be collected at the times indicated by the time-table. If from any cause a paper is not given out precisely at schedule time, the candidates must be informed of the fact and the exact time at which their work will be collected, and care must be taken that the exact time is allowed from the moment from which the paper was given out. The time consumed in collecting and giving out papers must not be included in the "full time" allowed for any paper. A candidate who attends late shall not be allowed any extension of time on that account.
13. Before proceeding to his seat in the examination-room a candidate shall lay aside his hat and overcoat, and any book, papers, or appliances the use of which is not expressly allowed to him. The candidate shall be allowed to bring with him a drawing-scale, slide-rule, protractor, a pair of compasses, and logarithmic and trigonometrical tables. Apart from such special articles, a candidate shall be at liberty to take to his place in the examination-room such ordinary appliances as pens, ink, penknife, chalks, and india-rubber; but the Presiding Examiners may, at their discretion, prohibit the use of any such articles.
14. If a candidate arrives late a note of the circumstances shall be made, and it shall always be stated whether any other candidate has already left the room.

15. The Presiding Examiners shall collect at the commencement of the examination the authorization obtained from the Department of Mines for appearing at the examination-room, and no candidate shall be allowed to enter the examination-room unless he presents such authorization.

16. Silence shall be observed in the examination-room while the examination is in progress.

17. The Presiding Examiners shall take every precaution to see that no candidate receives any improper assistance, either from books or papers or from any person. They shall check all disorderly or improper conduct in or about the room, enforce all rules for the conduct of the examination, and report to the Board any irregularity which may occur or any shortcoming in the arrangements for the examination.

18. Should it appear to the Presiding Examiners that a candidate has obtained improper assistance the papers of such candidate shall be cancelled. Any candidate giving assistance to another candidate shall be held to be equally guilty and shall be dealt with accordingly.

19. No candidate shall be allowed to leave the examination-room until the expiration of one hour after the time fixed for the commencement of the paper on which he is engaged.

A candidate obliged to leave the room through illness or other sufficient cause, and who wishes to return and continue work on the paper then in progress, shall leave the room in charge of a Presiding Examiner; a note as to the circumstances shall be made and the part of the paper at which the candidate was at work shall be endorsed by the Presiding Examiner, "The candidate left at this point."

Candidates shall not, without the express permission of the Presiding Examiners, remove from the examination-room any paper or other material supplied to them.

20. A candidate who asks a question as to any ambiguity in the papers shall be told to enter on his work any representation he may wish to make, but no further answer shall be given. The Presiding Examiners shall, themselves, forward a report to the Board stating the candidate's name and the general nature of the question.

A candidate making a complaint of any other nature shall be directed to make his statement in writing, which shall be sent to the Board.

21. Candidates shall be allowed, unless there is any special directions to the contrary, to keep their work in any subject until the expiration of the time allotted to that subject.

Every book, plan, form, or separate sheet of paper used by the candidate shall have inserted on it the name of the subject. The number of each question shall be inserted in the margin which shall be left along the left side of each sheet. In no case shall the name of the candidate be placed on any book, plan, form, or separate sheet of paper upon which the candidate has written or worked the answer to any question; but for the purpose of identification of papers the following system shall be used: At the commencement of the examination each candidate shall choose a number; he shall place this number on a slip furnished for this purpose, together with his name, and place the same in an envelope supplied for the purpose. These envelopes shall remain sealed until the paper has been examined. The candidate shall number all his examination papers with the number he has chosen and placed on the slip with his name.

22. Not more than one answer shall be written on the same sheet of paper. All answers shall be written in ink (except necessary diagrams, which may be in pencil) and on one side only of the paper, and each candidate shall enclose his question paper with his answers in the envelope supplied for the purpose.

23. After the Examiners have received the papers they will correct them and mark on them the marks obtained by each candidate for each paper.

24. After the examination the candidate will be furnished with a list of the marks obtained by him in the different subjects, but not the marks for the individual questions.

25. The apparent or presumed results of the examination shall not be communicated to any person until the same have been officially announced.

26. All correspondence intended for the Board must be addressed to the "Office of the Board of Examiners for Coal-mine Officials, Victoria, B.C."

27. The Presiding Examiners must see that the candidate obtains the right paper of questions.

28. All the work by which the results are obtained shall be clearly shown in immediate connection with the answer, so as to enable the Examiners to satisfy themselves that the candidate has understood the question and to see by what process the results were obtained. Anything which the candidate does not wish the Examiners to notice should be crossed out with pen or pencil, but not erased.

29. In the case of any applicant producing a certificate from a medical practitioner instead of from a recognized ambulance society, as provided for in section 41, subsection (c), such certificate shall be in the following form:—

"I hereby certify that I have examined \_\_\_\_\_, of \_\_\_\_\_, in ambulance-work, and find him qualified to render first aid to persons injured in or about a mine.

"(Signed.).....

*Medical Practitioner."*

30. The nature of the practical experience shall be experience gained in one or other of the following capacities in a coal-mine, or in a capacity which may be considered by the Board to be equivalent to:—

(a.) An underground official of a coal-mine—

(1.) In actual practical work at the working-face and other parts of the underground workings of a coal-mine;

- (2.) In direct supervision of such work; or
- (3.) In both (1) and (2); or
- (b.) As an underground workman of a coal-mine who has had direct practical experience in the work of getting minerals, and of stonework, timbering, and repairing;
- (c.) As mine surveyor. In the case of a person employed as mine surveyor, the practical experience will be considered to be the time the applicant has been employed underground in a coal-mine.

31. Candidates for certificates must possess such knowledge as will enable them to answer promptly questions on the following subjects:—

For First-class Certificates—

- (1.) Mining Act and Rules:
- (2.) Mine Gases:
- (3.) Ventilation:
- (4.) General Work:
- (5.) Mining Machinery:
- (6.) Surveying and Levelling.

For Second-class Certificates—

- (1.) Mining Act and Rules:
- (2.) Mine Gases:
- (3.) Mine Ventilation:
- (4.) General Work, including questions on underground machinery and surveying.

For Third-class Certificates—

- (1.) Mining Act and Rules and Mine Gases:
- (2.) Mine Ventilation and General Work.

For Mine Surveyors' Certificates—

Surveying, levelling, and drawing; determination of magnetic declination; loose and fast needle surveying underground and on the surface; calculation of areas and volume; contour lines and levelling; connecting of surface and underground surveys; triangulation; plotting by protractor and latitudes and departures; mine plans and sections; the use, care, and testing of the instruments.

32. A candidate for First-class Certificate of Competency must obtain 70 per cent. of the maximum marks obtainable for the first three subjects, Mining Act and Rules, Mine Gases, and Ventilation; and 60 per cent. of the marks obtainable on the fourth, fifth, and sixth subjects—namely, General Work, Mining Machinery, Surveying and Levelling; and 70 per cent. of the marks obtainable for the whole examination.

33. A candidate for a Second-class Certificate of Competency must obtain 70 per cent. of the marks obtainable for the first three papers, Mining Act and Rules, Mine Gases, and Mine Ventilation; and 60 per cent. for the fourth subject, General Work; and 70 per cent. of the marks obtainable for the whole examination.

34. A candidate for a Third-class Certificate of Competency must obtain not less than 65 per cent. of the marks obtainable on the first subject, Mining Act and Rules and Mine Gases; not less than 60 per cent. of the marks obtainable on the second paper, Ventilation and General Work; and not less than 65 per cent. of the marks obtainable for the whole examination.

35. A candidate for a Mine Surveyor's Certificate of Competency must obtain 70 per cent. of the marks obtainable for the whole examination.

No examination having been held in 1919 prior to the appointment of the Board of Examiners, it was decided to hold an examination for certificates of competency as coal-mine officials on the 26th, 27th, and 28th days of August, 1919, and that the examination be held simultaneously at Nanaimo, Cumberland, Merritt, and Fernie.

In view of the following regulation made, pursuant to the provisions of the "Coal-mines Regulation Act," by the Lieutenant-Governor in Council, it was decided to hold an examination for mine surveyors' certificates of competency at the above places on the 28th of August, 1919:—

#### REGULATION.

1. After the 1st day of October, 1919, all plans required to be kept in accordance with the provisions of the "Coal-mines Regulation Act" shall be made of durable material, and the surveying of mines and the preparation of mine-plans shall be done by a person or persons holding a certificate granted under the provisions of the "Coal-mines Regulation Act" and Amendment Acts.

2. In no case shall a certificate be granted to any applicant until he has satisfied the Board of Examiners that:—

- (1.) He has had two years' practical experience in the surveying of mines, or is the holder of a diploma in scientific and mining training after a course of study of at least two years at an educational institute approved by the Minister of Mines, or has taken a degree in scientific mining subjects at a university so approved:
- (2.) He is competent:—
  - (a.) To make an accurate survey of the workings of a coal-mine and to connect such survey with a surface survey:
  - (b.) To make accurate survey and levellings:
  - (c.) To plot accurately surveys and levellings:
- (3.) He has given satisfactory evidence of his sobriety and general good conduct.

3. Each plan required to be kept in accordance with the provisions of the "Coal-mines Regulation Act" shall have inserted on it the date on which the last survey was made and the signature of the person making such survey.

4. A certificate authorizing any person to act as mine surveyor may be granted to such person without written examination if the Board of Examiners reports that he has the necessary experience, and provided application is made for such certificate before the 1st day of December, 1919.

5. Every person who violates any rule or regulation under the "Coal-mines Regulation Act" or Amendment Acts shall be guilty of an offence against the "Coal-mines Regulation Act," and liable to the penalties and obligations imposed by the said Act.

The total number of candidates at this examination was as follows: For first-class certificates, 11 (2 passed, 9 failed); for second-class, 5 (2 passed, 3 failed); for third-class, 5 (3 passed, 2 failed); for mine surveyors, 9 (6 passed, 3 failed); making a total of 30.

The work of the candidates, with a few exceptions, was poor, and showed a lack of preparation and want of knowledge that is inconsistent with present-day requirements.

The candidates appear to give more attention to memorizing formulæ of more or less doubtful value than to the fundamental principles of mining.

It is the intention of the Board to maintain a high standard, so intending candidates, to gain a certificate of competency of any class, must devote more time to study and preparation.

The examinations will in future be held in the months of May and November.

The following is a list of the candidates who successfully passed the examination in the various classes:—

LIST OF CANDIDATES TO WHOM CERTIFICATES OF COMPETENCY WERE ISSUED AT THE EXAMINATIONS HELD IN AUGUST, 1919, AT NANAIMO, CUMBERLAND, MERRITT, AND FERNIE.

*First-class Candidates.*—Samuel David Wark and John McDonald.

*Second-class Candidates.*—John Smith, B 231; George Murray, B 232.

*Third-class Candidates.*—Alfred Davies, C 691; James Seddon, C 692; John Devlin, C 693.

*Mine Surveyors' Certificates.*—Thomas Wright Scott, Joseph Patrick Boyce, Robert McCulloch, Frederick William Reger, William Dixon Vallance, and William Holdsworth.

The Board recommended that the Honourable the Minister of Mines grant a certificate of competency as mine surveyor to the following applicants, each of whom applied for a certificate of competency as mine surveyor without written examination, according to section 41 of the "Coal-mines Regulation Act" and amendments, before December 1st, 1919, and satisfied the Board that they had the necessary experience: George Wilkinson, James Dickson, Maurice Wilbur Garman, Joseph Richardson Roaf, James A. Richards, Albert Crompton Lymn, Charles Clifton Richards, James Delaney, Peter Lancaster, Harold White, Alfred George King, Jr., George W. B. Daniell, Neville F. Townsend, P. W. Gregory, Harry Ernest Miard, William Arthur Owen, Ridgeway Robinson Wilson, Arthur Rupert Wilson, Wynne Jeffreys Balle, James Ridley, Samuel David Wark, Charles James Wilson, Hartley Paul Wilson, Octavius B. N. Wilkie, Gerald D. Davis, George Hunter, and James Hargreaves.

In addition to the above, there were several applications received prior to December 1st, 1919, in support of which the applicants did not provide sufficient proof to satisfy the Board that they had the necessary experience. These applicants were advised to provide further proof of experience in order that the Board may decide whether the applicant has the necessary qualifications.

The Board has also received several applications for certificates of competency as mine officials without written examination in accordance with the amended section 42, chapter 160, "Coal-mines Regulation Act":—

"The Minister may sign and deliver a certificate without written examination to an applicant who, being a British subject, is the holder of a certificate granted in any British Dominion if the Board reports that the standard of training required for the granting of such certificate is equivalent to that required for the granting of a corresponding certificate under this Act, and that after oral examination of the applicant it is satisfied with his qualifications."

The Board, however, has not had sufficient time to make itself familiar with the standards of training in the different parts of the Empire which grant certificates of competency as coal-mine officials, and has deferred action until it has sufficient knowledge of the different examination centres to enable it to make a proper decision on any application coming before it.

Any prospective candidates may, on application, have copies of the questions set at previous examinations by applying to the Board of Examiners at Victoria, B.C.

**REGISTERED LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY  
AS COAL-MINE OFFICIALS.**

FIRST-CLASS CERTIFICATES—SERVICE CERTIFICATES ISSUED UNDER SECTION 39, "COAL MINES  
REGULATION ACT, 1877."

Edward G. Prior.

James Dunsmuir, Victoria.

Thomas A. Buckley.

FIRST-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT, 1897."

NAME.	DATE.
Shepherd, Francis H.	March 5th, 1881
Honobin, William	May 1st, 1882
Little, Francis D	May 1st, 1882
Chandler, William	December 21st, 1883
Priest, Elijah	December 21st, 1883
McGregor, James	January 18th, 1888
Randle, Joseph	January 18th, 1888
Matthews, John	January 8th, 1889
Norton, Richard Henry	August 26th, 1889
Bryden, Andrew	December 30th, 1889
Sharp, Alexander	October 27th, 1891
Kesley, John	March 4th, 1892
Wall, William H	May 30th, 1896
Morgan, Thomas	May 30th, 1896
Wilson, David	May 30th, 1896
Smith, Frank B	May 30th, 1896
Bradshaw, George B	June 12th, 1899
Simpson, William G	June 12th, 1899
Hargreaves, James	February 5th, 1901
Drinnan, Robert G	February 5th, 1901
Stockett, Thomas, Jr	August 3rd, 1901
Cunliffe, John	August 3rd, 1901
Evans, Daniel	August 3rd, 1901
McEvoy, James	October 17th, 1902
Wilson, A. R.	October 17th, 1902
Simister, Charles	October 17th, 1902
Budge, Thomas	October 17th, 1902
Mills, Thomas	October 17th, 1902
Faulds, Alexander	October 17th, 1902
Richards, James A.	October 17th, 1902
McLean, Donald	January 21st, 1904
Wilkinson, Geo	January 21st, 1904
Wright, H. B.	January 21st, 1904
Coulthard, R. W	January 21st, 1904
Roaf, J. Richardson	January 21st, 1904
John, John	January 21st, 1904
Manley, H. L.	January 21st, 1904
Batley, Richard	May 27th, 1913
Baxter, Andrew	June 10th, 1911

## FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	NAME.	DATE.
Biggs, J. G.	July 22, 1908	McGuckie, Thomas	July 22, 1908
Bonar, Robert.	Oct. 28, 1911	McKendrick, Andrew	May 27, 1913
Brace, Tom.	May 13, 1915	McMillan, J. H.	Sept. 10, 1910
Bridge, Edward.	July 22, 1908	McVicar, Samuel	May 1, 1909
Brown, David.	May 21, 1914	Mazey, William John	Oct. 31, 1912
Brown, Robert Joyce	May 13, 1915	Miard, Henry Ernest	May 9, 1912
Caulfield, Bernard.	May 1, 1909	Michell, Dudley	Nov. 15, 1917
Church, James A. H.	June 10, 1911	Millar, John K.	Nov. 22, 1906
Cox, Richard.	May 13, 1915	Miller, Andrew Anderson	Oct. 31, 1912
Crowder, James.	June 10, 1911	Moutgomery, John W.	May 1, 1909
Cunningham, John Howard	May 9, 1912	Moore, Wm. H.	May 17, 1917
Davidson, W. A.	May 1, 1909	Mordy, Thomas.	Sept. 10, 1910
Davies, David.	June 10, 1911	Mottishaw, Sam. K.	Nov. 15, 1917
Davies, Stephen	Nov. 15, 1917	Newton, John.	July 22, 1908
Davies, Thos. Owen.	May 21, 1914	O'Brien, George	May 21, 1914
de Hart, J. B.	May 17, 1917	Ovington, John.	May 27, 1913
Derbyshire, James.	Nov. 9, 1907	Peacock, Frank David	Oct. 28, 1911
Devlin, Henry.	May 1, 1909	Penman, Hugh	May 21, 1914
Dickson, James.	Oct. 31, 1912	Phelan, Arthur	May 27, 1913
Elliott, Daniel.	Nov. 9, 1907	Powell, J. W.	June 10, 1911
Emmerson, Joseph.	Nov. 9, 1907	Quinn, John Graham.	July 8, 1916
Fairfoull, Robert	June 10, 1911	Ramsay, Peter Millar	May 16, 1918
France, Thos.	Nov. 22, 1906	Roper, William.	May 13, 1915
Fraser, Norman	Mar. 4, 1905	Russell, John	May 21, 1914
Freeman, H. N.	May 1, 1909	Shanks, John	May 1, 1909
Galloway, C. F. J.	July 22, 1908	Shaw, William	May 9, 1912
Garman, Morris W	Nov. 15, 1917	Shenton, T. J.	Sept. 10, 1910
Gascoyne, Rowland B.	May 21, 1914	Shone, Samuel.	May 1, 1909
Glover, Francis.	Oct. 31, 1912	Smith, A. E.	Oct. 28, 1911
Graham, Charles.	Nov. 14, 1905	Smith, Joseph.	July 22, 1908
Graham, Thomas	Nov. 9, 1907	Smith, Thos. Edwin	Dec. 19, 1918
Gray, James	Nov. 27, 1909	Spicer, J. E.	Oct. 28, 1911
Henderson, Robert.	Nov. 27, 1909	Spruston, T. A.	Nov. 27, 1909
Hewlett, Howe.	May 27, 1913	Stevens, L. C.	Nov. 27, 1909
Higgins, Alexander	Dec. 19, 1918	Stewart, R. T.	Sept. 10, 1910
Holden, James	May 1, 1909	Strachan, Robert.	Mar. 4, 1905
Howden, Archibald.	May 27, 1913	Strang, James.	June 10, 1911
Howells, Nathaniel	Oct. 28, 1911	Taylor, James.	May 16, 1918
Hughes, John C.	May 17, 1917	Thomas, J. D.	Sept. 10, 1910
Humphries, Clifford.	June 10, 1911	Thorne, B. L.	Sept. 10, 1910
Hunter, Alex. B.	July 8, 1916	Touhey, James.	May 21, 1914
Jackson, Thos. R.	Nov. 9, 1907	Walker, William	May 16, 1918
James, William.	July 22, 1908	Wallbank, J.	Sept. 10, 1910
Jaynes, Frank	May 13, 1915	Warburton, Ernest Leonard	July 8, 1916
Jemson, Jas. W.	May 27, 1913	Wark, Samuel David.	Oct. 3, 1919
Kellock, George.	June 10, 1911	Wesnedge, William	Dec. 19, 1918
Knox, T. K.	July 27, 1909	Whittaker, John	Dec. 19, 1918
Laird, Robert.	Nov. 15, 1917	Williams, John Samuel.	Dec. 19, 1918
Lancaster, William	July 22, 1908	Williams, Thos. B.	May 17, 1917
Leighton, Henry.	May 9, 1912	Williams, Thos. H.	Nov. 22, 1906
Macaulay, D. A.	June 10, 1911	Wilson, Ridgeway R.	Nov. 15, 1917
McCulloch, James	Sept. 10, 1910	Wilson, William	May 16, 1918
McDonald, John.	Oct. 3, 1919	Wylie, John	July 22, 1908

## SECOND-CLASS CERTIFICATES OF SERVICE.

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Lee, John S.	March 4, 1905	B 9	Hunt, John	March 4, 1905	B 13
Millar, J. K.	March 4, 1905	B 10	Walker, David	March 4, 1905	B 14
McCliment, John	March 4, 1905	B 11	Powell, William Baden	March 4, 1905	B 16
Martin, David.	March 4, 1905	B 12	Bryden, Alexander.	March 4, 1905	B 18

## SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Adamson, Robert.....	Sept. 10, 1910	B 120	Gillespie, John.....	Oct. 23, 1906	B 36
Allan, Alex. McDairmid..	May 27, 1913	B 167	Gould, Alfred.....	May 13, 1915	B 190
Almond, Walter.....	Nov. 15, 1917	B 213	Gourlay, Robert.....	Dec. 19, 1918	B 227
Barclay, Andrew.....	July 29, 1905	B 25	Graham, Chas.....	Mar. 4, 1905	B 1
Barlow, Benjamin Robert.	Dec. 19, 1918	B 229	Gray, David.....	May 1, 1909	B 76
Baybutt, Thomas.....	July 8, 1916	B 206	Gray, George.....	July 8, 1916	B 207
Bell, John.....	May 17, 1917	B 212	Greenwell, Archibald....	May 16, 1918	B 220
Bevis, Nathaniel.....	Sept. 10, 1910	B 123	Hamilton, Robert N.....	May 21, 1914	B 175
Biggs, John.....	May 1, 1909	B 94	Hastings, Andrew Peacock.	Dec. 19, 1918	B 223
Biggs, John G.....	Nov. 2, 1907	B 40	Henderson, Robert.....	July 22, 1908	B 60
Blair, James.....	May 13, 1915	B 197	Holliday, William.....	Dec. 19, 1918	B 230
Brace, Tom.....	Nov. 27, 1909	B 96	Horrocks, Abner G.....	June 10, 1911	B 130
Bridge, Edward.....	Oct. 23, 1906	B 33	Howells, Nathaniel.....	Nov. 27, 1909	B 97
Brown, David.....	Sept. 10, 1910	B 108	Huby, Norman W.....	May 13, 1915	B 198
Brown, George.....	Dec. 19, 1918	B 225	Hudson, George.....	Sept. 10, 1910	B 121
Brown, James L.....	Oct. 23, 1911	B 136	Hughes, John C.....	Sept. 10, 1910	B 109
Brown, John C.....	Oct. 23, 1906	B 39	Hutton, Isaac.....	May 21, 1914	B 185
Brown, John Todd.....	May 9, 1912	B 150	Hutton, John.....	May 9, 1912	B 154
Brown, R. J.....	Oct. 28, 1911	B 134	Jackson, Thos. R.....	Mar. 4, 1905	B 5
Brown, Robert.....	May 21, 1914	B 183	James, David.....	Nov. 2, 1907	B 58
Brown, Robert Sneddon....	May 13, 1915	B 196	Jarrett, Fred.....	May 1, 1909	B 84
Brown, William Gold....	Dec. 19, 1918	B 223	Jaynes, Frank.....	Sept. 10, 1910	B 111
Brownrigg, John H.....	May 17, 1917	B 124	John, Francis.....	July 8, 1916	B 200
Bushell, J. P.....	May 1, 1909	B 81	John, Howell.....	Sept. 10, 1910	B 122
Carroll, Henry.....	July 22, 1908	B 62	Johnson, Moses.....	May 1, 1909	B 75
Caufield, Bernard.....	Oct. 23, 1906	B 30	Jones, Samuel.....	May 16, 1918	B 221
Caufield, John.....	July 8, 1916	B 199	Jones, William T.....	July 22, 1908	B 66
Cawthorne, L.....	May 1, 1909	B 93	Jordon, Thos.....	Nov. 27, 1909	B 104
Challinor, Jno. Thomas....	May 27, 1913	B 169	Joyce, Walter.....	May 27, 1913	B 168
Challoner, Jno. Arthur....	May 21, 1914	B 178	Kirkwood, John Robertson	Oct. 31, 1912	B 160
Churchill, James.....	July 22, 1908	B 65	Knowles, James E.....	Oct. 23, 1911	B 137
Clarkstone, Wm. W.....	May 21, 1914	B 180	Laird Robert.....	May 17, 1917	B 210
Clarks, Wm.....	Sept. 10, 1910	B 115	Lancaster, William.....	Nov. 2, 1907	B 50
Coupland, George.....	May 16, 1918	B 217	Lander, Frank.....	May 13, 1915	B 195
Courtney, A. W.....	Oct. 23, 1911	B 138	Lane, Joseph.....	May 9, 1912	B 142
Cox, Richard.....	May 9, 1912	B 143	Lee, Robert John.....	Sept. 10, 1910	B 110
Crawford, David.....	May 1, 1909	B 88	Littler, Matthew.....	Oct. 31, 1912	B 157
Cunliffe, Thomas.....	May 1, 1909	B 78	Luck, George.....	June 10, 1911	B 123
Dando, John.....	May 27, 1913	B 164	Manifold, Albert.....	May 9, 1912	B 145
Daniels, David.....	Nov. 2, 1907	B 53	Marsh, John.....	Nov. 15, 1917	B 216
Derbyshire, James.....	Oct. 23, 1906	B 32	Mason, Joseph.....	May 13, 1915	B 193
Davidson, Hugh.....	May 27, 1913	B 165	Massey, H.....	Nov. 27, 1909	B 99
Davies, Stephen.....	Sept 10, 1910	B 113	Mather, Thomas.....	June 10, 1911	B 127
Dennis, Fred. W.....	May 21, 1914	B 174	Matusky, A.....	May 1, 1909	B 91
Devlin, Ernest H.....	May 21, 1914	B 179	Mayer, Ralph Waldo.....	May 9, 1912	B 144
Devlin, Henry.....	Nov. 2, 1907	B 44	Mazay, W. J.....	Nov. 27, 1909	B 101
Dewar, Alexander.....	Oct. 31, 1912	B 162	Merryfield, William.....	July 22, 1908	B 61
Dickenson, Clifford.....	May 13, 1915	B 189	Miard, Hy. E.....	Sept. 10, 1910	B 107
Dunsmuir, John.....	Nov. 14, 1905	B 26	Michek, John.....	May 17, 1917	B 188
Dykes, J. W.....	May 1, 1909	B 77	Michell, Dudley.....	May 13, 1915	B 187
Eccleston, Wm.....	May 1, 1909	B 87	Middleton, Robert.....	July 22, 1908	B 72
Fairfoull, James.....	May 21, 1914	B 186	Mitchell, Henry.....	July 8, 1916	B 201
Fairfoull, R.....	May 1, 1909	B 83	Monks, James.....	Nov. 2, 1907	B 55
Finlayson, James.....	July 29, 1905	B 21	Moore, Wm. H.....	May 21, 1914	B 173
Ford, Allan.....	May 27, 1913	B 171	Morgan, John.....	Nov. 2, 1907	B 43
Foster, W. R.....	Nov. 27, 1909	B 102	Morgan, William.....	Dec. 19, 1918	B 224
France, Thos.....	May 14, 1905	B 27	Morris, John.....	July 22, 1908	B 67
Francis, David M.....	May 21, 1914	B 182	Morton, Robert W.....	July 22, 1908	B 59
Francis, Fnoch.....	May 1, 1909	B 86	Mottishaw, S. K.....	Oct. 28, 1911	B 135
Francis, James.....	July 22, 1908	B 63	Murray, George.....	Oct. 3, 1919	B 232
Frater, George.....	July 8, 1916	B 204	Musgrave, J.....	May 1, 1909	B 90
Freeman, Henry N.....	Nov. 2, 1907	B 45	Myers, Peter.....	May 9, 1912	B 149
Garbett, Richard.....	Oct. 31, 1912	B 161	McDonald, J. A.....	Oct. 28, 1911	B 133
Garman, Morris Wilbur....	Oct. 31, 1912	B 155	McDonald, John.....	May 27, 1913	B 172
Gillespie, Hugh.....	July 29, 1905	B 24	McFegan, W.....	Nov. 31, 1909	B 106

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—Continued.

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
McGarry, Martin	Oct. 31, 1912	B 156	Smith, John	Oct. 3, 1919	B 231
McGuckie, Thomas M.	Oct. 23, 1906	B 35	Somerville, Alex.	Mar. 4, 1905	B 4
McKelvie, J.	May 1, 1909	B 92	Spruston, Robert Lecce.	July 8, 1916	B 202
McKendrick, And.	Sept. 10, 1910	B 112	Spruston, Thos. A.	Nov. 2, 1907	B 46
McMillan, D.	June 10, 1911	B 125	Stafford, Matthew	June 10, 1911	B 131
McNay, Carmichael.	May 9, 1912	B 151	Stewart, J. M.	May 1, 1909	B 95
McPherson, James E.	July 22, 1908	B 73	Stobbart, Jacob.	May 9, 1912	B 153
Neen, Joseph.	June 10, 1911	B 129	Stockwell, William	Nov. 2, 1907	B 56
Newbury, Arthur.	May 21, 1914	B 184	Strang, Thomas	Oct. 31, 1912	B 158
Newton, John.	Oct. 23, 1906	B 31	Sutherland, John	May 16, 1918	B 218
Newton, Wm.	Sept. 10, 1910	B 116	Taylor, James	May 13, 1915	B 194
O'Brien, Charles	May 9, 1912	B 148	Taylor, Thomas	July 8, 1916	B 203
O'Brien, George	May 1, 1909	B 82	Thomas, J. B.	Nov. 27, 1909	B 105
Ovington, John	Nov. 2, 1907	B 52	Thomas, Joseph D.	Oct. 23, 1906	B 38
Parkinson, T.	May 1, 1909	B 80	Thompson, Joseph	Sept. 10, 1910	B 114
Parnham, Charles.	Nov. 2, 1907	B 49	Touhey, James	May 9, 1912	B 147
Quinn, James.	May 21, 1914	B 181	Touhey, William	July 8, 1916	B 205
Quinn, John	May 9, 1912	B 146	Tonge, Thomas	July 22, 1908	B 71
Ramsay, Peter Millar	May 17, 1917	B 209	Tully, Thomas	Nov. 15, 1917	B 214
Rankin, Geo.	Nov. 27, 1909	B 103	Vanhulle, Peter.	Nov. 2, 1907	B 54
Raynes, M. T.	Oct. 28, 1911	B 139	Virgo, John	May 1, 1909	B 89
Reid, Wm.	Oct. 28, 1911	B 132	Walker, William	May 13, 1915	B 192
Benny, James.	Oct. 28, 1911	B 140	Warburton, Ernest L.	May 27, 1913	B 170
Richards, Thomas.	Nov. 2, 1907	B 57	Watson, Adam G.	Nov. 14, 1905	B 28
Richards, Samuel.	May 9, 1912	B 152	Watson, Arthur W.	May 17, 1917	B 211
Rigby, John	July 29, 1905	B 29	Webber, John Frank	Mar. 4, 1905	B 3
Roberts, Ebenezer	Sept. 10, 1910	B 117	Wesledge, William	Nov. 27, 1909	B 98
Robinson, William	July 22, 1908	B 69	White, John	Nov. 2, 1907	B 48
Rogers, George	May 1, 1909	B 79	Whitehouse, William	Oct. 31, 1912	B 163
Roper, William	May 9, 1912	B 141	Williams, John Samuel	Nov. 15, 1917	B 215
Rowbottom Thomas.	May 16, 1918	B 222	Wilson, Robinson	May 21, 1914	B 177
Russell, John	Nov. 2, 1907	B 47	Wilson, Thomas	July 22, 1908	B 74
Rutherford, Jasper.	May 16, 1918	B 219	Wilson, William	July 22, 1908	B 70
Scarpino, Francis.	Dec. 19, 1918	B 226	Wood, Thos. James	May 21, 1914	B 176
Shanks, David.	Oct. 31, 1912	B 159	Worthington, Joseph.	May 1, 1909	B 85
Shaw, Thomas John.	May 27, 1913	B 166			

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Adamson, Robert	May 1, 1909	C 323	Bateman, Joseph William.	Oct. 28, 1913	C 551
Ainsworth, Edward	May 16, 1918	C 674	Bauld, Wm	June 10, 1911	C 422
Allan, Alexander	Oct. 28, 1911	C 430	Baxter, Robert	Oct 28, 1911	C 450
Almond, Alex.	Oct. 1, 1907	C 252	Baybutt, Thomas	May 27, 1913	C 548
Almond, Walter	July 22, 1908	C 286	Beeton, D. H.	May 1, 1909	C 338
Anderson, John	Oct. 28, 1911	C 437	Bell, Fred	May 27, 1913	C 514
Anderson, Peter Blaus	Nov. 15, 1917	C 660	Bell, John	May 9, 1912	C 477
Anderson, Robt.	Oct. 14, 1914	C 593	Bennett, Andrew M.	Nov. 15, 1917	C 661
Angell, William	May 21, 1914	C 591	Bennett, John	Oct. 14, 1914	C 597
Arbuckle, John.	May 13, 1915	C 622	Bennie, John	June 10, 1911	C 411
Archibald, Geo.	May 21, 1914	C 569	Beveridge, Wm.	June 10, 1911	C 396
Archibald, Thomas	Oct. 28, 1911	C 454	Biggs, John	Mar. 4, 1905	C 210
Ball, Alfred	May 17, 1917	C 635	Biggs, Thomas	Oct. 28, 1911	C 449
Bann, Thomas	Oct. 31, 1912	C 494	Birchell, Richard	Oct. 1, 1907	C 266
Baggaley, J.	July 22, 1908	C 300	Blair, James	Oct. 31, 1912	C 502
Bain, James	May 27, 1913	C 546	Blewett, Ernest	July 22, 1908	C 298
Ball, Benjamin	May 21, 1914	C 583	Blinkhorn, Thomas	Dec. 19, 1918	C 681
Barker, Robert	June 10, 1911	C 415	Bradley, William	July 22, 1908	C 291
Barlow, B. R.	May 1, 1909	C 337	Bridge, Edward	July 29, 1905	C 223

## THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—Continued.

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Briscoe, F. ....	July 22, 1908	C 309	Doherty, J. J. ....	May 1, 1909	C 340
Broderick, Matthew. ....	Jan. 21, 1913	C 525	Doney, John ....	Mar. 4, 1905	C 211
Brown, Arthur A. ....	Oct. 14, 1914	C 596	Donnachie, John. ....	June 10, 1911	C 425
Brown, David. ....	Nov. 1, 1909	C 348	Doodson, Robert. ....	Oct. 28, 1911	C 455
Brown, George. ....	July 8, 1916	C 626	Dorrance, Orlin William. ....	Jan. 21, 1913	C 517
Brown, James. ....	Sept. 10, 1910	C 364	Douglas, D. B. ....	Oct. 23, 1906	C 235
Brown, James. ....	June 10, 1911	C 412	Dow, And. Y. ....	May 21, 1914	C 587
Brown, James. ....	July 8, 1916	C 625	Dunn, Wm. ....	Oct. 14, 1914	C 606
Brown, Jas. Millie. ....	May 13, 1915	C 615	Dykes, Isaac. ....	June 10, 1911	C 409
Brown, John. ....	Sept. 10, 1910	C 392	Dykes, Joseph W. ....	Oct. 1, 1907	C 248
Brown, Robert. ....	Oct. 28, 1911	C 451	Eccleston, Thomas. ....	May 17, 1917	C 482
Brown, Robert D. ....	June 10, 1911	C 423	Edwards, John. ....	May 27, 1913	C 542
Brown, Robert S. ....	June 10, 1911	C 408	Elliott, John. ....	May 27, 1913	C 541
Brown, Wm. A. ....	May 21, 1914	C 576	Elmes, George. ....	Oct. 31, 1912	C 511
Brown, William Gold. ....	July 8, 1916	C 629	Evans, D. ....	July 22, 1908	C 284
Bullen, Thomas. ....	Sept. 10, 1910	C 379	Ewing, Robert. ....	May 13, 1915	C 608
Bushell, Jas. P. ....	Oct. 1, 1907	C 264	Fairfoull, James. ....	Oct. 28, 1911	C 453
Bysouth, Thomas. ....	May 16, 1918	C 673	Farrow, John William. ....	Dec. 19, 1918	C 683
Cairns, Andrew. ....	June 10, 1911	C 420	Fitzpatrick, T. J. ....	Oct. 2, 1911	C 452
Cairns, Robert. ....	May 27, 1913	C 539	Flockart, David. ....	Jan. 21, 1913	C 531
Caldwell, Daniel. ....	May 17, 1917	C 639	Ford, Allen. ....	Oct. 28, 1911	C 445
Calverly, Joseph. ....	Sept. 10, 1910	C 375	Fowler, Robert. ....	Oct. 31, 1912	C 495
Camanile, Hollis. ....	Oct. 28, 1911	C 443	Francescini, Louis. ....	May 16, 1918	C 672
Campbell, Samuel. ....	Nov. 15, 1917	C 662	Francis, David Morgan. ....	Oct. 28, 1913	C 558
Carr, Peter. ....	Oct. 31, 1912	C 497	Francis, James. ....	Oct. 1, 1907	C 250
Carson, George. ....	Mar. 17, 1917	C 663	Frater, George. ....	May 13, 1915	C 616
Catchpole, Charles. ....	July 29, 1905	C 227	Freeman, H. N. ....	Nov. 14, 1905	C 230
Caulfield, Edward. ....	May 16, 1918	C 670	Frew, Andrew. ....	Nov. 27, 1909	C 360
Caulfield, John. ....	May 1, 1909	C 321	Frodsham, Vincent. ....	July 22, 1908	C 282
Challoner, Arthur. ....	Oct. 28, 1911	C 433	Furbow, John. ....	Jan. 21, 1913	C 528
Charnock, John. ....	Nov. 15, 1917	C 653	Garbett, Richard. ....	Sept. 10, 1910	C 377
Cheetam, Ben. ....	July 22, 1908	C 311	Gascoyne, Rowland B. ....	Jan. 21, 1913	C 513
Chester, John. ....	Oct. 28, 1911	C 440	Geater, Jas. Gordon. ....	May 21, 1914	C 573
Clark, Lewis. ....	June 10, 1911	C 405	Gemmell, James. ....	Oct. 31, 1912	C 505
Clark, Walter Pattison. ....	May 9, 1912	C 480	Gillham, John. ....	May 13, 1915	C 623
Clarkstone, Wm. W. ....	Oct. 28, 1911	C 431	Gillies, William. ....	May 16, 1918	C 668
Cleaves, Walter. ....	May 9, 1912	C 475	Glenn, James. ....	Oct. 28, 1911	C 435
Clifford, William. ....	July 22, 1908	C 313	Gordon, Davis John. ....	May 9, 1912	C 474
Colgrove, Charles Henry. ....	Dec. 19, 1918	C 679	Gourley, Robert. ....	May 9, 1912	C 470
Commons, William. ....	July 22, 1908	C 304	Gray, George. ....	May 9, 1912	C 467
Cooke, Joseph. ....	Mar. 4, 1905	C 209	Green, William. ....	Nov. 15, 1917	C 659
Coomb, Alexander. ....	May 27, 1913	C 533	Greenhorn, John. ....	May 21, 1914	C 575
Cooper, John Andrew. ....	Dec. 19, 1918	C 689	Griffiths, Edward. ....	Oct. 31, 1914	C 508
Copé, Frank. ....	Oct. 28, 1913	C 549	Gunniss, Matthew. ....	May 9, 1912	C 460
Coulthard, James. ....	June 10, 1911	C 407	Hallinan, William. ....	May 1, 1909	C 343
Crawford, David. ....	Mar. 4, 1905	C 208	Halsall, J. ....	July 22, 1908	C 307
Cunningham, G. F. ....	Nov. 11, 1905	C 229	Hamilton, John. ....	Oct. 28, 1911	C 444
Cunliffe, Thos. ....	Oct. 1, 1907	C 265	Hamilton, Robert Nesbitt. ....	Oct. 28, 1913	C 550
Dabb, Owen. ....	May 21, 1914	C 578	Hampton, Samuel. ....	Nov. 15, 1917	C 650
Dando, John. ....	May 9, 1912	C 465	Hancock, Arthur. ....	Nov. 15, 1917	C 656
Davidson, Hugh. ....	May 9, 1912	C 464	Hartley, Thomas. ....	Oct. 31, 1912	C 510
Davies, Alfred. ....	Oct. 3, 1919	C 691	Harwood, Fred. ....	Sept. 10, 1910	C 384
Davies, Evan Thomas. ....	May 9, 1912	C 463	Harvey, Thomas. ....	May 9, 1912	C 466
Davis, John David. ....	May 16, 1918	C 669	Harvie, George. ....	Sept. 10, 1910	C 378
Davis, William. ....	May 1, 1909	C 339	Heaps, Robert. ....	Sept. 10, 1910	C 373
Dean, Andrew. ....	Dec. 19, 1918	C 688	Hemer, Herbert. ....	Oct. 14, 1914	C 595
Dean, Joseph. ....	May 13, 1915	C 611	Henney, Jonathan. ....	June 10, 1911	C 424
Derbyshire, A. ....	June 10, 1911	C 401	Hendry, James. ....	May 9, 1912	C 471
Dewar, Alex. ....	Sept. 10, 1910	C 369	Herd, William. ....	Dec. 19, 1918	C 682
Devlin, Edward. ....	Oct. 23, 1906	C 241	Heyes, Edward. ....	May 1, 1909	C 320
Devlin, Ernest Henry. ....	May 27, 1913	C 538	Hill, Isaac. ....	Nov. 15, 1917	C 664
Devlin, John. ....	Oct. 3, 1919	C 693	Hilley, Fred. ....	July 22, 1908	C 290
Devoy, William. ....	May 17, 1917	C 638	Hilton, Mathias. ....	Dec. 19, 1918	C 677
Dickenson, Clifford. ....	May 27, 1917	C 532	Hilton, R. G. ....	Sept. 10, 1910	C 376
Dingsdale, Geo. ....	Oct. 28, 1911	C 459	Hodson, R. H. ....	Mar. 4, 1905	C 216

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—Continued.

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Holdsworth, William.....	May 16, 1918	C 671	Maxwell, Geo.....	May 21, 1914	C 571
Holliday, William.....	July 8, 1916	C 634	McAlpine, John.....	Mar. 4, 1905	C 217
Horbury, Joseph W.....	June 10, 1911	C 406	McArthur, John Malcolm..	May 17, 1917	C 648
Horrocks, A. G.....	May 1, 1909	C 324	McBroom, Al.....	July 2, 1908	C 287
Horwood, S.....	July 22, 1908	C 312	McCourt, John.....	Oct. 14, 1914	C 605
Houston, Robert.....	July 8, 1916	C 631	McCulloch, James.....	May 1, 1909	C 315
Howells, Nathaniel.....	May 1, 1909	C 316	McDonald, John.....	Oct. 28, 1911	C 448
Huby, Norman.....	June 10, 1911	C 394	McFagen, Alexander.....	May 9, 1912	C 490
Hutchison, Ben.....	Nov. 14, 1905	C 232	McFegan, W.....	May 1, 1909	C 319
Hutchison, Fred.....	Nov. 27, 1909	C 358	McGarry, Martin.....	May 1, 1909	C 326
Hynds, William.....	July 8, 1916	C 632	McGrath, James.....	July 8, 1916	C 630
Ireson, John.....	Oct. 31, 1912	C 507	McGuckie, Jno. M.....	May 21, 1914	C 562
Irvine, David.....	June 10, 1911	C 413	McGuckie, Thomas.....	July 29, 1905	C 226
Jack, John.....	May 21, 1914	C 582	McGuire, Thomas.....	Oct. 28, 1913	C 553
James, Thos.....	May 21, 1914	C 588	McIntyre, Neil.....	May 21, 1914	C 574
Jardine, George Edward..	Jan. 21, 1913	C 521	McKelvie, J.....	July 22, 1908	C 285
Jarrett, Fred. J.....	Oct. 1, 1907	C 256	McKenzie, Peter.....	June 10, 1911	C 427
Jaynes, Frank.....	July 22, 1908	C 277	McKibben, Matthew.....	May 21, 1914	C 580
Jemson, J. W.....	Mar. 4, 1905	C 205	McKinley, John.....	Oct. 28, 1914	C 442
Jenkins, John.....	Sept. 10, 1910	C 390	McLaughlin, James.....	May 9, 1912	C 485
John, Howel.....	July 22, 1908	C 305	McLachlan, Alex.....	June 10, 1912	C 419
Johnson, Moses.....	Oct. 1, 1907	C 258	McLean, M. D.....	Sept. 10, 1910	C 389
Johnston, Robert.....	May 9, 1912	C 479	McLellan, William.....	Mar. 4, 1905	C 219
Jones, Alf. Geo.....	May 21, 1914	C 584	McLeod, James.....	July 22, 1908	C 296
Jones, Samuel.....	May 27, 1913	C 518	McLeod, John.....	May 13, 1915	C 609
Jones, William C.....	Jan. 21, 1913	C 556	McMeakin, James.....	May 13, 1915	C 612
Jones, William Ernest.....	Oct. 28, 1913	C 221	McMillan, D.....	Sept. 10, 1910	C 363
Jones, W. T.....	Mar. 4, 1905	C 544	McMillan, Edward.....	Oct. 31, 1912	C 493
Joyce, Walter.....	Nov. 27, 1909	C 361	McMillan, Neil.....	Nov. 15, 1917	C 654
Judge, Peter.....	Sept. 10, 1910	C 391	McNay, Carmichael.....	July 22, 1908	C 306
Keenan, Wm. James.....	June 10, 1911	C 426	McNeill, Adam L.....	July 22, 1908	C 281
Kelly, Ernest.....	May 17, 1917	C 645	McNeill, Robert.....	Sept. 10, 1910	C 387
Kemp, Wm.....	Oct. 14, 1914	C 594	Meek, Matthew.....	May 9, 1912	C 484
Kingham, Alfred.....	Oct. 28, 1913	C 559	Meikle, Harry Alexander..	July 8, 1916	C 627
Kirkeberg, H. S.....	Nov. 27, 1909	C 350	Merrifield, George.....	Oct. 28, 1906	C 239
Lancaster, William.....	Oct. 23, 1906	C 243	Merrifield, William.....	Oct. 23, 1906	C 236
Lane, Joseph.....	Oct. 1, 1907	C 254	Michek, John.....	May 21, 1914	C 563
Leeman, T.....	May 1, 1909	C 345	Miles, John.....	June 10, 1911	C 414
Lewis, Benj. J.....	Sept. 10, 1910	C 386	Mitchell, Charles.....	May 1, 1909	C 322
Leynard, Paul.....	May 17, 1917	C 637	Mitchell, Henry.....	Sept. 10, 1910	C 366
Liddle, John.....	July 29, 1905	C 228	Monks, James.....	Nov. 14, 1905	C 234
Lindsay, William.....	May 17, 1917	C 642	Moore, George.....	Oct. 23, 1906	C 242
Littler, John.....	June 10, 1911	C 410	Moore, John.....	May 1, 1909	C 335
Littler, Matthew.....	June 10, 1911	C 417	Moreland, Thomas.....	July 22, 1908	C 299
Littler, Robert.....	June 10, 1911	C 418	Morgan, John.....	July 29, 1905	C 224
Livingstone, Alex.....	Oct. 28, 1911	C 436	Morgan, William.....	May 17, 1917	C 636
Loxton, George.....	June 10, 1911	C 428	Morris, David.....	May 9, 1912	C 472
Loxton, John.....	June 10, 1911	C 416	Mottishaw, Samuel K.....	Oct. 23, 1906	C 237
Luck, George.....	May 1, 1909	C 318	Murdock, Jno. Y.....	May 21, 1914	C 564
Lynch, Stewart.....	Oct. 28, 1911	C 432	Myers, Peter.....	Oct. 28, 1911	C 446
Mackie, John.....	June 10, 1911	C 421	Nanson, T. H.....	July 22, 1908	C 280
Makin, J. Wm.....	Sept. 10, 1910	C 385	Nash, George William.....	May 17, 1917	C 565
Malone, John.....	May 21, 1914	C 585	Neen, Joseph.....	Nov. 27, 1909	C 352
Malone, Patrick.....	Oct. 1, 1907	C 247	Nelson, Horatio.....	Oct. 1, 1907	C 263
Maltman, James.....	Oct. 31, 1912	C 501	Neilson, William.....	May 9, 1912	C 481
Mansfield, A.....	May 1, 1909	C 336	Newman, John.....	Oct. 14, 1914	C 603
Marrs, John.....	May 17, 1917	C 640	Nicholson, James.....	May 9, 1912	C 469
Marsh, Daniel Parks.....	May 27, 1913	C 543	Nimmo, James.....	May 9, 1912	C 461
Marsh, John.....	Oct. 1, 1907	C 270	Norris, Joshua.....	Oct. 28, 1913	C 557
Martin, James.....	June 10, 1911	C 398	Oakes, Robert.....	Oct. 31, 1912	C 498
Mason, Joseph.....	July 22, 1908	C 297	O'Brien, Charles.....	Nov. 27, 1909	C 349
Massey, Henry.....	May 1, 1909	C 317	Odgers, Alfred.....	Jan. 21, 1913	C 529
Mather, Thomas.....	July 22, 1908	C 293	Odgers, Eli.....	Jan. 21, 1913	C 523
Matusky, Andrew.....	Oct. 1, 1907	C 259	Orr, Alexander.....	Oct. 28, 1911	C 434
Mawson, J. T.....	Nov. 27, 1909	C 359	Osborne, Hugh.....	Oct. 28, 1913	C 555

## THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—Continued.

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Oswald, Geo. L.	Sept. 10, 1910	C 370	Smith, A. E.	Sept. 10, 1910	C 367
Owen, Thomas	May 1, 1909	C 347	Smith, John Watterson	May 16, 1918	C 665
Park, William	Dec. 19, 1918	C 684	Smith, Joseph	Mar. 4, 1905	C 207
Parks, Alexander	Jan. 21, 1913	C 519	Smith, Richard Beveridge	Oct. 28, 1913	C 561
Parker, L.	May 1, 1909	C 341	Smith, Thos. J.	Oct. 1, 1907	C 271
Parkinson, James William	Nov. 15, 1917	C 655	Smith, Thomas	May 9, 1912	C 486
Parkinson, T.	July 22, 1908	C 289	Snow, Aubrey	May 16, 1918	C 675
Parrott, Jas. E.	May 21, 1914	C 590	Sopwith, Reginald Scott	Jan. 21, 1913	C 512
Parson, Herbert	May 13, 1915	C 621	* Sparks, Edward	Oct. 1, 1907	C 255
Pearson, Jonathan	May 9, 1912	C 473	Spencer, G.	May 1, 1909	C 329
Penman, Hugh	Oct. 28, 1913	C 552	Spruston, R. L.	Nov. 27, 1909	C 355
Perry, George Harewood	May 17, 1917	C 643	Spruston, Thomas A.	Mar. 4, 1905	C 206
Phillips, Richard Stephen	May 17, 1917	C 620	Stafford, M.	Sept. 10, 1910	C 382
Pickup, A.	July 22, 1908	C 310	Starr, Wallace	May 9, 1912	C 488
Picton, W.	May 1, 1909	C 333	Staton, Edward	May 21, 1914	C 581
Plank, Samuel	Nov. 14, 1905	C 233	Steele, Walter	Oct. 28, 1911	C 439
Poole, Samuel	May 27, 1913	C 536	Stewart, George	May 27, 1913	C 534
Price, Walter	Sept. 10, 1910	C 371	Stewart, James M.	Oct. 23, 1906	C 240
Puckey, John Thomas	Dec. 19, 1918	C 687	Stockwell, William	Oct. 23, 1906	C 238
Quinn, James	Oct. 28, 1911	C 441	Strachan, John	Oct. 14, 1914	C 604
Quinn, John	Oct. 28, 1911	C 429	Strang, James	May 13, 1915	C 614
Radford, Albert	May 21, 1914	C 579	Strang, Thomas	June 10, 1911	C 400
Rallison, R.	July 22, 1908	C 279	Strang, Wm.	June 10, 1911	C 395
Rankin, George	July 22, 1908	C 275	Sutherland, John	May 27, 1913	C 545
Rankin, Wm. Shaw	May 9, 1912	C 489	Taylor, Charles M.	Mar. 4, 1905	C 213
Ratcliffe, Thomas	Oct. 1, 1907	C 253	Taylor, Hugh	Jan. 21, 1913	C 530
Raynor, Fred	Oct. 1, 1907	C 257	Taylor, James	May 21, 1914	C 567
Reid, Robert	Sept. 10, 1910	C 383	Taylor, Jonathan	Dec. 19, 1918	C 680
Reid, Thos.	May 21, 1914	C 592	Taylor, J. T.	Oct. 28, 1911	C 447
Reid, Wm.	June 10, 1911	C 403	Taylor, Leroy	Sept. 10, 1910	C 381
Reilly, Thomas	July 22, 1908	C 303	Taylor, Thomas	May 21, 1914	C 577
Renney, Jas.	Nov. 27, 1909	C 354	Thacker, Geo.	May 27, 1913	C 537
Richards, James	Nov. 1, 1907	C 249	Thomas, Thomas	Sept. 10, 1910	C 365
Richards, Samuel	Oct. 23, 1906	C 244	Thomas, John B.	Nov. 14, 1905	C 221
Richardson, J. H.	Oct. 28, 1911	C 458	Thomas, Joseph	Mar. 4, 1905	C 230
Rigby, John	July 29, 1905	C 225	Thomas, Warriett	Oct. 1, 1907	C 273
Roberts, Ebenezer	May 1, 1909	C 327	Thomason, Charles	Nov. 15, 1917	C 657
Robinson, Michael	May 1, 1909	C 332	Thompson, Thomas	Oct. 1, 1917	C 267
Robson, Thomas	May 21, 1914	C 566	Thompson, John	Oct. 31, 1912	C 509
Rogers, Ellis	May 13, 1915	C 624	Thompson, Joseph	Oct. 1, 1907	C 269
Roper, William	July 22, 1908	C 274	Thomson, Duncan	Mar. 4, 1905	C 218
Rowan, Alexander	Oct. 31, 1912	C 500	Tolley, John	Dec. 19, 1918	C 678
Rowan, John	Oct. 14, 1914	C 602	Touhey, William	May 27, 1913	C 547
Rowbottom, Thomas	Oct. 31, 1914	C 492	Tully, Thomas	May 9, 1912	C 468
Royle, Edward	Oct. 31, 1912	C 506	Tune, Elijah	May 9, 1912	C 476
Russell, Robert	Nov. 27, 1909	C 351	Turnbull, Matthew	Oct. 14, 1914	C 598
Rutherford, Jasper	May 17, 1917	C 644	Vardy, Robt.	May 21, 1914	C 570
Rutledge, Edwin	July 22, 1908	C 302	Vaughan, John Henry	Oct. 28, 1913	C 560
Scott, Henry	July 22, 1908	C 294	Walker, George	July 8, 1916	C 633
Saunders, Eustace L.	Jan. 21, 1913	C 520	Walker, Jas. Alexander	Oct. 31, 1912	C 496
Scarpino, Francis	May 17, 1917	C 649	Walker, Wm.	May 21, 1914	C 586
Seddon, James	Oct. 3, 1919	C 692	Wallace, Fred	Oct. 1, 1907	C 260
Shanks, David	Sept. 10, 1910	C 372	Warburton, Ernest Leonard	June 10, 1911	C 399
Sharp, James	May 1, 1909	C 325	Ward, Ernest Hedley	May 17, 1917	C 641
Sharples, J. T.	Sept. 10, 1910	C 380	Wardrop, James	Oct. 31, 1912	C 504
Shearer, L.	May 1, 1909	C 330	Watson, Adam G.	Mar. 4, 1905	C 212
Shields, Thomas	May 16, 1918	C 667	Watson, Arthur W.	May 27, 1913	C 535
Shipley, John W.	Oct. 28, 1911	C 456	Watson, George	July 22, 1908	C 288
Shooter, Joseph	Oct. 1, 1907	C 261	Watson, Joseph	Jan. 21, 1913	C 515
Shortman, J.	May 1, 1909	C 331	Watson, William	Oct. 22, 1906	C 246
Simister, J. H.	Nov. 27, 1909	C 353	Watson, William	May 17, 1917	C 645
Simister, W.	May 1, 1909	C 334	Webb, Herbert	Oct. 28, 1911	C 457
Simms, Hubert Allan	Jan. 21, 1913	C 526	Webster, James Stewart	Dec. 19, 1918	C 685
Sinclair, William	Jan. 21, 1913	C 527	Weeks, John	Mar. 4, 1905	C 214
Skelton, Thos	May 1, 1909	C 344	West, James Gloag	May 16, 1918	C 676

\* C 314 issued in lieu of C 255 destroyed by Fernie fire.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Whalley, William .....	Dec. 19, 1918	C 686	Wilson, William.....	May 17, 1917	C 647
White James.....	Oct. 31, 1912	C 499	Winstanley, H.....	July 22, 1908	C 283
White, John .....	Oct. 22, 1906	C 245	Wintle, Thomas A.....	July 29, 1905	C 222
Whitehouse, Wm.....	June 10, 1911	C 402	Witherington, George.....	Oct. 28, 1913	C 554
Wilkinson, Edward.....	Oct. 28, 1911	C 438	Wood, Thos. James.....	Oct. 31, 1912	C 491
Williams, John Sam.....	June 10, 1911	C 404	Worthington, J.....	July 22, 1908	C 295
Williams, Watkin .....	June 22, 1908	C 301	Wright, John.....	May 21, 1914	C 593
Wilson, Robinson.....	June 10, 1911	C 397	Wright, Robert.....	May 21, 1914	C 589
Wilson, Thomas M.....	Oct. 1, 1907	C 272	Wright, William .....	Jan. 21, 1913	C 522
Wilson, William.....	Oct. 1, 1907	C 262	Young, Alexander.....	May 16, 1918	C 666

## COAL-MINE OFFICIALS.

Third-class Certificates issued under "Coal Mines Regulation Act Further Amendment Act, 1904," sec. 38, subsec. (2), in exchange for Certificates issued under the "Coal Mines Regulation Act Amendment Act, 1901."

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Adam, Robert	Oct. 12, 1904	C 42	Lewis, Thos.	Oct. 11, 1904	C 35
Addison, Thos.	Dec. 10, 1904	C 52	Malpass, James	Nov. 7, 1904	C 113
Aitken, James	Oct. 24, 1904	C 44	Marsden, John	May 3, 1904	C 21
Ailsop, Harry	Oct. 11, 1904	C 34	Miard, Harry E.	March 3, 1905	C 76
Ashman, Jabez	Feb. 5, 1907	C 131	Middleton, Robt.	Feb. 11, 1905	C 71
Auchinvole, Alex.	March 29, 1905	C 89	Miller, Thos. K.	Feb. 21, 1905	C 74
Barclay, Andrew	April 27, 1904	C 19	McKenzie, John R.	Oct. 12, 1904	C 40
Barclay, James	April 27, 1904	C 20	McKinnon, Arch'd.	April 3, 1905	C 102
Barclay, John	April 17, 1905	C 111	McMillan, Peter	March 29, 1905	C 94
Bickle, Thos.	Oct. 11, 1904	C 37	McMurtrie, John	March 29, 1905	C 96
Bowie, James	May 13, 1905	C 116	Moore, Wm. H.	June 17, 1905	C 119
Briscoe, Edward	Oct. 10, 1906	C 129	Morris, John	Dec. 27, 1904	C 57
Campbell, Dan	March 29, 1905	C 93	Myles, Walter	April 3, 1905	C 100
Carr, Jos. E.	Oct. 11, 1904	C 36	Nash, Isaac	June 1, 1904	C 120
Carroll, Harry	March 29, 1905	C 98	Neave, Wm.	Oct. 12, 1904	C 43
Clarkson, Alexander	April 27, 1904	C 18	Nelson, James	April 27, 1904	C 16
Collishaw, John	Feb. 7, 1905	C 68	Newton, John	Oct. 12, 1904	C 39
Comb, John	March 23, 1904	C 2	Nimmo, Jas. P.	April 3, 1905	C 103
Cosier, Wm.	March 29, 1905	C 86	Nimmo, Richard E.	April 18, 1911	C 133
Courtney, A. W.	Nov. 2, 1904	C 45	O'Brien, Geo.	Feb. 6, 1905	C 66
Crawford, Frank	April 6, 1904	C 7	Pearse, Thomas W. H.	April 14, 1916	C 138
Daniels, David	April 27, 1904	C 12	Ferrie, James	March 15, 1905	C 81
Davidson, David	April 3, 1905	C 106	Price, Jas.	Nov. 8, 1904	C 50
Davidson, John	March 29, 1905	C 87	Rafter, Wm.	March 29, 1905	C 95
Devlin, Henry	Oct. 12, 1904	C 41	Reid, James	March 23, 1904	C 1
Dobbie, John	Nov. 27, 1905	C 126	Richards, Thos.	April 27, 1904	C 14
Dudley, James	March 22, 1905	C 114	Ross, John	April 3, 1905	C 101
Duncan, Thomas	Aug. 29, 1906	C 128	Roughead, George	Jan. 30, 1907	C 130
Dunlap, Henry	Nov. 21, 1904	C 51	Ryan, John	Dec. 28, 1904	C 59
Dunn, Geo.	Dec. 13, 1904	C 56	Sanders, John W.	April 3, 1905	C 107
Dunsmuir, John	March 29, 1905	C 90	Shenton, Thos. J.	July 25, 1904	C 30
Eccleston, Wm.	March 15, 1905	C 80	Shepherd, Henry	June 13, 1904	C 26
Fagan, David	April 6, 1905	C 109	Smith, Geo.	March 29, 1905	C 84
Farquharson, John	April 27, 1904	C 17	Somerville, Alex.	March 24, 1904	C 3
Findlayson, James	June 6, 1904	C 25	Stauss, Chas. F.	Feb. 9, 1905	C 69
Fulton, Hugh T.	April 3, 1905	C 105	Steele, Jas.	March 29, 1905	C 92
Gibson, Edward	May 30, 1905	C 118	Steele, John	June 4, 1913	C 4
Gilchrist, Wm.	March 29, 1905	C 85	Stewart, Duncan H.	March 28, 1904	C 137
Gillespie, Hugh	April 6, 1904	C 8	Stewart, John	April 3, 1904	C 104
Gillespie, John	April 6, 1904	C 5	Stewart, Daniel W.	May 16, 1904	C 23
Gould, Alfred	April 17, 1906	C 112	Stoddart, Jacob	Feb. 21, 1905	C 73
Green, Francis	Oct. 11, 1904	C 38	Strachan, Robt.	April 27, 1904	C 15
Handlen, Jas.	June 16, 1904	C 122	Strang, James	April 27, 1904	C 10
Harmison, Wm.	Feb. 3, 1905	C 65	Sullivan, John	July 4, 1916	C 139
Hescott, John	Jan. 16, 1905	C 62	Thomas, John	March 29, 1905	C 97
Hoggan, Wm.	June 6, 1911	C 134	Vass, Robt.	Dec. 12, 1904	C 53
John, David	Nov. 8, 1904	C 49	Vater, Charles	April 6, 1904	C 66
John, Evan	July 25, 1916	C 140*	Webber, Chas.	Sept. 13, 1904	C 32
Johnson, Geo.	May 9, 1904	C 124	Webber, Charles F.	Sept. 13, 1904	C 33
Johnson, Wm. R.	March 1, 1905	C 75	Whiting, Geo.	May 29, 1905	C 117
Jones, Evan	April 30, 1913	C 136	Wilson, Austin	Feb. 7, 1905	C 67
Kerr, Wm.	March 29, 1905	C 91	Wilson, Thos.	April 27, 1904	C 11
Lander, Frank	Jan. 9, 1905	C 61	Woodburn, Moses	March 29, 1905	C 83
Lanfear, Herbert	Jan. 27, 1905	C 63	Yarrow, Geo.	Nov. 3, 1904	C 46

\* Issued in lieu of No. C 132, lost.

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## INSPECTION OF METALLIFEROUS MINES.

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### WEST KOOTENAY AND BOUNDARY DISTRICTS.

REPORT BY JAMES MCGREGOR, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for West Kootenay and Boundary Districts for the year 1919.

#### NELSON DISTRICT.

There has been more activity in mining in this district than last year, consisting principally of development-work; especially is this the case in the Sheep Creek section, where there are two long crosscut tunnels now being driven—one at the *Queen* mines property and one at the *Nugget* mines property; they are still being pushed forward, not having reached their objective as yet. A great interest is taken in these crosscut tunnels by those interested in mining in this district, and the result of any discoveries made is eagerly looked for.

Contiguous to the city of Nelson there has been considerable increase in development of both old and new properties; the amount of production has increased during the year, with every indication of greater production in the near future. At all times when these mines were inspected they were found in a safe and sanitary condition.

#### LARDEAU DISTRICT.

Mining conditions in this district remain about the same as last year, consisting of further development of the older properties and prospecting in new sections, with a fair outlook for the future.

#### BOUNDARY DISTRICT.

Mining in this district has not been so active as in the past year. The Granby mines, the largest producer in the district, ceased producing temporarily on June 14th, and I have no knowledge when operations will be resumed. Upon the many inspections made during the year of these large mines the travelling-ways, haulage-ways, shafts, and hoists were at all times kept in good condition. The sleeping and eating rooms were clean and sanitary. The same careful system of handling and transporting of explosives was carried out.

#### SLOCAN DISTRICT.

Although mining was active in this district during last year, the activity has increased considerably during this year. The number of smaller mines being operated under lease has increased, the older and producing mines have greatly extended their workings by systematic development, and in nearly all cases have increased their output, with the exception of the *Standard* mine, situated near Silverton, which has about ceased shipping entirely, devoting all attention to developing the present mine and systematically prospecting other sections of the property.

The scarcity of water for milling purposes when the cold weather freezes the streams has been a drawback in this district as in former years, which has quite an effect on production. The scarcity of efficient labour has also been a retarding factor throughout this district.

From my own inspection of the mines in this district and from the reports of H. H. Johnstone, Inspector of Mines, who inspected most of the mines of the district, we have found care has been exercised at all times in complying with the requirements of the "Metalliferous Mines Inspection Act."

## TRAIL DISTRICT.

The principal mines of this district are located at Rossland. While they have not produced to their full capacity, the production has been much greater than last year. A large force has been steadily engaged in developing known areas and prospecting new ones. These mines are the deepest in the Province and are well ventilated, the travelling-ways are kept clean and safe, as are the skips, safety-catches, guides, and hoisting-ropes. The timber, which is used in plenty in these mines, is, as usual, framed by machinery and carefully placed. The sanitary conditions in and around the mines are good.

## YALE DISTRICT.

There has been no increase in the number of producing metalliferous mines in this district during the year, but those producing have operated continuously during the year, and much has been accomplished in the several mines of this district by development, which has been persistently and systematically carried on by diamond-drilling and drifting. The *Copper Mountain* mine, the largest in the district and located on Copper mountain, in the Princeton section, has not commenced active production owing to lack of transportation facilities. This mine bids fair to be one of the largest producers in the Province in the near future; the mine is well developed and equipped with the most modern appliances for sustaining a large output for many years. Upon inspection of this mine I have found it well ventilated, safe, and sanitary; the same conditions exist in the bunk-houses and eating-rooms.

Enclosed is a list of accidents reported to the office which occurred in and around the metalliferous mines of these districts during the year 1919.

## EAST KOOTENAY AND NICOLA INSPECTION DISTRICTS.

## REPORT BY ROBERT STRACHAN, INSPECTOR.

I have the honour to submit the annual report as Inspector of Metalliferous Mines for the above districts during the year ending December 31st, 1919.

The mines operating in the East Kootenay District during that period were the *Sullivan* at Kimberley and the *St. Eugene* at Moyie, both owned by the Consolidated Mining and Smelting Company of Canada, and the *Paradise*, in the Windermere district, owned by R. R. Bruce.

In the Nicola District the only mine operating during the entire year was the *Iron Mask*, owned by the Kamloops Copper Company, of Kamloops, and very little work was carried out at either the Highland Valley, Aberdeen, or Stump Lakes mines.

**Sullivan.** E. Montgomery, superintendent. This mine, which is situated about twenty miles from Cranbrook and is reached by a branch of the Canadian Pacific Railway, worked fairly steadily in the earlier part of the year, but owing to labour troubles the output of ore was very much reduced toward the latter end. The ore mined contains silver, lead, and zinc, and during the past few years iron pyrites have also been shipped to the smelter at Trail. The upper portion of the mine is mostly stoping, while in the lower portion, or new tunnel district, practically all development. This tunnel, now driven in for a distance of almost 8,000 feet, has reached its objective—namely, the ore-body—and is connected to the upper working by a drill-hole. A shaft has been started to connect the two workings, but due to the labour trouble has not been finished.

During my inspections I have always found the conditions very good, and, so far as I could observe, the "Metalliferous Mines Inspection Act" very well complied with. The upper workings are ventilated by natural ventilation, while a small blower-fan provides a plentiful supply for the tunnel district. Samples of the mine-air taken and analysed at Ottawa show no signs of carbon monoxide or other noxious gases.

One fatal accident, the only accident reported during the year, occurred in the upper working of this mine owing to an ore-chute built through the ore-pile giving way, allowing the lower portion of the loose rock to run into the chute unknown, and when the surface caved one of the workmen was drawn into the slide. The unfortunate workman was caught on the edge of the chute, and to prevent him being carried into the chute it was found necessary to secure him by ropes.



**Iron Mask Mine and Concentrator, Kamloops.**



**Middlesboro Colliery, Nicola, M.D.**

The work of rescue was carried out under very dangerous conditions, requiring the removal of almost 500 tons of ore and the bracing of thousands of tons before the man was reached. This work occupied almost twenty hours, during which everything that was possible to do to render his condition more comfortable was done, but unfortunately he succumbed a few minutes before reached. The work of the miners and officials in the face of very difficult and dangerous conditions was worthy of the greatest praise, no efforts being spared to rescue the unfortunate man.

The mine is generally very well timbered and attention is paid to bar down all the loose rocks before setting up the machines. The explosives used are the different percentages of Polar Ammonia Dynamite, and this is kept in a well-protected magazine, only sufficient being taken out for the day's requirements, and no open lights are allowed near the powder-house, this being fitted with electric light.

The main levels and hoist-rooms are lighted with electric lights and the miners use carbide-lamps. The mine is regularly inspected by a committee appointed by the workmen and any defects reported are immediately attended to.

The ore from the inside workings is taken by electric locomotive to the bunkers, where the inferior grade is picked out, and in the case of the upper workings the rest is conveyed by aerial tramway to the ore-pockets at the railway-track, to which also the ore from the lower tunnel is taken direct. From the ore-pockets it is shipped in railway-cars to Trail smelter for treatment.

**St. Eugene.** Situated at Moyie. John Taylor, superintendent. The work here, as mentioned in last year's report, consists of recovering small bodies of ore which could not have been very profitably mined on a larger scale. The ore mined is silver and lead, and all the work is done with hand-steel, the ore being sorted and sacked in the mine; then trammed to the outside, from where it is hauled to the railway-siding at Moyie and shipped to Trail smelter. Only a few men are employed and I have generally found the conditions very good, both with respect to ventilation and timbering.

**Paradise.** Robert McDonald, superintendent. This mine is situated about twenty miles from Invermere, at an elevation of 7,600 feet, and is reached by a fairly good wagon-road, which is used for transporting the ore to the railway-siding at Invermere. The ore mined carries fairly high values in silver and lead, and about forty men have been employed very steady during the year. The method of mining is shrinkage stoping, and, as there is no attempt made to concentrate, only the richer portion of the ore-body is taken out. This is taken to the outside in trams by pushers, and in the case of the No. 4 level these are run down to the ore-pockets by a surface tram; from the No. 2 level an aerial tramway brings the ore down to the pockets.

At the time of my inspection I found the conditions to be very good, both with respect to ventilation and timbering, and owing to the soft nature of the ore the ground has to be piled ahead. A sample of the mine-air showed it to be fairly good and free from noxious gases. The explosive used is Polar Ammonia Dynamite, which is kept in a safe magazine and only sufficient taken out for the day's work. Cook-house, bunk-house, office, and other buildings are maintained at the mine, while a half-way house is maintained at Jackpine for the use of the teamsters. In the early and late parts of the winter it is frequently found necessary to change from wheels to sleigh, and this is done at Jackpine.

**Iron Mask.** A. Wallinder, superintendent. This property is situated about seven miles south-east of the city of Kamloops and consists of the *Iron Mask* and *Erin* claims. These two are connected and all the ore mined is hoisted through the *Iron Mask*. The ore is a copper sulphide and carbonates and is worked on a shrinkage-pillar method; it is hauled to the ore-pockets by horse-haulage, then hoisted to the surface and taken to the concentrator by belt-conveyor.

The shaft is 780 feet deep, using a skip on guides, a 125-horse-power hoist being used for hoisting with a 1-inch steel cable. The mine is timbered with square sets and stulls as required, and I have always found it very well timbered and every precaution taken to ensure safety for the workmen. There is a good current of air circulating and the mine is kept in good sanitary condition. There were twenty-one men employed underground at the time of my inspection and they seem very capable and well supervised.

Two compressors with a joint capacity of 1,100 cubic feet of free air a minute supply power for the drills, and the pumps are driven by electric power. All the machinery around the mine

is driven by electric power, which is supplied from the hydro-electric plant of the city of Kamloops, being brought over wires to the mine at a voltage of 11,000 and reduced to 440 for power purposes. The oil-flotation system of concentration is used, the concentrates being hauled by teams to the railway-siding at Cherry Creek, on the main line of the Canadian Pacific Railway.

Great trouble is experienced in getting a suitable supply of water, especially for domestic purposes, and this has also to be brought by teams from Cherry Creek, but it is expected in the near future to install a pump on the Thompson river and pump to a reservoir at the mine. Attached is a list containing the only accident reported during the year.

## COAST INSPECTION DISTRICT.

REPORT BY JOHN NEWTON, INSPECTOR.

I have the honour to submit my annual report of the metalliferous mines in my inspectorate for the year ending December 31st, 1919.

The mines were inspected by Mr. Newton up to December, 1919, when he was taken ill on an inspection trip to Britannia, Howe sound. In the *Fairview* mine, the operation was carried on as in former years—namely, the extension of mine drifts for stoping operations on veins previously opened. Mining at the upper glory-holes above the 250-foot level was not carried on as extensively as at the *Bluff* glory-hole, the latter being worked on a large scale for approximately nine months of the year, being forced to discontinue it on account of unfavourable weather conditions.

The 1,600-foot level was driven to connection through Britannia mountain during the year, this being the fifth tunnel to pierce the mountain, having portals on both the north and south side. On the south side, at the mouth of the 500-, 1,000-, and 1,600-foot levels, bunk-houses have been erected during previous years for the accommodation of employees working in those sections of the mine.

The Victoria tunnel (8 x 8 feet), to the east of the *Empress* workings, at an elevation corresponding to the 1,800-foot level, advanced during the year to a total of 485 feet, from which point they are carrying on extensive diamond-drill prospecting. The Hillside tunnel (8 x 8 feet), to the west of the *Jane* mine, on the 1,000-foot level, was advanced to a total of 480 feet. The raise which is being driven on a 65-degree slope, with dimensions 7 x 12 feet, for transportation purposes between the 4,100-foot level and the 3,100-foot level tunnels, and which was commenced in the previous year, was driven for a short period only and advanced to a total of 120 feet. The 3,100-foot level, east drift, advanced 113 feet, work on it continuing but a short time.

In addition to the foregoing and exclusive of the work on the 1,800-foot level, above mentioned, the diamond-drill footage for the year amounted to 3,922 feet, being distributed between the *Bluff*, *Jane*, and *Empress* sections of the mine.

Eight hopper-bottom cars, 3-foot gauge, 20-ton capacity, and two 3-foot gauge, 20-ton, all-steel flat cars were added to the outside ore-haulage equipment for the transportation of ore between the rock-raise and the tramway and incline ore-bins.

The welfare of the Beach community was further considered during the year by the erection of a building 64 feet long by 36 feet wide, two stories high. The ground floor is occupied by barber-shop, billiard and pool hall, and reading-room; while the upper floor is fitted up as a dance-hall, which is much in requisition during the winter months. The building is heated by steam and provided with Brasco lights throughout.

On account of upset market conditions resulting in a very low price for copper, it was necessary to carry the operation on a reduced basis throughout practically the whole of the year, with the result that the programme in connection with transportation tunnels and raises and other construction-work was greatly curtailed. This operation was reported well ventilated and in safe condition.

This mine is situated on Texada Island and is operated by the Tacoma Steel  
**Marble Bay.** Company. The officials are: E. F. Eastman, managing director; D. C. Stevens, general superintendent. The mechanical equipment is the same as reported in 1918. This mine has now reached a vertical depth of 1,600 feet below the collar of the shaft. A considerable proportion of the tonnage was mined from the 1,600-foot level and some development and drilling was carried on in the 1,700 level, which is 225 feet below the 1,600-foot level on a pitch of 45 degrees. This mine was well ventilated and in good and safe condition.

## NORTHERN INSPECTION DISTRICT.

## EXTRACTS FROM REPORT OF T. J. SHENTON, INSPECTOR.

The *Engineer* mine on east side of Taku arm is the only metalliferous mine being worked in the Atlin Division. "Ample provision has been made to meet requirements so far as safety, ventilation, and sanitation are concerned."

*Premier.*—Portland Canal Mining Division. "I found all conditions, both in and about the mine, to be in harmony with the 'Metalliferous Mines Inspection Act.'"

*Swamp Point.*—Portland Canal Mining Division. Operated by Granby Company. "The prevailing conditions at this mine are in accord with the 'Metalliferous Mines Inspection Act.'"

*Anyox Mines.*—Owned by Granby Company. "The prevailing conditions in connection with the whole of the works in the mine and on the surface have been in full compliance with the 'Metalliferous Mines Inspection Act.'"

*Quartz Point.*—Owned by Granby Company. "The prevailing conditions of ventilation, timbering, and other matters pertaining to the safety of those employed has been in satisfactory compliance with the law."

*First-aid and Safety-first Work of Granby Co.*—"There is no part of the work more carefully attempted on the part of the Granby management which is more gratifying to me than that relating to the endeavour being made in first-aid and safety-first work."

*Missouri and Joker.*—"The general conditions of timbering, ventilation, etc., were well within the stipulations of the 'Metalliferous Mines Inspection Act.'"

*Dolly Varden.*—Nass Mining Division. "In all my inspections of this mine I am able to say that the operations, and consequently prevailing conditions, were in keeping with the requirements of the 'Metalliferous Mines Inspection Act.'"

*Grouse Mountain.*—Omineca Mining Division, twenty miles from Telkwa. "I have inspected this property a number of times during the present year and I have found the company always willing to co-operate with me in the carrying-out of the recommendations of the law."

*Silver Standard.*—"In all my visits of inspection to this mine I have found the general conditions in strict accord with the 'Metalliferous Mines Inspection Act.'"

*Surf Inlet.*—Princess Royal island. "In my inspections of the mine I have always found a willingness on the part of the management to co-operate in carrying out the 'Metalliferous Mines Inspection Act.' The general conditions of the entire operations are fully in accord with the Act."

*Ikeda.*—Queen Charlotte Islands. "In my inspection of the mine I found the general conditions to be in fair keeping with the 'Metalliferous Mines Inspection Act.'"

## LIST OF ACCIDENTS IN METALLIFEROUS MINES, 1919.

## COAST DISTRICT.

REPORT BY T. J. SHENTON AND JOHN NEWTON, INSPECTORS.

No.	Mine.	Date.	Name.	Occupation.	Details.
1	Surf Inlet.....	Jan. 3	G. C. Adams..	Mucker.....	Wound on scalp, shoulder, arm, and hand, left side; rock fell off hanging-wall and struck him.
2	" .....	" 4	P. Jonikatis..	Machine and bar man	Piece of rock fell on right wrist, inflicting wound $1\frac{1}{2}$ inches long.
3	" .....	" 25	Thos. Koleff..	Machineman	Small rock rolled down manway, hitting him on left foot, causing severe bruise.
4	" .....	Feb. 21	Cecil A. Brett.	Asst. to Mine Engineer	Bruises on right side of neck, severe laceration of scalp over right temple, caused by being struck by piece of drill-steel while passing steel chute.
5	" .....	March 6	A. L. Donahue.	Timberman..	Fatally injured by being caught between skip and timbers in shaft.
6	" .....	April 7	A. Mikuliki..	Mucker.....	Wound on right ear, caused by bar slipping and hitting him.
7	Britannia.....	June 7	Val Dapoto..	Miner .....	Fell into glory-hole and was crushed to death.
8	Hidden Creek .....	" 25	Nat Condo....	Barman.....	Fell down stope, receiving fatal injuries.
9	Britannia.....	July 14	Oscar Granberg	Miner .....	Fell through grizzly, dropping 170 feet, and was killed.
10	" .....	Dec. 10	Dan Gillis....	" .....	Fatally injured through being struck by material when compressed-air pipe broke at mine portal (surface).
11	Hidden Creek .....	" 16	D. McLeod....	Chuteman...	Dislocated right hip, bruised right side, caused by being hit with rock in chute, which he had entered in violation of order forbidding same.

## KOOTENAY-SIMILKAMEEN DISTRICT.

REPORT BY JAMES MCGREGOR, H. H. JOHNSTONE, AND ROBERT STRACHAN, INSPECTORS.

12	Granby, Phoenix..	Mar. 19	G. T. Mattock.	Motorman..	Broken bone of right leg, caused by rock rolling over chute-gate and striking him.
13	" .....	April 13	H. Christensen	Mucker-boss.	Bruised shoulders and broken leg, caused by being hit with rock rolling down chute.
14	Horne Silver, Similkameen	" 24	James Fuller..	Blacksmith..	Cut on top of head, caused by small rock rolling down mountain-side and striking him while in a stooping position (surface).
15	Copper Mountain, Similkameen	May 3	Alex. Corsi....	Barman.....	Fracture of two ribs on left side and small puncture of left lung, bruises on body and cuts on face and head, caused by falling rock knocking out staging in shaft, dropping him 20 ft.
16	Sullivan, Kimberley....	June 9	Henry Hogberg	Miner .....	Fatally injured by being dragged into chute and buried with rock.
17	Rosebery Surprise.....	July 6	Wm. Eccles...	Mucker.....	Radius of right arm broken half-way between hand and elbow, wound in hand, and other minor bruises, caused by fall of rock.
18	Sally, Greenwood.....	" 16	John Ryan....	Miner .....	Strained muscles in right knee, caused by falling clay.
19	Bluebell, Riandel.....	" 18	Fred. Watts...	Carman.....	Right foot bruised by falling from loading-platform to deck of barge.
20	Wonderful, Sandon....	" 27	Ernest Larson.	Miner .....	Damage to hip and internal injuries, caused by fall of rock from foot-wall.
21	Bell, Beavardell.....	Nov. 15	T. Sullivan....	" .....	Bruised leg caused by fall of rock.

TABULATED LIST OF ACCIDENTS IN METALLIFEROUS MINES, 1919.

	Cause of Accident.	Extent of Injury.			
		Fatal.	Serious.	Slight.	Total.
A	Blasting.....	..	..	..	..
B	Defective powder.....	..	..	..	..
C	Drilling.....	..	..	..	..
D	Powder in muck.....	..	..	..	..
E	Shafts and cages, accidents connected with.....	1	..	..	1
F	Falling down shafts, stopes, or winzes.....	1	..	..	1
G	Falling down chutes.....	3	..	1	4
H	Mine-cars.....	..	..	..	..
I	Rock falling in stopes, levels, etc.....	..	..	2	2
J	Rock falling down chutes or openings.....	..	3	5	8
K	Timbering.....	..	..	..	..
L	Miscellaneous, underground.....	..	..	2	2
M	Miscellaneous, surface.....	1	..	2	3
	Totals.....	6	3	12	21
Accidents for each 100,000 tons ore mined.....		0.280	0.140	0.560	0.98
Accidents for each 1,000 men employed.....		1.588	0.794	3.176	5.55

## COAL-MINING IN BRITISH COLUMBIA.

BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

During the year 1919 there was mined in the various collieries of the Province 2,408,948 tons (2,240 lb.) of coal, a decrease from the preceding year of 169,776 tons, equivalent to about 6.5 per cent.

The output of coke shows a decrease of about 51 per cent. as compared with the previous year.

The following table shows, for the past ten years, the output and the *per capita* production of the various districts:—

OUTPUT AND PER CAPITA PRODUCTION OF VARIOUS DISTRICTS.

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1910	East Kootenay District	1,365,119	3,111	439	2,374	575
	Coast District.....	1,774,116	4,647	382	3,529	502
	Whole Province.....	3,139,235	7,758	404	5,903	532
1911	East Kootenay District	442,057	2,197	201	1,585	272
	Coast District.....	1,855,661	4,676	397	3,627	511
	Whole Province.....	2,297,718	6,873	334	5,212	440
1912	East Kootenay District	1,261,212	2,410	523	1,780	708
	Coast District.....	1,764,497	4,720	374	3,495	504
	Whole Province.....	3,025,709	7,130	424	5,275	574
1913	East Kootenay District	1,331,725	2,666	500	1,965	678
	Coast District.....	1,239,035	3,777	328	2,865	433
	Whole Province.....	2,570,760	6,443	399	4,830	532
1914	East Kootenay District	955,183	2,397	399	1,749	547
	Coast District.....	1,211,245	3,335	363	2,518	481
	Whole Province.....	2,166,428	5,732	379	4,267	508
1915	East Kootenay District	852,572	1,748	488	1,183	721
	Coast District.....	1,120,008	3,230	347	2,512	446
	Whole Province.....	1,972,580	4,978	396	3,695	534
1916	East Kootenay District	882,270	1,674	527	1,125	784
	Coast District.....	1,603,310	3,386	474	2,569	624
	Whole Province.....	2,485,580	5,060	491	3,694	673
1917	East Kootenay District	551,751	1,481	372	944	584
	Coast District.....	1,846,964	3,689	501	2,816	656
	Whole Province.....	2,398,715	5,170	463	3,760	638
1918	East Kootenay District	732,864	1,327	552	814	900
	Coast District.....	1,845,860	4,100	450	2,844	645
	Whole Province.....	2,578,724	5,427	475	3,658	705
1919	East Kootenay District	558,806	1,369	409	1,000	559
	Coast District.....	1,850,142	4,597	402	3,145	588
	Whole Province.....	2,408,948	5,966	404	4,145	581

While no figures can be given as to the actual cost of mining in the different fields, the *per capita* production of these fields is of interest, as having a bearing upon the working costs and as indicating the mining facilities existing and the improvement made in these conditions from year to year.

It will be seen from the foregoing table that the production *per capita* increased more or less regularly up to the year 1912, but that the years 1913, 1914, 1915, and 1919 show a decrease, especially in the Coast District. This decreased effectiveness, during the last few years, of the labour employed is largely due to the extension of the workings of the mines, causing a greater length of haulage and greater extent of old workings to be taken care of, but some of the increased labour is undoubtedly on account of the greater number of men employed in safeguarding the mine and workmen. In the year 1917 it will be observed that while the *per capita* output of the Coast collieries also shows an increase, the Crow's Nest District shows a very considerable decrease, which is caused by the fact that a large amount of the underground labour in these collieries is engaged in non-productive work, such as repairing the damage from the former explosion and in opening up a new system of mining which it is expected will tend to greater safety of employees and also of the property.

In 1919 in the Coast District the production *per capita* of men employed underground has decreased from 645 tons to 588 tons, and in the Crow's Nest District such production *per capita* has decreased from 900 tons, the highest ever attained in British Columbia, to 559 tons, the lowest it has been in that district since 1914.

The market of the East Kootenay field is provided primarily by the railways of the south-eastern part of the Province and of the northern parts of the adjoining States of Montana and Washington, approximately three-quarters of the coal, sold as such, being exported to those States, while the remainder went to supply the demands of the south-eastern part of the Province—its domestic needs, its railways, steamboats, mines, and smelters. The competition of fuel-oil, frequently referred to in the past, has diminished and promises to practically cease, as supply of oil is scarcely attainable now, and even then only at a price which is not competitive with coal.

Coke, a product of the coal-mines, is sold in the same markets, with the difference that the local consumption—chiefly by the smelters of Trail and the Boundary District—took about 90 per cent. of the product, while 10 per cent. was exported to the States mentioned.

As regards the marketing conditions in this field, the East Kootenay collieries are, however, brought into direct competition with the collieries of Alberta, just over the Provincial boundary-line, all these collieries being in the same coalfield, with practically the same grade of coal and working under similar conditions.

The Coast District may be subdivided into two fields—the Nicola-Princeton field and the Vancouver Island field—in which the markets differ considerably.

The new coalfield on the Telkwa river, in Omineca Division, produced some 1,752 tons of coal which was sold locally. The production of this field has been included in the Coast District.

In the Nicola-Princeton field the consumption is chiefly by the local railways, while a small amount finds its way to Vancouver, even under the handicap of what seems to be an excessively high freight charge.

The Vancouver Island coal market is provided by the domestic and manufacturing requirements of the Coast cities, and of the ocean-going steamers calling at these ports.

The larger coasting steamers and railways, which in later years have all been using California crude oil as fuel, will now be forced to come back to the use of coal, which will mean a largely increased production from Coast collieries.

As in former years, the greater proportion of the coal production was made by three larger companies—the Crow's Nest Pass Coal Company, with two collieries in East Kootenay; and by the Canadian Western Fuel Company, of Nanaimo, and the Canadian Collieries (Dunsmuir), Limited (formerly the Wellington Colliery Company), these last two operating on Vancouver island.

In addition to these large collieries, shipments have been made by the Corbin Coal and Coke Company, in East Kootenay; by the Middlesboro Collieries, Fleming Coal Company (operating Coal Hill Colliery), and Coalmont Collieries, Limited, all of the Nicola Valley; by the Princeton Coal and Land Company, of Princeton; by the Pacific Coast Coal Mines, Limited, British Columbia Coal Mining Company, Limited (formerly Vancouver & Nanaimo Coal Mining Com-

pany), and Nanoose Collieries, Limited, all operating on Vancouver island, near Nanaimo; and by Granby Colliery No. 1 at Cassidy, and Telkwa Collieries Company, of Telkwa.

The details of the shipments made by each of these companies will be found in reports of the Inspectors of the various districts.

During the year 1919 about 60 per cent. of the coal, sold as such by the collieries of the Province, was consumed in British Columbia; and the remainder was exported to the United States, including Alaska. Of the coke sold, about 90 per cent. was consumed in British Columbia, and the remaining 10 per cent. was exported to the United States.

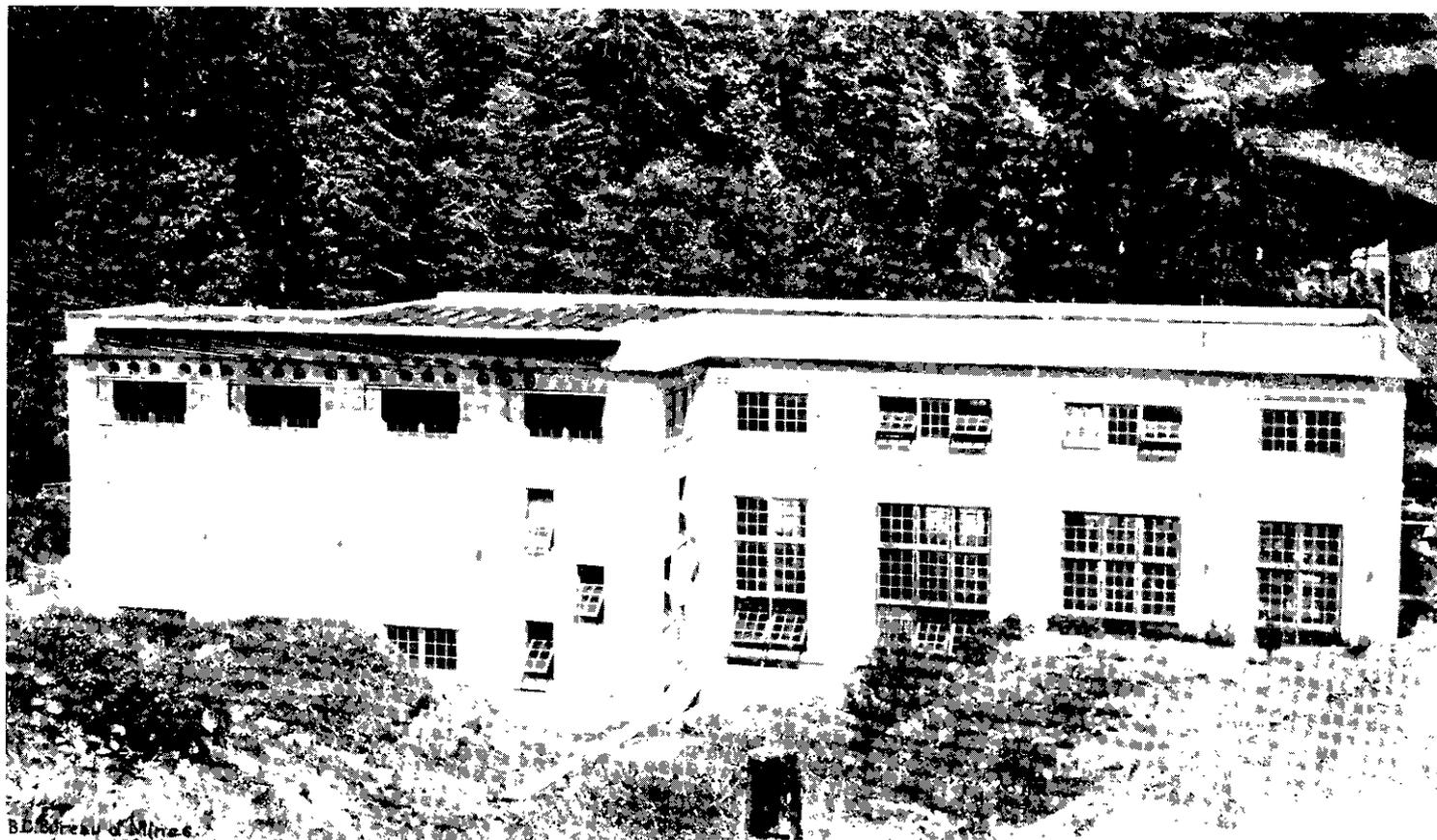
The distribution of this output of coal and coke is shown in the following table:—

COAL AND COKE PRODUCED, EXPORTED, ETC., BY PROVINCE DURING YEAR 1919.

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada .....	1,057,404		84,631	
" export to United States .....	763,990		8,134	
" " other countries .....				
Total sales .....		1,821,394		92,765
Lost in washing .....	252,380			
Used in making coke .....	141,407			
Used under colliery boilers, etc .....	210,003		76	
Total for colliery use .....		603,790		76
		2,425,184		92,841
Stocks on hand first of year .....	12,924		2,119	
" last of year .....	76,688		416	
Difference taken from stock during year .....		16,236		1,703
Output of collieries for year .....		2,408,948		91,138

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	221		119		340	
Whites—Miners .....	1,869				1,869	
Miners' helpers .....	79		2		81	
Labourers .....	822		574		1,396	
Mechanics and skilled labour .....	542		546		1,088	
Boys .....	94		118		212	
Japanese—Miners .....	60				60	
Helpers .....	7				7	
Labourers .....	14		1		15	
Chinese—Miners .....	92				92	
Helpers .....	118				118	
Labourers .....	223		461		684	
Indians—Labourers .....	4				4	
Totals .....	4,145		1,821		5,966	



B.C. Bureau of Mines 6

Canadian Collieries—Hydro-electric Power Plant, Comox.

## COLLIERIES OF THE COAST DISTRICT.

The gross output of the Coast District collieries, including the Nicola valley and Telkwa, for the year 1918 was 1,850,142 tons (of 2,240 lb.) of coal actually mined, while some 3,407 tons was taken from "stock," making the actual consumption of coal 1,853,549 tons.

Of this gross consumption, 1,382,119 tons was sold as coal, 163,378 tons was consumed by the producing companies as fuel, and 252,380 tons was lost in washing; while 55,672 tons was used in making coke.

Formerly, in 1902, the Coast collieries exported to the United States 75 per cent. of their coal; in 1910 they exported thereto only 24.5 per cent. of their product, 71.3 per cent. of the output being consumed in Canada. In 1911, 76.1 per cent. of the coal sold was for consumption in Canada, 21.6 per cent. was exported to the United States, and 2.3 per cent. to other countries.

In 1912, 71.25 per cent. was sold for consumption in Canada, 21.25 per cent. exported to the United States, and 7.47 per cent. to other countries.

In 1913, 89.8 per cent. was sold for consumption in Canada, and the balance, or 10.2 per cent., was exported to the United States.

In 1914, 77.3 per cent. was sold for consumption in Canada, and the balance, or 22.7 per cent., was exported to the United States.

In 1915, 67 per cent. was sold for consumption in Canada, and the balance, or 33 per cent., was exported to the United States.

In 1916, 63 per cent. was sold for consumption in Canada, and the balance, or 37 per cent., was exported to the United States.

In 1917, 60 per cent. was sold for consumption in Canada, 37 per cent. exported to the United States, and 3 per cent. to other countries; and in 1918 the proportions were almost the same.

In 1918, 66 per cent. was sold for consumption in Canada, 30 per cent. exported to the United States, and 4 per cent. to other countries.

In 1919, 72 per cent. was sold for consumption in Canada, and the balance, 28 per cent., was exported to the United States.

The following table gives an aggregate summary of the output of the Coast collieries for the year 1919, and shows the disposition made of such product:—

COAL-OUTPUT FROM THE COAST DISTRICT FOR YEAR 1919.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada.....	991,477		35,635	
" export to United States.....	390,642			
" " other countries.....				
<b>Total sales.....</b>		<b>1,382,119</b>		<b>35,635</b>
Lost in washing.....	252,380			
Used in making coke.....	55,672			
Used under colliery boilers, etc.....	163,378		76	
<b>Total for colliery use.....</b>		<b>471,430</b>		<b>76</b>
		<b>1,853,549</b>		<b>35,711</b>
Stocks on hand first of year.....	75,978		1,744	
" last of year.....	72,571		104	
Difference taken from stock during year.....		3,407		1,640
<b>Output of collieries for year.....</b>		<b>1,850,142</b>		<b>34,071</b>

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	176		101		277	
Whites—Miners .....	1,357				1,357	
Miners' helpers .....	72		2		74	
Labourers .....	647		384		1,031	
Mechanics and skilled labour .....	292		403		695	
Boys .....	83		100		183	
Japanese—Miners .....	60				60	
Helpers .....	7				7	
Labourers .....	14		1		15	
Chinese—Miners .....	92				92	
Helpers .....	118				118	
Labourers .....	223		461		684	
Indians—Labourers .....	4				4	
Totals .....	3,145		1,452		4,597	

The following tables show the output of coal and the disposition made of it in the subdivisions of the Coast District:—

## COAL-OUTPUT, ETC., 1919, VANCOUVER ISLAND SUB-DISTRICT.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	858,001		35,635	
" export to United States .....	385,927			
" other countries .....				
Total sales .....		1,243,928		35,635
Lost in washing .....	251,239			
Used in making coke .....	55,672			
" under colliery boilers, etc. ....	151,736		76	
Total for colliery use .....		458,647		76
		1,702,575		35,711
Stocks on hand first of year .....	74,597		1,744	
" last of year .....	71,370		104	
Difference taken from stock during year .....		3,227		1,640
Output of collieries for year .....		1,699,348		34,071

## COAL-OUTPUT, ETC., 1919, NICOLA-PRINCETON SUB-DISTRICT.

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada .....	131,724			
" export to United States .....	4,715			
Total sales .....		136,439		
Lost in washing .....	1,141			
Used in making coke .....	11,642			
" under colliery boilers, etc .....				
Total for colliery use .....		12,783		
		149,222		
Stocks on hand first of year .....	1,381			
" last of year .....	1,201			
Difference added to stock during year .....		180		
Output of collieries for year .....		149,042		

## COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1919 was 558,806 tons (2,240 lb.) of coal actually mined, while 12,829 tons was taken from stock, making the actual consumption of coal 571,635 tons. Of this gross consumption of coal, 439,275 tons was sold as coal, 46,625 tons was consumed as fuel by the producing companies, while 85,735 tons was converted into coke, producing 57,067 tons of coke, while 1,640 tons was taken from stock and 76 tons used as fuel by the producing companies, making the coke sales for the year 57,130 tons.

The East Kootenay collieries exported to the United States about 85 per cent. of the coal sold and about 15 per cent. of the coke.

The following table gives an aggregate summary of the output of the East Kootenay collieries for the year 1919 and shows the dispositions made of such product:—

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	65,927		48,996	
" export to United States .....	373,348		8,134	
" " other countries.....				
Total sales.....		439,275		57,130
Used in making coke.....	85,735			
" under colliery boilers, etc.....	46,625			
Total for colliery use.....		132,360		
Stocks on hand first of year.....	16,946	571,635	375	
" last of year.....	4,117		312	
Difference taken from stock during year.....		12,829		63
Output of collieries for year.....		558,806		57,067

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	45		18		63	
Whites—Miners .....	512				512	
Miners' helpers.....	7				7	
Labourers .....	175		190		365	
Mechanics and skilled labour .....	250		143		393	
Boys .....	11		18		29	
Japanese .....						
Chinese .....						
Indians .....						
Totals .....	1,000		369		1,369	

## INSPECTION OF COAL-MINES, 1919.

The coal-producing areas of the Province are divided into the Coast District, which includes the Vancouver Island and the Nicola-Princeton coalfields, and the East Kootenay District.

### COAST DISTRICT.

This district, comprising, as it does, the coalfields of Vancouver island and the Coast, as well as those of the Nicola and Similkameen valleys, has been subdivided, for inspection purposes, into three Inspection Districts.

Two of these Inspection Districts are on Vancouver island, with headquarters for both at Nanaimo, which permits of one of the Inspectors being constantly at headquarters while the other is making inspections; it also permits of the interchanging of inspection duties, so that each Inspector knows both districts.

The third district is the Nicola-Princeton Inspection District, with headquarters at Merritt. During 1918 there was no Inspector for this district, but from January to May inspections were made by John Newton from the Nanaimo office; while from May to the end of the year the inspections were made by either Robert Strachan or Wm. Lancaster, Inspectors from the Fernie office.

#### NANAIMO INSPECTION DISTRICT.

JAMES DICKSON, INSPECTOR (OFFICE, NANAIMO).

The collieries operating and producing coal during the year in this Inspection District, including the new mines that have been started, were:—

**NANAIMO:** The Canadian Western Fuel Company—No. 1 shaft, Protection shaft, Reserve Colliery, Harewood mine, and two new shafts, called the Wakesiah shafts, which did not produce coal in 1918.

Pacific Coast Coal Mines, Limited—The Morden mine.

British Columbia Coal Mining Company, Limited—New East Wellington Colliery, Mountain District, Nanaimo, No. 1 slope.

Nanoose Collieries, Limited—No. 1 mine.

#### COMOX INSPECTION DISTRICT.

HENRY DEVLIN, INSPECTOR (OFFICE, NANAIMO).

The collieries operating and producing coal during the year in this Inspection District, including the new mines that have been started, were:—

**EXTENSION:** The Canadian Collieries (Dunsmuir), Limited—Nos. 1, 2, and 3 mines, all worked from what is known as the No. 1 tunnel, and No. 5 mine at South Wellington.

**CUMBERLAND:** The Canadian Collieries (Dunsmuir), Limited—Nos. 4 and 7 slopes and No. 5 shaft.

Granby Colliery No. 1 at Cassidy—3 slopes.

#### NICOLA-PRINCETON INSPECTION DISTRICT.

The collieries in this district were inspected during the year by Inspectors from the Nanaimo and Fernie offices.

The collieries operating during the year in this Inspection District, including the new mines that have been started, were:—

**NICOLA VALLEY:** The Middlesboro Colliery of the Middlesboro Collieries, Limited, Merritt—Nos. 2, 3, 4, 5, 6, and 7 mines.

Inland Coal and Coke Syndicate, Merritt—One shaft and 3 slopes.

Fleming Coal Company.

**PRINCETON:** Princeton Coal and Land Company's Princeton Colliery—No. 1 slope.

**COALMONT:** Columbia Coal and Coke Company, Limited—Developing only.

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### EAST KOOTENAY DISTRICT.

The East Kootenay District is subdivided into two Inspection Districts—i.e., Northern Inspection District and Southern Inspection District. Both these districts are inspected by Robert Strachan as Senior Inspector and Wm. Lancaster, Inspector with headquarters at the Mine-rescue Station at Fernie.

### NANAIMO INSPECTION DISTRICT.

REPORT BY JAMES DICKSON, INSPECTOR.

I have the honour to submit my annual report for the year ending December 31st, 1919, on the various coal-mines in my inspectorate, consisting of the Canadian Western Fuel Company, Pacific Coast Coal Mines, Nanoose Collieries, and the British Columbia Collieries, all in the Nanaimo Inspectorate.

A short description is given of each colliery in the district, with names of certified officials.

#### MINE-RESCUE AND FIRST-AID WORK.

I am pleased to be able to report that active interest has been displayed in rescue-training and first-aid work in this district. A number of men have studied first-aid work and qualified for the St. John Ambulance certificate during the year.

The service rendered by the trained first-aid man in the mine can be properly appreciated only by the persons who receive injuries in the course of their work, and who, but for the first-aid man, might have a considerable time to wait and a long distance to travel before receiving proper treatment.

A number of men have gone through the regular course of training in mine-rescue work at the Nanaimo Mine-rescue Station under the capable supervision of John D. Stewart, who is in charge of this station. The training included the use of the Draeger and the Gibbs apparatus in addition to lectures on the machine. There were ten periods of two hours each in the training-gallery, which contains an irrespirable atmosphere, so that conditions are as near as possible to what would naturally exist in a mine after a fire or explosion. The training is very arduous work and the men who take up this work in addition to their daily labour underground are to be highly commended.

In accordance with the requirements of the "Coal-mines Regulation Act," all officials, except those physically unfit, are required to take a course in rescue-work. This year the Chief Inspector of Mines requested the various companies to see that any officials who were physically unfit to take the full training attended the rescue-station for a course of lectures on the machine, so that in case of need they would be able to assist. A special certificate is given to each man who is found proficient at the termination of the lectures.

The rescue-station has been ready at all times to meet any emergency calls, but fortunately there was no accident where the apparatus was required.

On one occasion the spontaneous heating in some pillar-workings in the south side of No. 1 shaft required the use of the apparatus in sealing off the affected section. Mr. Stewart supervised the use of the apparatus underground on this occasion. The use of the apparatus made easy work of an operation which otherwise might have been difficult and dangerous.

## The Canadian Western Fuel Company.

Head Office—Nanaimo, B.C.

Capital, \$1,500,000.

### Officers.

G. W. Bowen, Vice-Chairman,  
 Mark Bate, Jr., Secretary-Treasurer,  
 John Hunt, General Superintendent,  
 T. R. Jackson, Mine Manager, No. 1 Mine,  
 David Brown, Mine Manager, Reserve Mine,  
 Robert Henderson, Harewood Mine,  
 William Moore, Wakesiah Mine,

### Address.

Nanaimo, B.C.  
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 Nanaimo, B.C.

The above company has operated the following collieries at Nanaimo during the past year, namely: No. 1 or Esplanade shaft, Nanaimo; Protection Island mine, Harewood, and Reserve.

The following returns show the combined output of all the company's mines for the past year:—

### AGGREGATE RETURNS FROM CANADIAN WESTERN FUEL COMPANY'S MINES FOR YEAR 1919.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	310,888			
"  export to United States .....	171,415			
"  "  other countries .....				
Total sales .....		482,303		
Used under colliery boilers, etc. ....	92,267			
Lost in washing .....	61,676			
Total for colliery use .....		153,943		
		636,246		
Stocks on hand first of year .....	43,292			
"  last of year .....	43,611			
Difference added to stock during year. ....		2,319		
Output of collieries for year .....		638,565		

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	43	.....	28	.....	71	.....
Whites—Miners .. .. .	489	.....	.....	.....	489	.....
Miners' helpers .. .. .	.....	.....	.....	.....	.....	.....
Labourers .. .. .	284	.....	182	.....	466	.....
Mechanics and skilled labour .. .	102	.....	141	.....	243	.....
Boys .. .. .	55	.....	37	.....	92	.....
Japanese .. .. .	.....	.....	.....	.....	.....	.....
Chinese—Labourers .. .. .	.....	.....	128	.....	128	.....
Indians .. .. .	4	.....	.....	.....	4	.....
Totals .. .. .	977	.....	516	.....	1,493	.....

## NANAIMO COLLIERY.

Thomas R. Jackson, Manager.

## No. 1 SHAFT, ESPLANADE.

Edward Courtenay, Overman, North Side; Robert Adams, James McMeakin, John Hamilton, Frank Jaynes, Joseph Dean, John Sullivan, William Johnson, James Dudley, Ernest Kelly, John Blinkhorn, George Jardine, George Stewart, William Halliday, Joshua Norris, George Perry, John Marrs, John Shipley, Elias Rogers, and Thos. W. Woods, Firebosses.

Access to this mine is given by three shafts—No. 1 shaft, Protection shaft, and Newcastle shaft—and work is carried on in the Douglas and Newcastle seams. The Newcastle seam is from 3 to 3.5 feet thick and is worked by the long-wall method. In some sections the mining is done by hand, but most of the output is produced by machine-mining. Where the ground is faulty or the face is not extensive the mining is done by the "puncher" machine, and where there is sufficient length of face to warrant it the long-wall machine known as the "pick quick" is used. Both machines give good results in this seam.

The "pick quick" machine undercuts the coal to a depth of 6 feet, after which it is drilled and shot down. The coal is loaded into cars by loaders working under the direct supervision of a faceman. This faceman is a certificated miner. The coal loaded from the long-wall workings is hauled by rope-haulage to No. 1 Main level, after which it is hauled by electric motors to No. 1 shaft. In this part of the mine the Douglas seam is worked in the sections known as Protection pillars and Lamb's incline. In Lamb's incline, where the pillars are being drawn, the gob is well supported by cogs.

The ventilation in these districts is produced by a Guibal force-fan, 9 x 18 feet, rope-driven at 70 revolutions a minute by a 100-horse-power engine. This fan is capable of producing 100,000 cubic feet of air a minute at a 2-inch water-gauge. There is also an emergency fan at Newcastle shaft.

On the last examination I found 66,000 cubic feet of air passing down the Protection slope, dividing into four splits.

*No. 1 Slope.*—There was 12,500 cubic feet of air a minute passing into this section for the use of twenty-six men and four horses. The timbering was well done and the section in fair condition generally, and no explosive gas was found.

*No. 2 Slope.*—There was 14,000 cubic feet of air a minute passing into this section for fifty men and six horses.

*No. 3 Slope.*—There was 10,000 cubic feet of air a minute passing into this section for the use of forty-four men and six horses. The Burrell gas-detector showed 0.2 per cent. of methane.

*Lamb's Incline.*—There was 5,400 cubic feet of air a minute passing into this split for the use of thirty-two men and four horses. This section was well timbered in the roadways and the gob was well packed with cogs. No explosive gas was found. The Burrell gas-detector did not show any gas present.

*South Side of No. 1, Nanaimo.*

Robert Laird, Overman; John Weeks, Frank Green, Matthew Gunniss, Alex. Coombs, George Bradshaw, William Neave, Matthew Broderick, and Moses Woodburn, Firebosses.

The workings are all in the Douglas seam and, except for one prospecting-tunnel, are confined to the extraction of pillars.

The South side of this mine has been much troubled during the past few years by spontaneous combustion, which has at times interfered with the operation of the mine. During the past year several instances have occurred which necessitated sealing off the part affected.

The company maintains a crew of men experienced in this work, and immediately any heating starts, which is generally detected by the smell, all the openings leading to the suspected place are sealed. By means of chains of stoppings the pillar-workings are subdivided into comparatively small sections, so that it is easy to isolate any particular part without interfering with the general operations.

The Main slope was reopened during the year, and a rock tunnel, known as No. 8 North level, has been driven a distance of 350 feet. The coal found so far has proved disappointing, but prospecting is being continued. With the above exception, all the operations on the South side are retreating.

The ventilation is produced by a 72- x 90-inch double-inlet Sirocco fan, rope-driven, ratio  $3\frac{1}{2}$  to 1, capable of producing 195,000 cubic feet of air a minute at 4-inch water-gauge, and is driven by an engine of 350 horse-power. A duplicate ventilation installation is kept in readiness for any emergency.

On my last inspection I found the following to be the condition of the ventilation in the various splits:—

*Simms Dip Section.*—There was 9,000 cubic feet of air a minute passing into this section for the use of twenty men and three horses. This section was well timbered and in fair condition generally. Burrell gas-detector showed 0.4 per cent. methane. This section is fairly free from coal-dust.

*Right Incline Section.*—There was 3,000 cubic feet of air a minute passing into this section for the use of five men and one horse. Timbering and roadways in good condition. Burrell gas-detector showed 0.4 per cent. methane. This section is fairly free from coal-dust.

*Farmer's Incline Section.*—The ventilation was poor in this section and on this occasion, especially at the working-faces. The attention of the management was drawn to this and it was remedied at once. There was 3,000 cubic feet of air passing into this section for the use of sixteen men and three horses. The timbering and roadways were in fair condition. The Burrell gas-detector showed 0.9 per cent. of methane. There is no shot-firing in this section, as it is considered a dusty section.

*No. 7 Level.*—There was 5,000 cubic feet of air a minute passing into this section for the use of eighteen men and two horses. Roadways and timbering in good condition. Burrell gas-detector showed 0.6 per cent. methane.

*No. 2 South Section.*—There was 3,000 cubic feet of air a minute passing into this section for the use of ten men and two horses. Timbering and roadways in good condition. Burrell gas-detector showed 0.3 per cent. of methane. Main return showed 0.4 per cent. of methane, with 30,000 cubic feet of air a minute passing.

The following are the official returns from the No. 1 shaft and Protection Island collieries for the year 1919:—

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada .....	165,686			
" " export to United States .....	91,354			
" " other countries .....				
Total sales .....		257,040		
Used in making coke .....				
Used under colliery boilers, etc. ....	46,784			
Lost in washing .....	25,348			
Total for colliery use .....		72,132		
		329,172		
Stocks on hand first of year .....	34,067			
" " last of year .....	24,096			
Difference taken from stock during year .....		9,971		
Output of colliery for year .....		319,201		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	19	\$	14	\$	33	
Whites—Miners .....	236	7.86			236	
Miners' helpers .....						
Labourers .....	180	5.21-5.38	83	4.25-5.73	263	
Mechanics and skilled labour .....	61	5.75-6.43	68	5.86-7.08	129	
Boys .....	25	2.98-4.87	11	2.22-4.15	36	
Japanese .....						
Chinese .....			58	2.82-3.85	58	
Indians .....						
Total .....	521		234		755	

## RESERVE MINE.

David Brown, Manager; Francis John, Overman; George Moore, Benjamin Cheetham, Fred Ball, John Walbank, Harry Meikle, Allan Ford, Fred Hille, James Knowles, John Ovington, George Frater, and Albert Manifold, Firebosses.

The mine is situated in what is known as the Cranberry district, about five miles south of No. 1 shaft, Nanaimo. The coal is reached by two shafts at a depth of 955 feet, from which a rock tunnel 8 x 10 feet in area is driven across the measures on a 1-per-cent. grade to the rise. The tunnel tapped the seam at a distance of 180 feet.

The shaft-bottom is laid out in a most up-to-date method for handling large quantities of coal. All the tracks are laid with 30-lb. rails and on a grade of 1 per cent. up from the shaft. All the main tunnels leading to this shaft are timbered with 12- x 12-inch timbers.

The seam worked in this mine is the Douglas, the thickness of which varies from 1 to 20 feet. The pitch varies from 10 to 50 degrees and is generally dipping north or north-east. The coal is mostly of a soft nature, with a fairly strong shale roof, while the floor is generally black shale, sometimes mixed with boulders of hard rock.

The coal in the No. 1 West heading varies from 5 to 10 feet in thickness and is of a very hard nature. There is a diamond-drill hole down a considerable advance behind this heading and in about 9 feet of coal. If the present thickness of coal continues in this No. 1 West heading, a large tunnel will be driven on a 1-per-cent. grade, back of No. 1 holsting-shaft, and connect with the shaft about 150 feet above the present shaft-bottom.

The ventilation of the mine is produced by a pair of 90-inch Sirocco fans, connected to a 20 x 30 engine, rope-driven. On the engine is a drive-wheel 17 feet in diameter and on the fan-shaft a drive-wheel 5 feet in diameter; these fans, running with an engine-speed of 16 revolutions a minute, produce 140,000 cubic feet of air a minute in the fan-drift, with a 3-inch water-gauge. The fan and engine are installed on a concrete foundation 80 feet from the shaft.

The air is carried along the main levels on both sides of the mine and maintained by permanent stoppings of 12- x 12-inch timbers between the intake and return airways, these being kept close up to the face of the levels. The main intakes are naturally damp and systematic watering is carried out in the main places and around the chutes. There is very little gas found in the workings and analysis of the return shows a low per cent.

The mechanical haulage is all carried on by means of compressed-air winches, of which there are twelve in use. The pillars have been withdrawn in two small prospect sections which did not prove of sufficient value to warrant their continuation. One section in which pillars are being withdrawn was stopped owing to striking a fairly large feeder of water. Pillars are being extracted in all sections of this mine, but prospecting is being carried on by means of two pairs of headings about 2,000 feet apart. These headings are being driven up the full pitch of the seam and at the last inspection appear to be approaching a better part of the seam.

The following is the general condition of this mine on my last inspection:—

*No. 1 West Section.*—There was 15,000 cubic feet of air a minute passing for the use of twenty-eight men and three horses. This section was well timbered and in good condition generally. The Burrell gas-detector showed 0.2 per cent. methane. This section is fairly free from coal-dust.

*No. 8 Section.*—There was 8,750 cubic feet of air a minute for the use of eighteen men. This section was well timbered and the roadways were in good condition and free from dust, except No. 8 chute. The attention of the management was directed to this. The Burrell gas-detector showed 0.2 per cent. of methane.

*East Level.*—There was 15,000 cubic feet of air a minute passing for the use of thirty men and three horses. The timbering and roadways were in good condition generally and fairly free from coal-dust. The Burrell gas-detector showed 0.3 per cent. of methane.

*West Slant.*—There was 10,600 cubic feet of air a minute passing for the use of fourteen men and two horses. The timbering and roadways were in good condition and fairly free from coal-dust. The Burrell gas-detector showed 0.4 per cent. of methane.

*Main Return.*—There was 60,000 cubic feet of air passing a minute. The Burrell gas-detector showed 0.3 per cent. of methane.

Owing to trade conditions this mine was closed down from the end of May to August, when work was resumed.

The following are the official returns of the Reserve Colliery for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	38,809			
" export to United States.....	21,398			
" " other countries.....				
Total sales.....		60,207		
Used under colliery boilers, etc.....	16,081			
Lost in washing.....	5,370			
Total for colliery use.....		21,451		
		81,658		
Stocks on hand first of year.....	3,142			
" last of year.....	435			
Difference taken from stock during year.....		2,707		
Output of colliery for year.....		78,951		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	11	\$.....	5	\$.....	16	\$.....
Whites—Miners.....	91	7.32			91	
Miners' helpers.....						
Labourers.....	55	5.21 - 5.38	32	4.25 - 5.73	87	
Mechanics and skilled labour.....	22	5.75 - 6.43	25	5.86 - 7.08	47	
Boys.....	18	2.98 - 4.87	7	2.22 - 3.85	25	
Japanese.....						
Chinese.....		5.21 - 5.38	30		30	
Indians.....	4				4	
Totals.....	201		99		300	

HAREWOOD MINE.

Robert Henderson, Manager; John White, Overman; Alex. Bryden, James Hanlon, Joseph Dykes, John Kirkwood, John Sutherland, Henry Carroll, and William Watson, Firebosses.

Harewood mine was first opened about forty years ago, when the coal-outcropping at the bluff was worked for a small area. Operations were eventually suspended.

The mine was again opened in 1902, when a shaft was sunk to the dip of the old workings, entering the seam at a depth of 150 feet. Coal was worked to the rise and a pair of headings driven up to the old workings, when operations were again suspended in 1904.

The present operations were commenced in 1917. In August the tunnel driven by the first operations was cleared out, and the coal was reached about 1,000 feet from the present tunnel. Operations on the coal were commenced at the top of the old slopes, when skips were taken from the pillars until the coal-faces were reached, when a level was commenced and driven until a fault was struck in May, 1918.

At a point where the original face was, an incline was driven up and holed at the surface outcrop in the bluff 1,200 feet south of the old entrance. Coal is being worked to the right and left of this incline and varies from 2 to 12 feet in thickness.

The other workings are to the dip of No. 1 level, and the old slope is used as a haulage-road. No. 2 level is some 300 feet down and runs parallel to No. 1 level. Narrow skips were taken from the bottom of the pillars to make a roadway to the old face, where rock was encountered in such quantities that operations were suspended. The workings at the present are to the dip of this level and about 300 feet from the old face. This level has been driven about 750 feet from the level, but so far has been unable to penetrate through the rock to the south. Most of the working-faces are now being driven in the direction of the old slope and expect shortly to hole into the old pillars that were worked from the old shaft. The coal was taken out of the pillars between Nos. 1 and 2 levels during the operations in 1902 and 1904.

No. 3 level is some 250 feet farther down the slope from No. 2, to which it runs parallel, and the coal was worked to the dip until operations were suspended by a series of large faults. These pillars and the pillars between Nos. 2 and 3 levels are left and will not be extracted until the last operations. This No. 3 level is abandoned and now used as a return airway.

Nos. 4, 5, and 6 levels were started from the slope and driven in the same direction as the other levels. The area here was so broken up by faults that No. 6 was cut out and No. 5 driven up to No. 4, and this level now carries all the workings which were holed through to the places from the dip of No. 2 level.

The most important development during the year was the rock tunnel known as the southwest heading. This heading, after going in rock for a considerable distance, found coal about 6 feet thick. This part of the property is now being developed.

The haulage is performed by two electric locomotives and three electric hoists. The motors are used on the Main and No. 1 levels, and winches are used, one to pull out of No. 2 level dips, one from the slope, and one on No. 1 incline. The coal is all concentrated on No. 1 level and taken to the tunnel-mouth by the motors.

The air-current is at present divided into two splits, and there are two intakes, one by way of the tunnel and the other from the opening at the outcrop at the bluff. This current supplies No. 1 split, which comprises the workings of Nos. 1 and 2 inclines, and is passed over Nos. 1 and 2 levels by overcasts, returning down old No. 3 level over the slope and overcast to the counter-slope, and thence to the upcast shaft. No. 2 ventilates the No. 1 level and is taken from the tunnel intake current. After passing the working-faces the air joins No. 1 split air below No. 1 level overcast. The No. 2 split ventilates Nos. 2 and 3 levels and is taken down the slope for the tunnel intake, and after passing around the working-places is taken down the Main slope to the shaft.

The ventilation is produced by a Murphy fan placed near the top of the shaft. The pressure is 2.5 lb. to the square foot, and the total quantity is about 40,000 cubic feet a minute.

The power-house is also situated at the shaft and comprises two return-tubular boilers of 120 horse-power each and a Nagle engine coupled direct to the generator. The voltage is 250, with a capacity of 750 amperes. The screening plant comprises one shaker and one revolving screen, with a revolving dump, all of which are electrically driven.

In the shaft a manway is provided with ladders; a pump is stationed at the bottom to handle the mine-water. The drainage to this point is by gravity, and although the mine is fairly dry, considerable surface water is handled in the winter.

On my last examination I found 36,000 cubic feet of air a minute passing into the mine, dividing into two splits.

*No. 1 Split.*—There was 25,000 cubic feet of air a minute passing for the use of thirty-two men and seven horses.

*No. 2 Split.*—There was 11,000 cubic feet of air a minute passing for the use of fifty-nine men and eight horses. This mine was well timbered and is free from explosive gas and coal-dust. The Burrell gas-detector did not show methane present.

The following are the official returns of the Harewood Colliery for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada.....	103,510			
" " export to United States.....	57,073			
" " other countries.....				
Total sales.....		160,583		
Used in making coke.....				
" " under colliery boilers, etc.....	28,550			
Lost in washing.....	28,863			
Total for colliery use.....		57,413		
		217,996		
Stocks on hand first of year.....	6,083			
" " last of year.....	21,080			
Difference added to stock during year.....		14,997		
Output of colliery for year.....		232,993		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		\$		\$		
Supervision and clerical assistance.....	10		7		17	
Whites—Miners.....	131	9.07			131	
Miners' helpers.....						
Labourers.....	41	5.21 - 5.38	52	4.25 - 5.73	93	
Mechanics & skilled labour.....	14	5.75 - 6.43	42	5.86 - 7.08	56	
Boys.....	9	2.98 - 4.87	17	2.22 - 4.15	26	
Japanese.....						
Chinese.....			33	2.82 - 3.85	33	
Indians.....						
Totals.....	205		151		356	

WAKESIAH MINE.

William H. Moore, Manager; Thos. Jordan, Arthur Challoner, and Isaac Hill, Firebosses.

This mine is situated on the Canadian Western Fuel Company's farm, about two miles from Nanaimo, and is connected by a spur with the Harewood branch line. Two shafts were sunk to a depth of 320 feet and a pair of levels driven about 1,200 feet in a general south-westerly direction. Considerable difficulty was encountered with faults, etc., but at the present the prospects are good for rapid development, as a good seam of coal has been struck, varying from 3 to 12 feet in thickness. The output is now about 250 tons daily. Haulage is being carried on by means of two compressed-air winches supplemented by horses. The water is taken care of by a Duplex and two small Cameron pumps. Stables have been built underground. The methods of working are by pillar and stall and long-wall. In the former 60-foot pillars are left, stalls being driven 16 to 20 feet wide, levels 10 x 12 feet wide, timbered on 3½-foot centres.

The "pick quick" mining-machine is used in the long-wall, while the Sisco and Rand punchers are used in some of the stalls. The Denver clipper-drill is used for drilling. Safety-lamps only are used underground, except a few electric cap-lamps.

Ventilation is produced by means of a single-inlet, belt-driven Murphy fan operated as a blower, producing about 30,000 cubic feet of air a minute at 160 revolutions a minute.

The mine is damp and free from coal-dust. A small shaker screen making three grades of coal is used to prepare the product, while suitable railroad sidings have been built. The hoist is a 14- x 18-inch first-motion engine, to which steam is supplied by two 80-horse-power tubular boilers at 120 lb. pressure. A 6/19 1½-inch rope is used at No. 2 shaft, which is used temporarily as the hoisting-shaft until the permanent machinery is installed.

No serious accidents have yet been reported, notwithstanding the rather frail roof, and every possible effort is being put forth to maintain the enviable reputation in this respect. The rest of the plant is as reported last year.

On the occasion of my last inspection there was 21,000 cubic feet of air a minute passing for thirty-five men and three horses. This mine is practically free from coal-dust and no explosive gas was found. Burrell gas-detector showed 0.2 per cent. of methane.

The following are the official returns from the Wakesiah Colliery for the year 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada.....	2,883			
" export to United States.....	1,590			
" " other countries.....				
Total sales.....		4,473		
Used in making coke.....				
Used under colliery boilers, etc.....	852			
Lost in washing.....	2,095			
Total for colliery use.....		2,947		
		7,420		
Stocks on hand first of year....				
" last of year.....				
Difference added to stock during year.....				
Output of colliery for year.....		7,420		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	3	\$	2	\$	5	
Whites—Miners.....	31	8.49			31	
Miners' helpers.....						
Labourers.....	8	5.21-5.38	15	4.25-5.73	23	
Mechanics and skilled labour.....	5	5.75-6.43	6	5.86-7.08	11	
Boys.....	3	2.98-4.87	2	2.22-4.15	5	
Japanese.....						
Chinese.....			7	2.82-3.85	7	
Indians.....						
Totals.....	50		32		82	

British Columbia Coal Mining Co., Ltd., and Vancouver-  
Nanaimo Coal Mining Co., Ltd.

Head Office—Nanaimo, B.C.

Capital, \$300,000.

<i>Officers.</i>	<i>Address.</i>
William Warner, President,	17 Williams Bldg., Vancouver, B.C.
Howard Gallagher, Secretary-Treasurer,	P.O. Box 834, Nanaimo, B.C.
S. K. Mottishaw, Superintendent,	Nanaimo, B.C.

Value of plant, \$100,000.

NEW EAST WELLINGTON COLLIERY.

Samuel K. Mottishaw, Manager; Joseph Thompson, Overman; Wm. Park and Geo. Oswald,  
*Firemen.*

This mine is practically finished, as all the pillars, with the exception of those immediately around the foot of the slope, have been extracted. The plant is the same as reported last year. On the occasion of my last inspection the ventilation was as follows:—

*No. 1 Split.*—There was 12,000 cubic feet of air a minute passing for the use of nine men and one horse.

*No. 2 Split.*—There was 13,000 cubic feet of air a minute passing for the use of thirteen men and two horses. The workings were well timbered and no explosive gas was found.

The Burrell gas-detector in the main return showed 0.4 per cent. of methane.

The following are the official aggregate returns for the year ending December 31st, 1919, for the two companies which operated the No. 1 East Wellington Colliery during the year:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	24,259			
" export to United States .....	5,262			
" " other countries .....				
Total sales .....		29,521		
Used in making coke .....				
Used under colliery boilers, etc. ....	8,804			
Total for colliery use .....		8,804		
		38,325		
Stocks on hand first of year .....	1,330			
" last of year .....				
Difference taken from stock during year .....		1,330		
Output of colliery for year .....		36,995		

## Pacific Coast Coal Mines, Limited.

Head Office—Victoria, B.C.

Capital, \$3,000,000.

<i>Officers.</i>	<i>Address.</i>
James Carruthers, President,	Montreal, Que.
J. H. Paine, Vice-President and Managing Director,	Victoria, B.C.
Douglas Muir, Secretary-Treasurer,	Victoria, B.C.
Robert Bonar, Superintendent,	South Wellington, B.C.

### MORDEN MINE.

Robert Bonar, Manager; Thos. Taylor, Overman; John Donnachie, Thos. Robson, Hy. Winstanley, Neil McIntyre, William Brown, and Peter Carr, Firebosses.

This mine is operated on the Douglas seam and is situated on Section 11, Range 8, Cranberry district, and about two miles from the town of South Wellington.

The plant consists of three 150-horse-power Goldie & McCulloch 72- x 18-inch boilers, 160 lb. working-pressure; one pair 24 x 36 hoisting-engines equipped with safety overwinding device, steam-brake; two 10-foot sheaves with collars and boxes and two self-dumping cages; one Gwynnes 5-inch centrifugal pump direct-connected to 250-volt a.c. motor; two 150-kw. electrical generators connected to two Goldie & McCulloch 18 x 20 x 9 high-speed engines; five electrical motors, 400-volt, Iron Works fan-engine; one Marcus screen 65 feet long, one Marcus screen 63 feet long, both with double decks and doors; one Weir feed-pump.

The mine is entered by two shafts sunk to a depth of 600 feet; the main shaft is 9 x 16 feet and the air-shaft 9 x 12 feet in the clear.

A new shaft-bottom has been completed below the level of the old one, with two slopes driven direct from the bottom of the shaft, which will pass through the centre of the company's property.

The ventilation is produced by a Sheldon double-entry fan 7 feet in diameter, driven by a 16- x 12-inch engine made by the Vulcan Iron Works, built on reinforced-concrete foundation. There has also been installed an up-to-date motor ambulance, which has been a great benefit not only to the mine, but to the surrounding district as well.

Extensive development underground has been carried on during the year. The new shaft-bottom has been widened to allow the handling of more coal. The Main slope has been driven through almost 900 feet of rock-fault and has again struck coal; although only 4 feet high, it is of very good quality. A main diagonal slope has been turned off the Main slope, and will replace the old slope which has been abandoned on account of the haulage system. This new development-work is being pushed ahead as speedily as possible, as the Main slope, striking this big fault, seriously delayed development.

The coal is well adapted for steam purposes and varies from 3 to 30 feet in thickness. The mine is worked exclusively by safety-lamps of the Wolf pattern, and only permitted explosives are used, fired by electric battery.

No. 4 shaft or return-air shaft is now being used exclusively as an emergency shaft. An engine with steam on and a hoisting-cage in the shaft is always ready to hoist the men in case of emergency.

On my last inspection there was 60,000 cubic feet of air a minute passing into this mine, all the workings being on one split, for the use of fifty-seven men and four horses. There was explosive gas found in six working-places on this day, on account of which the management was notified to suspend the firing of shots until the ventilation was improved. This mine is fairly free from coal-dust, except No. 1 North haulage-road and No. 4 Bight haulage-road. The management remedied these matters at once. The timbering was in good order and the Burrell gas-detector showed 0.3 per cent. of methane.

At Morden mine the plant consists of three 150-horse-power and two 100-horse-power return-tubular boilers; one pair 24 x 36 hoisting-engines with safety overwinding device, with steam-reverse and steam-brake; two 10-foot sheaves and two self-dumping cages; one Canadian Rand cross-compound air-compressor; two 150-kw. electrical generators connected with 13 x 20 x 9 high-speed engines; one Sheldon ventilating mine-fan, direct-connected to a 17- x 20-inch engine, also motor-driven as auxiliary. Upcast air-shaft is also equipped with steam-hoist and cage as the emergency outlet. All machinery for handling coal is electrically driven. There is a thoroughly equipped machine-shop and also mine-rescue station, containing two sets of Gibbs rescue apparatus complete, capacity four to eight hours. A standard-gauge railway seven miles and a half long connects the mines with Boat harbour, the shipping-point, equipped with wharves and bunkers which will accommodate the largest ocean-going steamers.

The following are the official returns from Morden Colliery for year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	36,259			
" export to United States .....	21,384			
" " other countries .....				
Total sales .....		57,643		
Used in making coke .....				
Used under colliery boilers, etc .....	16,744			
Lost in washing .....	9,876			
Total for colliery use .....		26,620		
		84,263		
Stocks on hand first of year .....	410			
" last of year .....	320			
Difference taken from stock during year .....	90 )			
Coal reclaimed from dump .....	18,330 (	18,420		
Output of colliery for year .....		65,843		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	7	\$ 6.40 - 9.00	6	\$ 2.85 - 6.00	13	\$ 2.85 - 9.00
Whites—Miners .....	62	5.70 - 7.30			62	5.70 - 7.30
Miners' helpers .....	19	5.00			19	5.00
Labourers .....	41	4.94 - 5.72	14	5.00	55	4.94 - 5.72
Mechanics and skilled labour .....	3	5.37 - 6.00	31	4.50 - 6.70	34	4.50 - 6.70
Boys .....	9	3.75	5	3.00	14	3.00 - 3.75
Japanese .....						
Chinese .....			34	3.00	34	3.00
Indians .....						
Totals .....	141		90		231	

## The Nanoose Collieries Co., Ltd.

Head Office—Vancouver, B.C.

*Officers.*

L. Williams, President,  
 F. H. Lantz, Vice-President,  
 John A. Coleman, Secretary-Treasurer,  
 John John, Superintendent,

*Address.*

Smith Bldg., Seattle.  
 Vancouver, B.C.  
 Wellington, B.C.

Value of plant, \$200,000.

### NANOOSE COLLIERIES.

John John, Manager; Chas. Simister, John Michie, John McLeod, Fred Jarrett,  
 and Arch. McBroom, Firemen.

This mine is situated at Nanoose Bay, about five miles in a north-westerly direction from what is known as North Wellington, which was formerly worked under the old Dunsmuir Company, and is known as the Old Wellington seam.

A shaft 8 x 16 was sunk on the property a distance of 133 feet, with levels turned off east and west. The coal varies from 3 to 4 feet in thickness, lying in two benches, with rock varying from 2 to 5 feet in thickness between the coal. The hoisting is carried on in the shaft and the slope is used as a travelling-way for the men and for ventilation.

The seam here is generally in two parts, with a shale, which occurs in thickness from 2 to 6 feet, between. The coal is hard and of good quality and finds a ready market. The seam up to the present time has been subject to considerable disturbance and is very irregular. All the workings so far have been on the pillar-and-stall system.

The plant now consists of three boilers with a total horse-power of 360, two compressors delivering 950 cubic feet of free-air a minute and a first-motion hoisting-engine of 75 horse-power.

Electrical power is generated by a 150-kw. generator, this power being used extensively in the screening and washing plant. The storage-bunkers have a capacity of 1,000 tons, the coal being conveyed from these bunkers to the shipping-points by means of cars.

There was 17,500 cubic feet of air a minute passing for the use of forty-six men and four horses. No explosive gas was found and the airways and roadways were in good condition.

The following are the official returns for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	9,788			
"  export to United States .....	10,473			
"  "  other countries .....				
Total sales .....		20,261		
Used in making coke .....				
"  under colliery boilers, etc. ....	1,372			
Total for colliery use .....		1,372		
Stocks on hand first of year .....	104			
"  last of year .....	113			
Difference added to stock during year .....		9		
Output of collieries for year .....		21,642		

## COMOX INSPECTION DISTRICT.

REPORT OF HENRY DEVLIN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Mines for the Comox Inspection District of Vancouver Island for the year ending December 31st, 1919, together with a list of all accidents and colliery returns.

## Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Capital, \$15,000,000.

<i>Officers.</i>	<i>Address.</i>
Henry S. Fleming, President,	New York.
F. Perry, Vice-President,	Montreal, Que.
H. S. Adlington, Secretary-Treasurer,	Montreal, Que.
J. M. Savage, General Manager,	Victoria, B.C.
Thos. Graham, General Superintendent,	Cumberland, B.C.

The Canadian Collieries (Dunsmuir), Limited, in 1910 acquired all the holdings of the Wellington Colliery Company, Limited, and since then has been operating the following mines:—

The Extension Colliery, in the Cranberry District (Extension); T. A. Spruston, manager.  
The Comox Colliery, in the Comox District; J. W. Montgomery, George O'Brien, J. G. Quinn, managers at the several mines.

The following table shows the combined output of all this company's collieries during the past year:—

## AGGREGATE RETURNS FROM THE CANADIAN COLLIERIES, LTD., MINES FOR YEAR 1919.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	454,620		16,429	
"    export to United States.....	174,705			
"    "    other countries.....				
Total sales .....		629,325		16,429
Used in making coke.....	24,049			
Used under colliery boilers, etc.....	23,984		76	
Lost in washing .....	179,687			
Total for colliery use.....		227,720		76
				16,505
Stocks on hand first of year .....	7,368		1,744	
"    last of year.....	13,741		104	
Difference { * added to } stock during year.....		*6,373		†1,640
{ † taken from }				
Output of collieries for year .....		863,418		14,865

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	89		43		132	
Whites—Miners.....	496				496	
Miners' helpers.....	23				23	
Labourers.....	209		97		306	
Mechanics and skilled labour.....	181		146		327	
Boys.....	16		38		54	
Japanese.....	81		1		82	
Chinese.....	433		268		701	
Indians.....						
Totals.....	1,528		593		2,121	

## COMOX COLLIERIES.

These mines were formerly operated by the Wellington Colliery Company, but were taken over by the Canadian Collieries (Dunsmuir), Limited, in 1910. The mines are situated in the Comox district, about seventy miles from Nanaimo. A railway about twenty miles in length connects the various mines to a shipping-point at Union Bay, over which the whole output is conveyed.

This company is operating in Cumberland mines known as Nos. 4 and 7 slopes and Nos. 5, 6, and 8 shafts. Nos. 4, 5, and 7 mines have been in continuous operation throughout the year; but there have been no operations in either No. 6 or No. 8 mines during the year.

## THE HYDRO-ELECTRIC PLANT.

This plant has been in continuous operation throughout the year. The power-house has been operated satisfactorily and no repairs or improvements were needed.

## UNION BAY.

At Union Bay the coke-ovens have been in operation only part of the year. Considerable drilling has been carried out in the Tsaabl River field and indicates the existence of a considerable body of coal in this district.

## No. 4 MINE, COMOX.

George O'Brien, Manager; Robert Adamson, Overman, No. 1 Slope; Charles Parnham, Overman, No. 2 Slope; John Bennie and James Quinn, Shiftbosses; Sidney Horwood, Arthur W. Watson, Alfred Jones, Thomas Cunliffe, Hugh M. Davidson, Peter Myers, Richard H. Hodson, Daniel P. Marsh, John Liddle, Henry King, William Beveridge, Louie Franscescini, Robert Reid, Thomas Lewis, Thomas Eccleston, Frederick Hutchinson, Norman W. Huby, John H. Vaughan, John G. Biggs, and John C. Brown, Firebosses.

This mine is situated about two miles from Cumberland and about twenty miles from the shipping-point at Union Bay.

The ventilation is produced in this mine by a Sullivan reversible fan driven by a 350-horse-power motor, direct-coupled, running at 245 r.p.m., and capable of delivering 196,000 cubic feet of air a minute, against a 7-inch water-gauge.

This mine has been in continuous operation during the year. Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used exclusively in this mine. Where blasting is permitted in this mine it is done with permitted explosives fired by electric battery.

#### *New Work at No. 4 Mine.*

The new tibble at this mine was put into operation in March and has given every satisfaction. It contains a 3-car rotary dump and Marcus screens, displacing the old dump and bar screens. The installation of the rotary dump permits the closing-up of the end gates in the mine-cars, which prevents considerable spilling of coal and coal-dust on the mine roadways.

A storage-battery locomotive and charging equipment for same has been installed in No. 15 West level, No. 1 slope. This is a 5½-ton Ironton locomotive with oxide batteries. This locomotive is running from the top of the new slope in No. 15 West level to the bottom of the Main slope and has given excellent satisfaction to date.

No. 15 East level, No. 2 slope, is being reopened in order to develop an area inside of the large fault on the east side of No. 2 slope. A new bore-hole was put down for power purposes on No. 2 slope and a 6-inch borehole for water-discharge. A new 9-stage turbine-pump, driven by a 200-horse-power motor, has been installed at the foot of No. 2 slope. This pump will handle all the water in No. 2 slope direct through the borehole to the surface. This will cut out three pumps which are at present used to pump this water to No. 1 slope main sump.

#### *No. 1 Slope.*

This slope is down a distance of 7,000 feet, running due north. A diagonal slope, 4,000 feet from the entrance of the mine, running N. 45° E., is down a distance of 4,000 feet, where levels are turned off east and west—Nos. 15, 16, 17, 18, 19, and 20 on the West side. There are no operations on the East side of No. 1 slope at the present time, No. 19 East level being used as a travelling-road between Nos. 1 and 2 slopes.

The new slope driven off No. 15 West level, No. 1 slope, is still going ahead, and Nos. 1, 2, 3, and 4 levels are turned off on the West side and No. 1 level on the East side. These levels are in good coal ranging from 4 to 6 feet in height, with a band of rock running in the centre from 10 to 15 inches thick and having a fairly good roof.

During my last inspection in December I measured 31,000 cubic feet of air a minute passing into this part of the mine, divided into two splits.

In No. 1 split there was 12,500 cubic feet of air a minute passing for the use of fifty-five men and four mules, or an average of 186 cubic feet of air a minute for each unit employed.

In No. 2 split there was 13,000 cubic feet of air a minute passing for the use of fifty-five men and five mules, or an average of 185 cubic feet of air a minute for each unit employed.

I found no explosive gas in No. 1 slope, but found a ⅜-inch gas-cap in No. 19 West level pillars. There is no blasting permitted in No. 19 West pillars. Timbering and roadways were in good condition.

#### *No. 2 Slope.*

This slope branches off No. 1 slope a short distance from the mine portal, running N. 45° E., and is down a distance of 9,000 feet and forms the deepest workings of the mine.

No. 2 slope has not been advanced during the year. There has been considerable repair-work done in the return air-courses during the year.

Levels are turned off this slope east and west—Nos. 15, 16, 17, 18, 19, and 20 on the East side. In Nos. 16, 18, and 19 levels on the East side are all pillar-extraction, only No. 20 East level being driven in the solid.

Nos. 17 and 20 are the only levels operating on the West side of No. 2 slope. Pillar-extraction in No. 17 West level, and No. 20 West level being driven in the solid with fairly good prospects.

When I made my inspection in December I measured 50,000 cubic feet of air a minute passing into No. 2 slope, divided into three splits.

In No. 1 East split there was 6,500 cubic feet of air a minute passing for the use of sixteen men and two mules, or an average of 290 cubic feet of air a minute for each unit employed.

In No. 2 East split there was 22,000 cubic feet of air a minute passing for the use of forty-five men and eight mules, or an average of 318 cubic feet of air a minute for each unit employed.

In the West side split there was 12,500 cubic feet of air a minute passing for the use of nine men and one mule, or an average of 1,000 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in the following places in No. 2 slope: In a crosscut off No. 18 stall off No. 16 East level in face of No. 12 stall, and crosscut off No. 13 stall off No. 19 East level; also a slight gas-cap travelling in the air-current on the return side of No. 19 East level. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

I made tests with the Burrell gas-detector in the several splits and main return airways, with the following results: No. 1 split, No. 1 slope, showing 0.8 per cent. methane in 15,000 cubic feet of air a minute; No. 2 split, No. 1 slope, showing 1.4 per cent. methane in 14,800 cubic feet of air a minute; No. 1 East split, No. 2 slope, showing 1.3 per cent. methane in 7,600 cubic feet of air a minute; No. 2 East split, No. 2 slope, showing 1.6 per cent. methane in 26,000 cubic feet of air a minute; West side split, No. 2 slope, showing 1.4 per cent. methane in 14,800 cubic feet of air a minute; main return showing 0.9 per cent. methane in 165,000 cubic feet of air a minute.

#### No. 5 MINE, COMOX.

William Walker, Manager; Robert Brown, Overman; Samuel Jones, Andrew McKendrick, William Devoy, Duncan Thomson, Thomas S. Bradson, Frank Crawford, John E. Spicer, Thomas Shields, William Harmison, William Bradley, William J. Keenan, Robert Houston, James Brown, and Thomas J. Shaw, Firebosses.

This mine has been in continuous operation during the year. A new lamp-house has been built, and fully equipped with the Edison storage-battery head-lamp and all the necessary fixings for charging the lamps. The Sirocco fan for ventilating this and No. 6 mine has been in continuous operation during the year and has given every satisfaction.

A rearrangement of screening facilities at this mine was made in April. A Marcus screen was installed in the present tippie, displacing the old bar screen and conveyor arrangement.

A new slope has been driven on the West side of the shaft, which is opening up a promising area in this section of the mine.

When I made my inspection in December I measured 95,000 cubic feet of air a minute passing into the mine, divided into four splits.

In the split on the East side of No. 1 dip East there was 16,500 cubic feet of air a minute passing for the use of thirty-five men and five mules, or an average of 330 cubic feet of air a minute for each unit employed.

In the split on the West side of No. 1 dip East there was 12,500 cubic feet of air a minute passing for the use of thirty men and two mules, or an average of 347 cubic feet of air a minute for each unit employed.

In No. 1 West dip split there was 24,000 cubic feet of air a minute passing for the use of forty-five men and six mules, or an average of 380 cubic feet of air a minute for each unit employed.

In No. 2 dip split there was 18,000 cubic feet of air a minute passing for the use of forty men and six mules, or an average of 327 cubic feet of air a minute for each unit employed.

I found a little explosive gas in J. McAllister's place off No. 4 West level, No. 1 dip East. Timbering and roadways were in good condition and the mine entirely free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: Return from No. 1 East split showing 0.6 per cent. methane in 18,200 cubic feet of air a minute; return from the West side of No. 1 dip East showing 0.3 per cent. methane in 14,500 cubic feet of air a minute; return from No. 1 West dip showing 0.3 per cent. methane in 26,250 cubic feet of air a minute; No. 2 dip split showing 0.2 per cent. methane in 19,000 cubic feet of air a minute; return from Nos. 5 and 6 mines, between Nos. 1 and 2 inclines, showing 0.6 per cent. methane in 85,900 cubic feet of air a minute.

#### No. 6 MINE, COMOX.

William Walker, Manager; Thomas Mordy, Overman.

There has been no coal hoisted from this mine during the year. Practically all the water made in both Nos. 5 and 6 mines is hoisted from No. 6 shaft by specially constructed water-tanks.

When I made my last inspection during December I measured 24,000 cubic feet of air a minute passing around the workings of the mine. I found a little explosive gas issuing from a break in the roof in a slant off No. 2 East level. Timbering and roadways were in fair condition.

#### NO. 7 MINE, COMOX.

John G. Quinn, Manager; James L. Brown, Overman; William Herd, Robert Walker, John McMurtrie, Watkin Williams, Daniel McMillan, and James Monks, Firebosses.

This mine has worked continuously during the year. All workings below No. 3 East level have been abandoned on account of the dirty nature of the seam. A rock tunnel was driven through the fault at the face of No. 3 East level to open up a new area in that section of the mine. A slope is being driven in the coal in this area and should develop rapidly.

A new 5½-ton storage-battery locomotive of the same type as that used in No. 4 mine has been installed on No. 3 East level for haulage purposes. A borehole for power purposes was put down at the face of No. 3 East level, and a new electric hoist has been installed on this slope. Compressed air has been almost entirely eliminated from this mine, it only being required in the old sections, which will soon be finished.

When I made my inspection in December I measured 96,000 cubic feet of air a minute passing into the mine, divided into three splits.

In the West split there was 25,000 cubic feet of air a minute passing for the use of twenty-one men and one mule, or an average of 1,037 cubic feet of air a minute for each unit employed.

In No. 1 East split there was 15,000 cubic feet of air a minute passing for the use of twelve men, or an average of 1,250 cubic feet of air a minute for each unit employed.

In No. 2 East split there was 16,000 cubic feet of air a minute passing for the use of twenty-four men, or an average of 666 cubic feet of air a minute for each unit employed.

No explosive gas found in this mine. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: West side split showing 0.2 per cent. methane in 28,000 cubic feet of air a minute; No. 1 East split showing 0.1 per cent. methane in 17,000 cubic feet of air a minute; No. 2 East split showing 0.2 per cent. methane in 18,450 cubic feet of air a minute; main return showing 0.2 per cent. methane in 120,000 cubic feet of air a minute.

The following are the official returns from the Comox Collieries for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	(Tons of 2,240 lb.)			
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	285,162	.....	16,429	.....
" export to United States.....	111,195	.....	.....	.....
" " other countries.....	.....	.....	.....	.....
Total sales.....	.....	396,357	.....	16,429
Used in making coke.....	23,816	.....	.....	.....
" under colliery boilers, etc.....	7,589	.....	76	.....
Lost in washing.....	116,868	.....	.....	.....
Total for colliery use.....	.....	148,273	.....	76
Stocks on hand first of year.....	3,752	.....	1,744	16,505
" last of year.....	11,318	.....	104	.....
Difference { added to* } stock during year.....	.....	*7,566	.....	†1,640
Output of collieries for year.....	.....	552,196	.....	14,865



Canadian Collieries—Tipples, No. 4 Mine, Comox.



Canadian Collieries—Portal of Tunnel, No. 4 Mine, Comox.

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	58		24		82	
Whites—Miners .....	190				190	
Miners' helpers .....						
Labourers .....	179		50		229	
Mechanics and skilled labour .....	51		102		153	
Boys .....	16		11		27	
Japanese .....	81		1		82	
Chinese .....	428		192		620	
Indians .....						
Totals .....	1,003		380		1,383	

Name of seams or pits—Comox mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 4, 5, and 6 shafts and Nos. 4 and 7 slopes.

## WELLINGTON-EXTENSION COLLIERY.

Thomas A. Spruston, Superintendent; James Strang, Manager, Nos. 1, 2, and 3 Mines.

The general supervision of this colliery is entrusted to Mr. Spruston, who has an overman in charge of each mine. These mines were formerly operated by the Wellington Colliery Company, but, like the Comox Colliery, were taken over by the Canadian Collieries (Dunsmuir), Limited, in 1910.

The Wellington-Extension Colliery, which is composed of Nos. 1, 2, and 3 mines, are situated in the Cranberry district, about six miles by road from Nanaimo and about eleven miles by railway from Ladysmith. No. 5 mine is also in Cranberry district, at South Wellington, about five miles south of Nanaimo. Coal is shipped from the Extension mines over eleven miles of railway to the shipping-wharves at Ladysmith. No. 5 mine shipments are made over the Esquimalt & Nanaimo Railway to the shipping-wharves at Ladysmith. All these mines have been working continuously throughout the year.

Nos. 1, 2, and 3 mines, situated at Extension, are connected by a tunnel driven 14 x 7 in the clear and one mile long, with a double track running practically the whole distance, and operated by a Westinghouse electric locomotive. A wooden flume 18 x 18 inches is laid parallel to the tracks for the whole length of the tunnel to take care of the water from each mine. Electric lights are strung at important points along the tunnel. During the year an elevated rock-dump has been installed with self-dumping skips, operated by an electric hoist with a 1-inch wire rope attached.

The change and wash house which was erected in the latter part of 1917 continues to give every satisfaction, being maintained up to the standard for the welfare of the men going and coming from their work. Additional lockers have had to be installed during the present year to accommodate the ever-increasing applicants, as they find the advantage of the luxury after coming off shift. (For description of power-house equipment and plant at Extension see Minister of Mines' Report for 1917.)

A fully equipped rescue-station is kept and maintained in good condition at Extension, with work-room, observation-room, smoke-room, and dressing-room fitted with lockers, bath, and wash-basin. The equipment consists of four 2-hour sets of Draeger apparatus (1917 type), one oxygen-pump, four oxygen-tanks, one pulmotor, and electric safety of the Draeger and Edison type.

## LADYSMITH.

During the year shipping and railway-car service has been steady. The coal-washery, which is situated at this point, consists of three "washers" of the following dimensions: Nos. 1 and 2, diameter 8 feet 9 inches, depth 5 feet 6 inches; No. 3, diameter 8 feet 3 inches, depth 5 feet 9 inches; computed capacity of each washer 300 tons in twelve hours. A Masco table 14 x 17 feet handles the fines or waste recovery and is giving good results.

Power for the washery is supplied by a Pelton wheel which is operated from the mountain water source. An auxiliary salt-water pumping plant has been installed near the beach to supply the washery in an emergency, such as the mountain water-supply giving out or during a hard frosty spell.

## No. 1 OR TUNNEL MINE, EXTENSION.

James Strang, Manager, Nos. 1, 2, and 3 Mines; William Wilson, Overman; David J. Gordon, Thomas Wilson, William Wesnedge, John Greenhorn, James Glen, and William Clifford, Firebosses.

This mine is worked on the long-wall system, hand-mining being employed. The Main slope is down a distance of 4,000 feet; Nos. 2 and 3 slopes are turned off to the south-west at points 1,800 feet and 3,200 feet off Main slope.

Levels are turned off east and west of these slopes, leaving a slope pillar 100 feet in thickness, from which the advance system of long-wall was commenced. The condition of this mine, although somewhat troubled with thin coal and shale-bands in the coal, is looking fairly promising. Safety-lamps of the Wolf type and the Edison storage-battery electric lamps are used throughout the mine, and all blasting is done with permitted explosives, fired by electric battery.

The mine is ventilated by a Murphy-type exhaust-fan with a capacity of 45,000 cubic feet of air a minute, against a 1.7-inch water-gauge, driven by an Allis-Chalmers-Bullock motor.

When I made my last inspection of this mine I measured 23,100 cubic feet of air a minute passing into the mine for the use of fifty-four men and five mules, or an average of 33½ cubic feet of air a minute for each unit employed.

No explosive gas was found, but found a slight gas-cap in a slant off No. 1 East level, No. 3 slope. I found timbering and roadways in good condition and the mine free from coal-dust.

Test made with the Burrell gas-detector in the main return airway showed 0.4 per cent. methane in 26,500 cubic feet of air a minute.

## No. 2 MINE, EXTENSION.

Robert L. Spruston, Overman; Robert N. Hamilton, Owen Dabb, Joseph Watson, Joseph Mason, John Davidson, Edward Heyes, John Wright, and William Cosier, Firebosses.

This mine is divided into three districts—namely, No. 4 East district, Slope district, and the West Incline district. No. 4 East turns off the Main tunnel at the "Cog" and is in a distance of one mile and a quarter. The output from this district is concentrated to the motor-road by self-acting inclines at various points along the level, and then gathered by a 13-ton Baldwin-Westinghouse electric motor. Longwall and pillar-and-stall methods of working the coal are used in the various sections of this district owing to the fluctuating conditions of the seam, varying from 3 feet in some sections to 10 feet in others.

*Slope District.*

A large amount of recovery-work has been done during the year, and some excellent coal has been taken out from the old abandoned workings of this slope. The old No. 3 East and West levels were opened up and the ventilation improved in this district.

*The West Incline District.*

This incline was developed during the year by driving a pair of inclines through the pillars paralleling the old No. 2 slope and intersecting the old Nos. 2 and 3 East and West levels, where some good hard coal of excellent quality has been recovered.

Opening-up work is being continued with very promising results in this part of the mine. Safety-lamps of the Wolf type and the Edison storage-battery electric lamps are used in this mine, and all blasting is done with permitted explosives fired by electric battery.

This mine is ventilated by a Murphy fan of 40,000 cubic feet capacity, against a 1.9-inch water-gauge, and is driven by a 25-horse-power type D.L.C. General Electric motor.

When I made my last inspection in this mine I measured 34,850 cubic feet of air a minute passing into the mine, divided into three splits.

In the West side split there was 11,500 cubic feet of air a minute passing for the use of eighteen men and three mules, or an average of 425 cubic feet of air a minute for each unit employed.

In the East side split there was 12,000 cubic feet of air a minute passing for the use of twenty men and three mules, or an average of 413 cubic feet of air a minute for each unit employed.

In No. 4 East split there was 10,850 cubic feet of air a minute passing for the use of thirty-two men and six mules, or an average of 217 cubic feet of air a minute for each unit employed.

I found no explosive gas in No. 2 mine. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: West side split showing 0.4 per cent. methane in 12,840 cubic feet of air a minute; East side split showing 0.3 per cent. methane in 13,000 cubic feet of air a minute; No. 4 East split showing 0.2 per cent. methane in 12,000 cubic feet of air a minute; main return showing 0.4 per cent. methane in 40,000 cubic feet of air a minute.

#### NO. 3 MINE, EXTENSION.

Thomas Strang, Overman; Daniel Campbell, David Davidson, James P. Nimmo, Jr., James Nelson, Patrick Malone, and George Smith, Firebosses.

Development-work in this mine during the year has been continued principally in No. 4 West level and in the overlap section of McCoy's incline. No. 4 West level has been driven through the old workings that have been abandoned for several years. Some pillar coal is being opened up and extracted. Practically the whole of the mine is employed in pillar-extraction, with the exception of a small section of solid work off McCoy's incline.

Safety-lamps of the Wolf type and the Edison electric lamp are used throughout the mine; all blasting is done with permitted explosives fired by electric battery. This mine is ventilated by Guibal fan with a capacity of 65,000 cubic feet of air a minute, against a 1.7-inch water-gauge.

When I made my last inspection of this mine I measured 23,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 13,000 cubic feet of air a minute passing for the use of forty-two men and seven mules, or an average of 206 cubic feet of air a minute for each unit employed.

In No. 2 split there was 10,000 cubic feet of air a minute passing for the use of thirty-two men and five mules, or an average of 212 cubic feet of air a minute for each unit employed.

No explosive gas found. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: Return from No. 1 split showing 0.3 per cent. methane in 14,300 cubic feet of air a minute; return from No. 2 split showing 0.2 per cent. methane in 11,350 cubic feet of air a minute; main return showing 0.4 per cent. methane in 27,000 cubic feet of air a minute.

The following are the official returns from the Extension Collieries for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	109,371			
" export to United States .....	63,510			
" " other countries .....				
Total sales .....		172,881		
Used in making coke .....	233			
Used under colliery boilers, etc. ....	12,995			
Lost in washing .....	40,798			
Total for colliery use .....		54,026		
		226,907		
Stocks on hand first of year .....	3,616			
" last of year .....	2,423			
Difference taken from stock during year .....		1,193		
Output of collieries for year .....		225,714		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	25		18		43	
Whites—Miners .....	207				207	
Miners' helpers .....	23				23	
Labourers .....	23		29		52	
Mechanics and skilled labour .....	99		36		135	
Boys .....			19		19	
Japanese .....						
Chinese .....	5		55		60	
Indians .....						
Totals .....	382		157		539	

Name of seams or pits—Wellington, Extension.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 1, 2, and 3 mines connected by one main tunnel.

## No. 5 MINE, SOUTH WELLINGTON.

Thomas A. Spruston, Manager; David Martin, Overman; Robert Ewing, Ernest H. Devlin, James E. Parrott, Joseph Lane, and Adam Watson, Firebosses.

This mine is situated at South Wellington, about five miles south of Nanaimo, alongside of the Esquimalt & Nanaimo Railway. It is operating in the Douglas seam, adjacent to the Old Alexandria mine.

The Main slope is down a distance of 3,000 feet, being driven 14 x 8 feet in the clear, and timbered with heavy sets, 4-foot centres. The coal is well adapted for steam purposes and varies from 2 to 16 feet in thickness. It is worked on the pillar-and-stall plan. Levels are turned off to the north and south of this slope, in which some met with barren and disturbed ground.

Diagonal slopes have been driven from the Nos. 3 North and 3 South to develop the territory expeditiously to the north and south of the Main slope, and from these diagonal slopes levels have been turned off to the right and left.

The ventilation is produced in this mine by an 8-foot Stine fan, belt-driven by a 50-horse-power type 3 Westinghouse motor, with a capacity of 90,000 cubic feet of air a minute.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used exclusively in this mine, and all blasting is done with permitted explosives fired by electric battery.

During the year a new Goldie & Bullock return-tubular boiler has been installed, making a battery of three of this type of boilers of 108.8-horse-power capacity each. Fuel is supplied from the fine screenings conveyed by a scraper conveyor direct from the shaker screens to the boiler-house. A marked feature of this plant is the compatible arrangements of tipple, power-house, mechanical shops, pumping plant, and office in close conjunction with the mine and railway.

When I made my last inspection of this mine I measured 70,000 cubic feet of air a minute passing into the mine, divided into two splits.

In the North side split there was 31,500 cubic feet of air a minute passing for the use of thirty-five men and three horses, or an average of 715 cubic feet of air a minute for each unit employed.

In the South side split there was 25,000 cubic feet of air a minute passing for the use of twenty-five men and one horse, or an average of 893 cubic feet of air a minute for each unit employed.

No explosive gas found in this mine. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests made with the Burrell gas-detector were as follows: North side split showing 0.2 per cent. methane in 32,400 cubic feet of air a minute; South side split showing 0.1 per cent. methane in 27,000 cubic feet of air a minute; main return showing 0.2 per cent. methane in 72,600 cubic feet of air a minute.

The following are the official returns from the No. 5 South Wellington Colliery for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	60,087			
" export to United States .....				
" " other countries .....				
Total sales .....		60,087		
Used under colliery boilers, etc. ....	3,400			
Lost in washing .....	22,021			
Total for colliery use .....		25,421		
Stocks on hand first of year .....				
" last of year .....				
Difference taken from stock during year .....				
Output of colliery for year .....		85,508		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	6		1		7	
Whites—Miners .....	99				99	
Miners' helpers .....						
Labourers .....	7		18		25	
Mechanics and skilled labour .....	31		8		39	
Boys .....			8		8	
Japanese .....						
Chinese .....			21		21	
Indians .....						
Totals .....	143		56		199	

Name of seams or pits—Wellington.

Description of seams, tunnels, levels, shafts, etc., and number of same—Slope located just south of Old Alexandria mine.

## Granby Consolidated Mining, Smelting, and Power Co. Colliery at Cassidy.

<i>Officers.</i>	<i>Address.</i>
W. L. Nichols, President or Chairman,	52 Broadway, New York.
J. T. Crabbs, Vice-President or Vice-Chairman,	52 Broadway, New York.
F. M. Sylvester, Vice-President and Managing Director,	813 Birks Bldg., Vancouver.
W. P. Earle, Secretary,	52 Wall Street, New York.
G. W. Wooster, Treasurer,	813 Birks Bldg., Vancouver.
R. R. Wilson, Superintendent,	Cassidy, B.C.

### GRANBY No. 1 COLLIERY.

R. R. Wilson, Manager; Joseph Thompson, Overman; James Touhey, Jonathan Henney, John Bennett, Firebosses; John C. Hughes, James Webster, Alexander Orr, and Thomas Bullen, Shotlighters.

This mine is situated at Cassidy, B.C., and is being opened up in the Douglas seam, which averages 10 feet in thickness. It was acquired mainly to secure a supply of coke for the copper-smelter at Anyox. The area set apart at this colliery for a residence district comprises about 80 acres of bench land overlooking the Nanaimo river to the north and Haslem creek to the south, and sheltered by forested ridge to east and west, which is being preserved as a park.

The townsite was carefully planned to present a pleasing appearance. The streets are boulevarded and the houses surrounded by fresh green lawns and flower-gardens. Shade-trees have been planted along the boulevards on each street. The town is furnished with a modern sewage-disposal system and also with up-to-date waterworks system.

This colliery is provided with one of the finest athletic parks in the country. There is a baseball diamond, football ground, tennis-courts, bowling-green, and quarter-mile track. The athletic field is so large that a baseball and football game can be played at the same time without clashing, and the entire field is as level as a billiard-table. The hillside back of the athletic field forms a natural grandstand, and the company has reserved this as well as the timber on the other side of the town as a natural park.

A striking feature of the company's plans in laying down ideal conditions under which the men shall work is the programme of entertainment and physical and mental relaxation provided.

A temporary recreation-hall has been provided with gymnasium, dance-hall, library, reading-room, billiard and pool room, wrestling, boxing, and every other means of amusement and recreation which is possible to give the men.

The houses are neat and commodious, the architecture varies, and each house is equipped with every modern convenience. The streets are boulevarded, lined with shade-trees, and lighted with electric lights.

### ROOMING-HOUSE.

The rooming-house for the accommodation of single employees is a guinite structure built in the form of a double L. It contains about eighty rooms, all of which open to the verandah or balcony. The rooms are steam-heated, electric-lighted, and each room is provided with running hot and cold water. The floor is a patent material, "Raccolith," and the rooms can be washed out with a hose when necessary. The company supplies the furniture and bedding as a precaution to ensure cleanliness and comfort of employees.

### MESS-HOUSE.

The mess-house or dining-room is a guinite structure and is equipped with every modern convenience. The men enter the building through a lobby equipped with wash-basins and running hot and cold water, so that they can enjoy a refreshing wash, hang up their hats, and then proceed through a pretty vine-covered pergola to the dining-hall. At the entrance to the dining-room a drinking-fountain is provided where a stream of clear cold water is constantly available. The dining-hall is bright and comfortable, cool in summer and steam-heated in winter; each table accommodates six men. The kitchen is equipped with every labour-saving and modern device—electric dish-washing machine, vegetable-paring machine, tables heated by steam-coils device to keep dishes hot, large bake-oven, and refrigeration plant.

#### THE CHANGE-HOUSE.

The change-house is in charge of Mr. Bond, an old experienced "first-aid man." Here the miners turn in their working-clothes if they are wet and have them placed in the drying-room by the attendant, so that they will be perfectly dry and comfortable when ready to go to work in the morning. The change-house is equipped with steel lockers which are heated with steam-coils from underneath, shower-baths, and large lavatory, including every convenience.

#### HOSPITAL AND FIRST AID.

A modern temporary hospital and first-aid station has been established in one of the larger houses until the permanent hospital can be constructed. This hospital is in charge of a skilled matron and trained nurse.

#### MINE BUILDINGS.

Between the change-house and the manway portal are the powder-house, in which the stock of explosives is limited to one day's supply, the large magazine being on the opposite side of the hill from the town, the time-keeper's office, lamp-house, and mine-rescue station. The lamp-house is equipped with 300 Edison storage-battery electric lamps and recharging apparatus. The rescue-station is equipped with four sets of Gibbs apparatus, lung-motor, smoke-chamber, etc., and a large lecture-room for holding first-aid or mining classes. The above buildings are all steam-heated with exhaust steam from the power-house.

#### TIPPLE AND WASHERY.

The tippie is equipped with Fairbanks scale, rotary dump, Marcus screen, and loading-boom. The railroad-cars are handled with Fairmont car-retarders. The track-scale is a Fairbanks standard, all steel and concrete. The rock-cars are handled with special Wilson rotary dump.

The washery is equipped with two 2-compartment jigs having a capacity of 40 tons an hour each. The tippie and washery were designed by Roberts & Schafer, of Chicago. The washery is equipped with sludge-recovery and uses the same water over and over again. The washed slack is used in the new by-product plant at Anyox in making coke for the copper-smelter, and the lump, nut, and some pea coal sold. The bone coal is burned under the colliery boilers.

#### POWER-HOUSE.

The boiler plant at present consists of two Badenhauser water-tube boilers, 260-horse-power each, fired by mechanical stokers. The ashes are removed by washing and fluming to the dump. The feed-water is heated with a Webster feed-water heater and forced draught is used. The brick stack is 8 feet in diameter and 125 feet high. The boilers and steam-pipes are all insulated with asbestos and magnesia to prevent loss of heat. Venturi meters are used to check quantity of water at pump-station and at the boilers. The compressor is a Rand cross-compound condensing, capacity 2,000 cubic feet of air a minute. The air is used for running the underground drills, pumps, and hoists.

Electric power is supplied by an Allis-Chalmers 450-kw. generator (2,300 volts, 3-phase, 60 cycles, 360 r.p.m.), also an auxiliary unit, 250 kw. (2,300 volts, 3-phase, 60 cycles, 450 r.p.m.), both direct-connected to vertical high-speed engines (Goldie & McCollough). The remainder of the electric equipment is of Westinghouse make. The power-house is equipped with the Bowser oil-handling system. A Worthington fire-pump, capacity 1,000 gallons a minute, size 18 x 10 x 12 inches, is ever in readiness for an emergency.

The entire plant is equipped with an exhaust steam-heating system, the condensation being returned to the boilers.

#### CARPENTER, MACHINE, AND BLACKSMITH SHOPS.

The shops are all thoroughly equipped and well lighted and will be connected with the mine-tracks. The carpenter-shop is fitted with rip-saw, band-saw, planer, boring and mortising machine.

The machine-shop is equipped with a large lathe, small lathe, planer and shaper, pipe-threading machine, drill-press, emery-wheel, etc. The shafting is well guarded. The master mechanic's office adjoins the machine-shop.

The blacksmith-shop is fitted with two forges, steam-hammer, and swing-crane. Adjoining the blacksmith-shop is a special tool-house where miners' picks are kept after sharpening. All scrap-iron is sorted and stored in pockets provided for the purpose.

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#### WATERWORKS SYSTEM.

The pump-station is equipped with two Morris centrifugal pumps, each having a capacity of 300 gallons a minute. These pumps elevate the water to the two 50,000-gallon storage-tanks situated on top of the hill overlooking the town, whence it flows by gravity through the water-mains.

The pumps are driven by a 50-horse-power Westinghouse electric motor. A Venturi meter records the quantity of water leaving the station at all times. The Nanaimo river furnishes a plentiful supply of pure water for domestic and power purposes.

#### TELEPHONE SYSTEM.

The colliery is equipped with complete telephone system, which connects all surface offices, shops, and buildings with the underground workings.

#### THE MINE.

The seam dips at about 18 degrees and the coal-seam varies in thickness from 5 to 20 feet, averaging about 10 feet. The roof and floor are of shale formation and subjected to rolls. The roof is fairly regular, most of the rolls occurring in the floor.

The mine is opened on the full dip of the seam, the Main slope having been driven about 2,500 feet. It is being driven 7 x 14 in the clear to allow for double track, and is timbered with 12- x 14-inch framed sets, spaced 4 feet from centre to centre. A separate manway is provided as a travelling-road, and employees are not allowed to use the Main slope haulage-road in passing to and from their working-places.

The mine is being worked on the pillar-and-stall system; four levels are turned off to the north and four levels to the south, with parallel counter-levels.

The mine is divided into relatively small panels as a precaution against mine fires, and large pillars are left along all main haulage-roads and permanent airways, the idea being to extract a maximum amount of coal at least cost rather than to take out cheap coal for a few years to the final detriment of the mine.

Mining is planned so as to deliver the coal from the faces to the main haulage system by gravity as far as possible. Storage-battery locomotives are used on the levels underground; no horses or mules are used. The drainage system has been carefully planned, so that surface water entering the mine from the gravel will drain by gravity, and water from the workings below the drainage will be pumped to a central sump.

The mine is ventilated by a Sirocco fan with a capacity of 150,000 cubic feet of air a minute. The mine is provided with a double intake and return airway throughout the mine, and the workings are planned so that the air can be taken to the face with a minimum loss. The fan-house is a concrete structure, and also houses the telephone exchange and motor-generator set for charging storage-battery locomotives. The fan is driven by a 150-horse-power Westinghouse electric motor. The main hoist is a Vulcan 18- x 36-inch double-drum, second-motion hoist.

The mine-cars are wooden cars having a capacity of 1¾ tons of coal. The track-gauge is 36 inches. Hadfield manganese steel, self-oiling wheels, 18-inch diameter and 3-inch tread, are used. The cars are built in the company shops at the mine and have no end doors.

When I made my last inspection of this mine in December I measured 100,000 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 1 North split there was 11,000 cubic feet of air a minute passing for the use of four men, or an average of 2,750 cubic feet of air a minute for each unit employed.

In No. 2 North split there was 30,500 cubic feet of air a minute passing for the use of thirty-six men, or an average of 847 cubic feet of air a minute for each unit employed.

In the South side split there was 42,000 cubic feet of air a minute passing for the use of twenty-two men, or an average of 1,909 cubic feet of air a minute for each unit employed.

I found no explosive gas in this mine. Timbering and roadways were in good condition and the mine free from coal-dust.

The following are the official returns from the Granby Colliery for year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada .....	22,187	.....	19,206	.....
" export to United States .....	2,688	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	24,875	.....	19,206
Used in making coke, Anyox .....	31,623	.....	.....	.....
Used under colliery boilers, etc.....	8,565	.....	.....	.....
Total for colliery use .....	.....	40,188	.....	.....
Stocks on hand first of year .....	3,763	.....	.....	.....
" last of year .....	11,585	.....	.....	.....
Difference added to stock during year.....	.....	7,822	.....	.....
Output of colliery for year .....	.....	72,885	.....	19,206

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	5	\$ 6.67	7	\$ 7.40	12	\$ 7.09
Whites—Miners .....	82	9.00	.....	.....	82	9.00
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers .....	12	5.25	28	4.65	40	4.83
Mechanics and skilled labour .....	4	5.90	11	6.35	15	6.23
Boys .....	.....	.....	4	3.00	4	3.00
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals .....	103	8.32	50	5.27	153	7.32

Name of seams or pits—Douglas.

Description of seams, tunnels, levels, shafts, etc., and number of same—Dip, 18 degrees; average thickness, 8 feet; seam subject to rolls, floor and roof. Thickness varies in different parts of mine. Roof is shale; floor same.

Description and length of tramway, plant, etc.—Plant modern in every way. Sirocco fan, capacity 150,000 cubic feet a minute; Vulcan hoist, 18 x 36 inches, double-drum second-motion; tippie equipped with rotary pump, Marcus screen, loading-booms, and railway-cars handled by Fairmont car-retarders; washery equipped with two 2-compartment jigs, capacity 80 tons an hour, and sludge-recovery. Bone coal burned under the boilers. Edison storage-battery electric lamps used underground; no horses or mules used. Storage-battery locomotives for haulage underground. Boiler plant equipped with Badenhausen boilers fired by type E mechanical stokers; ashes are flumed to dump. The Main slope has been driven to a depth of approximately 2,500 feet; No. 1 North level, 1,570 feet to the Nanaimo river; No. 2 North, 1,365 feet; No. 3 North, 180 feet; No. 4 North, just started; No. 4 South, 90 feet; No. 3 South, 170 feet; No. 2 South, approximately 1,230 feet.

## NORTHERN INSPECTION DISTRICT.

REPORT BY THOS. J. SHENTON, DISTRICT INSPECTOR.

## Telkwa Collieries Co., Ltd.

*Officers.*

W. A. Woodland, President or Chairman,  
 J. K. Ashman, Vice-President or Vice-Chairman,  
 T. McClymont, Secretary,  
 John Gillespie, Superintendent,

*Address.*

Prince Rupert, B.C.  
 Smithers, B.C.  
 Prince Rupert, B.C.  
 Telkwa, B.C.

## TELKWA COLLIERY.

Indications show improvement with respect to thickness and continuity. The thickness of the veins measure from 2 to 8 feet, and the working-faces are reached by Nos. 1 and 2 drifts, now measuring a distance of 75 and 90 feet respectively. A number of places have already been turned off, many of which, have been again abandoned, due to trouble in wash-out or dislocation of the vein. The mine from a standpoint of timbering, ventilation, and general conditions is in fair keeping with the provisions of the "Coal-mines Regulation Act."

The following are the official returns from the Telkwa Colliery for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada.....	1,752			
"    export to United States.....				
"    "    other countries.....				
Total sales.....		1,752		
Used in making coke.....				
Used under colliery boilers, etc.....				
Total for colliery use.....				
Stocks on hand first of year.....				
"    last of year.....				
Difference { added to } stock during year.....				
{ taken from }				
Output of colliery for year.....		1,752		

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	1	\$ 7.00	.....	.....	1	.....
Whites—Miners .....	2	6.00	.....	.....	2	.....
Miners' helpers .....	2	5.50	.....	.....	2	.....
Labourers .....	1	.....	.....	.....	1	.....
Mechanics and skilled labour .....	.....	.....	.....	.....	.....	.....
Boys .....	.....	.....	.....	.....	.....	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals .....	6	.....	.....	.....	6	.....

Name of seams or pits—Goat creek.

Description of seams, tunnels, levels, shafts, etc., and number of same—Two tunnels in side-hill.

## NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY ROBERT STRACHAN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Coal-mines for the Nicola-Princeton Inspection District during the year ending December 31st, 1919.

The Middlesboro Collieries Company, Limited; Fleming Coal Company, Limited; Princeton Coal and Land Company; Coalmont Collieries, Limited; and the Merritt Collieries all operated during the year, and no active mining was carried out at either the Pacific Coast Collieries of British Columbia, Merritt; the United Empire, Princeton; or the Boundary Mining and Exploration Company, of Midway.

Work has been fairly steady in all the operating mines, with the exception of the Merritt Collieries, which was only working for some weeks.

The gross output for the district shows 149,042 long tons, being a decrease of 30,137 as compared with the previous year.

It is very pleasing to record that there have been no fatal accidents during the year; one serious and one slight. A cave of roof-rock which was being timbered caused the serious accident, and shows that greater care should be exercised in this work.

Samples of the mine-air have been taken during the year, and show that the percentages of methane in the air-currents in this district are fairly low.

Inspection on behalf of the workmen, as required by section 91, Rule 37, of the "Coal-mines Regulation Act," has been carried out regularly every month, so far as Nos. 7 and 8 mines, Middlesboro, and No. 3 mine of the Fleming Coal Company are concerned, but in the others no attempt has been made to comply with this rule. These other mines are small, making the cost of this inspection heavy, and, as suggested last year, it would be in the best interest of these if small mines could be grouped together for this purpose.

## MINE FIRES.

Trouble from mine fires have been experienced in Middlesboro Colliery, Nos. 4 and 7 mines; No. 3 mine, Coal Hill, of the Fleming Coal Company; and in Princeton mine of the Princeton Coal and Land Company. With the exception of No. 7 mine, Middlesboro Colliery, these were old fires which have been burning for years sealed off, and either burned over the stoppings or had been presumed to be out, allowing the district to be reopened, but later developed activity.

I might mention here that the principal cause of fires in mines, which seem to be greatly on the increase, is lack of sufficient ventilation; old districts are abandoned improperly sealed off, sluggish air-currents travel through them, timber decay and decrepitation of the coal is caused by the crushing of pillars, all furnishing the most favourable conditions for spontaneous combustion. In very few cases is the sealing-off successful to the extent of extinguishing the fires; invariably within a few weeks or months of the reopening of the sealed off area the supposed extinguished fire is fanned into activity, and it is a distinct disappointment that greater care is not taken to prevent them.

The Edison electric mine safety-lamp is in general use for the workmen at Middlesboro, Princeton, and Coal Hill mines; all the others use the Wolf safety-lamp, except at Coalmont, where open lights are in use by the workmen.

Blasting is carried out at all the mines subject to the requirements as laid down in the "Coal-mines Regulation Act," and I have generally found the requirements very well complied with.

The explosives are those shown on the "Permitted List" as issued by the Hon. the Minister of Mines, and the quantities used during the year are as follows:—

Colliery.	Explosive.	Quantity.	Shots fired.	Per Shot.	Miss-fires.
		Lb.		Lb.	
Middlesboro .....	Monobel .....	16,280	24,550	0.7	11
" .....	Polar Ammonia .....	1,050			
Coalmont.. ..	Monobel .....	4,100	10,250	0.4	..
Coal Hill.....	Monobel No. 4.....	11,857	13,443	0.88	26
Princeton.....	Monobel .....	2,400	3,500	0.68	..
Totals.....	.....	35,687	51,743	....	37

#### MINE-RESCUE WORK.

The standard in this work has been very well maintained at the larger collieries, but in the case of the smaller mines the condition, number of apparatus, and lack of trained workmen make the presence of apparatus a positive danger.

The excuse, and excuse it generally is, is that they will not require it, but the unfortunate aspect is that when apparatus is required the need comes quickly and is great. There is then no time to repair apparatus, get new parts, or train men, and the only remedy I can see is that stringent rules be laid down, requiring a minimum amount of apparatus in proportion to the workmen employed, with a minimum amount of training, which should be maintained at least every month.

The work of first aid to the injured has been well maintained during the year, classes being held in Merritt and Princeton, and I think a great deal of credit is due to those who take up this work and ungrudgingly give their services to reduce the amount of human suffering.

I wish to extend our very best thanks to the workmen and mine officials for their assistance in carrying out our duties during the year 1919, and confidently look forward for a continuation of the same during the year we are now entering upon, for it is only by co-operation on the part of every one that we can expect to keep the list of accidents where it has been during the past year, free from fatal accident, and try to reduce the non-fatal.

## Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, \$1,107,700.

<i>Officers.</i>	<i>Address.</i>
E. W. Hamber, President,	Vancouver, B.C.
G. S. Raphael, Vice-President,	Vancouver, B.C.
Thomas Sanderson, Managing Director and Secretary,	Vancouver, B.C.
Robert Fairfoull, Mine Manager,	Middlesboro, B.C.

Value of plant, \$250,000.

### MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This colliery is situated one mile from Merritt Station, on the Kettle Valley Railway, and consists of Nos. 2, 4, 4 East, and 7 mines, the last three of which were operated during the year 1919.

#### No. 4 MINE.

Alexander Ewart, Overman; William Hallinan, Geo. Hudson, Thos. Archibald, and A. D. Allan, Firebosses.

This mine, which is reached by a rock tunnel crossing the measures, cutting Nos. 4, 5, 6, 8, and 9 seams, operated on the Nos. 4, 6, 8, and 9 seams, all of which are connected through to the surface at the outcrop. The method of work is pillar and stall, pillars being left about 50 feet square, while the stalls are driven 10 feet wide.

All the seams lie at an angle of 20 degrees, dipping to the south, allowing of the use of chutes which carry the coal to the level, where it is loaded into cars and taken to the surface by horse first, then main and tail-rope haulage.

During the year the work has consisted of the extraction of pillars in No. 4 seam; in the others development. The coal is mined by hand and blasted where required, permitted explosives and electric detonators being used.

Ventilation is produced by a steam-driven fan of the Sheldon type, 8.5 feet in diameter, and constructed so that it can be reversed if required, and at my last inspection was producing 54,000 cubic feet of air a minute for the use of thirty-three men and two horses, running at a speed of 90 revolutions a minute, with a 0.5-inch water-gauge. Barometer, 28.5 inches; thermometer, 3° Fahr.

The general conditions with regard to ventilation during the year have been very good, and very seldom has explosive gas been reported, while the mine is free from coal-dust. The working-places and roadways have been kept in good condition, while a plentiful supply of timber was provided for the use of the workmen.

As I mentioned in my report last year, trouble had been experienced with an old gob-fire which had been sealed off; at the latter part of the present year this broke out again, and as there was very little coal to be recovered the No. 4 seam was abandoned. This contingency had been provided for by having strong concrete stoppings constructed, and it was only necessary to fill these in, which was rapidly accomplished with very little risk.

#### No. 4 EAST MINE.

James Fairfoull, Overman; Lewis Shearer, Fireboss.

This mine is situated a short distance to the east of the entrance to No. 4, and is also on the same seam. The Main slope has not been sunk during the year owing to the faulting of the seam, which has caused considerable trouble in this mine, resulting in most of the work

being of a prospecting nature. The pitch, method of work, and haulage arrangements are very similar to those described in the No. 4 mine.

The ventilation is produced by a small quick-running fan of the Sirocco type, 4 feet in diameter, and at the time of my last inspection was producing 40,000 cubic feet of air a minute for the use of eleven men and one horse, running at a speed of 375 revolutions a minute, with a 0.5-inch water-gauge. Barometer, 28.5 inches; thermometer, 3° Fahr. The mine is very well timbered and plenty of timber is provided convenient for the use of the workmen.

Explosive gas has been rarely found in this mine, and it is naturally damp and free from dangerous coal-dust.

#### No. 7 MINE.

Jno. McDonald, Overman; Thos. Rowbottom, James McGrath, and Howell John, Firebosses.

This mine is situated in Coal gully, about 400 feet higher than the entrance to No. 4 mine and the tipple. The seam, which is generally considered to be the same as No. 4, is about 15 feet thick, of which only the upper 8 feet has been worked in the preliminary operation of development. The method of work, inclination, and haulage are very similar to those described in No. 4 mine, but the pillars have been increased with the depth attained.

As mentioned in the last year's report, the work was started to retreat, extracting the pillars, and this has been continued during the present year.

The ventilation, which is produced by a small fan of the Guibal type, driven by a compressed-air engine, has been very good all the times I have examined the mine, and no signs of explosive gas have been found.

At the last inspection I found 40,000 cubic feet of air a minute for the use of twenty-two men and one horse. The speed of the fan was 200 revolutions a minute, with a 0.3-inch water-gauge. Barometer, 28 inches; thermometer, 3° Fahr.

All the working-places and roadways are very well timbered and a plentiful supply of timber was provided convenient for the use of the workmen. The mine is naturally damp and free from dangerous accumulations of coal-dust.

The Nos. 8 and 9 mines mentioned last year are now connected to No. 4, are ventilated from No. 4 mine, and the coal is taken out to the tipple through this mine.

Blasting is carried out at all the mines under the supervision of competent persons as provided for in the "Coal-mines Regulation Act." All the lamps in use are the Edison electric mine safety or of the Wolf type, the first by the workmen, the second by the officials for inspection purposes.

All the coal is brought to a common tipple in cars with a capacity of 1.75 tons, where it is unloaded by a Phillips crossover dump, a switchback and car-haul taking the empty cars back, so that they can be arranged in trips for whatever place required. The coal is screened, sized, and picked before it goes into the coal-pockets, from which it is taken as required, a box-car loader being used for loading cars of that kind.

The main power plant is situated near the tipple, consisting of four return-tubular boilers with a capacity of 640 horse-power, a Canadian Rand low-pressure air-compressor with a capacity of 2,000 cubic feet of free air a minute providing power for the underground hoists, pumps, etc. Well-equipped machine, car-repair, and carpenter shops are maintained, besides commodious offices and dwellings for the workmen.

Copies of the "Coal-mines Regulation Act," special rules, systematic timbering orders, and plans of the mine are all kept posted at the colliery.

A very well-equipped mine-rescue training is also maintained by the Middlesboro Collieries, where, in addition to their own mine-rescue apparatus, that of the Department of Mines is kept in a high state of efficiency. A great deal of credit is due this company and the instructor, Mr. Stone, for the interest taken in this work, which is reflected in the number of men trained not only for the use of the Middlesboro Colliery, but for the district.

The following are the official returns of the Middlesboro Colliery for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada .....	73,180			
" export to United States .....				
" " other countries .....				
Total sales .....		73,180		
Used in making coke .....				
Used under colliery boilers, etc. ....	4,490			
Total for colliery use .....		4,490		
Stocks on hand first of year .....	156			
" last of year .....	36			
Difference taken from stock during year .....			120	
Output of colliery for year .....		77,550		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	12	\$	5	6.00	17	
Whites—Miners .....	55	7.00			55	
Miners' helpers .....	14	4.25			14	
Labourers .....	36	4.50	20	4.75	56	
Mechanics and skilled labour .....			14	5.25	14	
Boys .....			8	2.25	8	
Japanese .....						
Chinese .....						
Indians .....						
Totals .....	117		47		164	

Name of seams or pits—Nos. 4, 6, and 8. The operating mines of the Middlesboro Collieries, Nos. 7, 4, and 4 East, are situated about one mile from the city of Merritt, a branch of the Kettle Valley Railway providing communication with the Canadian Pacific Railway and the Boundary country. Mining operations at present are confined to the Lower or Coal Gully series.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 4 mine: This mine is including Nos. 5, 8, and 6 seams and is reached by a Main level driven in No. 5 seam, and then by a crosscut tunnel passing through Nos. 4 and 8 seams to No. 6 seam. Mining is now confined to the Nos. 6 and 8 seams. These seams are about 6 feet thick, pitching south at an angle of about 25 degrees. The method of work is pillar and stall; haulage by a compressed-air hoist. The ventilation is provided by a Sheldon fan 8½ feet in diameter and driven by an Ideal steam-engine. The fan is built so that it can be used either as an exhaust or positive type and is capable of producing 90,000 feet of air, with a 4-inch gauge. No. 4 East: The entrance to No. 4 East is situated about 800 feet to the east of No. 4 mine,

operations being carried out in the No. 4 seam, in which is driven the Main slope. Development-work in this mine has been restricted to the driving of a main level and counter from a point near the bottom of the slope. Ventilation is provided by a small quick running fan driven by a Sheldon steam-engine. Haulage on the Main slope is by a steam-engine; underground by compressed-air hoists, the cars being brought to the landing by mules. No. 7 mine: The entrance to No. 7 mine is situated in Coal gully at an elevation of 300 feet above the tippie, and is operating in the No. 4 seam. Mining operations in this mine are now confined to the extraction of pillars. Haulage is by compressed-air hoists, the cars being brought to the sidings by mules. After reaching the surface the coal is lowered to the tippie by a gravity-plane 1,000 feet long and pitching 30 degrees. Ventilation is produced by a small fan of the Guibal type capable of producing 50,000 cubic feet of air a minute, with a water-gauge of 1 inch.

Description and length of tramway, plant, etc.—All the coal from the various mines is brought to a common tippie in cars having a capacity of 1.5 tons. They are dumped by a Phillips crossover dump, a switchback and car-haul bringing back the empties for distribution to the mines. A Christie car-loader is used for loading box cars. The main power plant is situated near the tippie and consists of four return-tubular boilers, each 150 horse-power; a Canadian Rand cross-compound compressor with a capacity of 2,000 cubic feet of free air a minute; a 27½-kw. generator for lighting purposes; and the necessary feed-pumps for the boilers, fire-protection, and household purposes. There is also a well-equipped machine-shop, carpenter and car-repairing shops, also a mine-rescue station in which is stored with our own rescue apparatus the Government apparatus.

### The Fleming Coal Company, Ltd.

(FORMERLY THE INLAND COAL AND COKE COMPANY, LTD.)

Head Office—Vancouver, B.C.

*Officers.*

Joseph Martin, President,  
Joseph Graham, Managing Director,  
A. L. Welch, Secretary-Treasurer,  
A. E. Smith, Manager,

*Address.*

315 Credit Foncier Bldg., Vancouver, B.C.  
Merritt, B.C.  
404 Drake Street, Vancouver, B.C.  
Merritt, B.C.

### COAL CREEK COLLIERY.

This colliery is situated south-west of the Middlesboro and at an elevation of 500 feet above it.

#### No. 3 MINE.

A. E. Smith, Manager; John T. Brown, Overman; John Smith, Geo. Maxwell, and George Walker, Firebosses.

This colliery, like the Middlesboro, is situated close to the town of Merritt and is served by a branch of the Kettle Valley Railway. The mine is sunk on the seam at a point about 500 feet higher up the hill than the Middlesboro Colliery and on the No. 3 seam, which is the same as that worked in No. 7, Middlesboro.

A cross-cut tunnel from the No. 3 seam cuts the No. 5 seam, and both of these have been working during the year. The No. 3 seam is about 12 feet thick, while the No. 5 is 5.5 feet; both are worked by the pillar-and-stall method; the pitch varies from 20 to 30 degrees and allows of the coal being brought from the faces to the levels by chutes. During the past year, with the exception of some development-work, the chief operation consisted of the extraction of pillars.

Unfortunately, at the latter part of the year the fire which had caused a large part of this mine to be sealed off for some years revived, and it was found necessary to abandon all the development-work and seal this district up again.

Conditions with respect to ventilation and gas have been fairly good during the year, and at the last inspection I found 7,500 cubic feet of air circulating for the use of fourteen men and two horses in the No. 3 seam. In the No. 5 seam I found 12,000 cubic feet of air a minute for sixteen men. Speed of fan, 360 revolutions a minute; water-gauge, 0.5 inch. Barometer, 27.6 inches; thermometer, 0° Fahr.

All the working-places were very well timbered and plenty of timber was provided convenient for the use of the workmen. The No. 3 seam is fairly well free from coal-dust, and in the inby portions of No. 5 flue-dust is used to keep this down on the roadways and water where blasting is carried out.

The coal is all mined by hand; the explosive used is Monobel with electric detonators under the supervision of certificated officials. The haulage from the foot of the chutes is by horse to the Main slope, where they are hoisted by steam to the surface. From the top of the slope the cars are lowered in trips to the top of a gravity-plane, which lowers them to the tippie. This gravity-tram consists of a 3-rail track with passing in the middle, 1,800 feet long, handling six-car trips, each car having a capacity of 1 ton, using a 1-inch steel rope on a Stine wheel.

The lamps used in the mine are either Edison electric safety-lamp or the Wolf safety-lamp.

The power plant consists of two Leonard-type boilers with a joint capacity of 80 horse-power, furnishing steam for the hoists, pumps, fan-engine, and lighting plant. An auxiliary plant at the tippie consists of one small 25-horse-power boiler which furnishes steam for the small hoist on the tippie and the pump which delivers the water to the mine. Another small boiler is situated near the river to furnish the steam for the pump, which delivers the water to the tank at the tippie. The other surface equipment consists of machine, carpenter, car-repair shop, and office buildings.

The following are the official returns of the Fleming Coal Company for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	37,260			
" export to United States .....				
" " other countries .....				
Total sales .....		37,260		
Used in making coke .....				
" under colliery boilers, etc. ....	1,890			
Total for colliery use .....		1,890		
Stocks on hand first of year .....	140	39,150		
" last of year .....	100			
Difference taken from stock during year .....		40		
Output of colliery for year .....	39,110	39,110		

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	5	\$ 7.00	2	\$ 5.00	7	.....
Whites—Miners.....	35	7.50	.....	.....	35	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	12	4.50	12	4.25	24	.....
Mechanics and skilled labour.....	.....	.....	7	5.00	7	.....
Boys.....	.....	.....	.....	.....	.....	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	52	.....	21	.....	73	.....

Name of seams or pits—Coal Hill Colliery, Nos. 3 and 5 seams.

Description of seams, tunnels, levels, shafts, etc., and number of same—Five seams have been discovered on this property, but, as the practice for some years past, only two, the No. 3 and No. 5 seams, were operated. The No. 3 seam, which is 10 feet thick, furnished 60 per cent. of the output, mainly pillar coal. The development-work during the year was confined to reopening No. 4 West level, which had been closed several years ago owing to a gob-fire. Retimbering and realigning this level was quite an arduous job, but made available a large body of pillar coal, and it was decided to drive through the West fault, some 80 feet, where a fine body of coal from 9 to 14 feet thick was opened up for several thousand feet in entries and rooms. A threat of the gob-fire to develop forced the closing of this section, which will be reopened from another point. No. 5 seam was developed on the 600 West level for a considerable distance, maintaining its size and quality.

Description and length of tramway, plant, etc.—The plant, which has been well maintained, consists mainly of two Eclipse Leonard boilers, 40 horse-power; Aleos fan, 50,000 feet capacity, driven by a 60-horse-power engine; one 60-horse-power Ottuma hoisting-engine; tramway 1,800 feet long, 3-rail system, with Stine wheel. Tipple, bunkers, and scales are connected with a railway spur one mile long to Canadian Pacific Railway and Kettle Valley Railway tracks.

## Princeton Coal and Land Company, Ltd.

Head Office—15 Great St. Helens, London, E.C.

Capital, \$1,000,000.

<i>Officers.</i>	<i>Address.</i>
A. St. George Hamersley, Chairman,	London, Eng.
E. S. Neave, Secretary,	London, Eng.
Ernest Waterman, General Manager,	Princeton, B.C.
Francis Glover, Manager,	Princeton, B.C.

Value of plant, \$77,000.

### PRINCETON COLLIERY.

Francis Glover, Manager; William James, Overman; Robert Gourlay, Ben. J. Barlow,  
and Hugh Gillisple, Firebosses.

This colliery is situated on the right-hand bank of the Similkameen river, near the town of Princeton, and consists of one slope for haulage, with a vertical shaft for ventilation purposes. The slope, dipping through a gravel covering at an angle of 14 degrees, reaches the coal in about 200 feet.

The coal-seam averages 20 feet thick, with an inclination of about 12 degrees to the south. Work is confined to the upper 10 feet of this, and the method of working is pillar and stall; pillars 50 feet square and stalls 12 feet wide.

The mining of the coal during the development stage of the mine was done by machines of the post-puncher type, driven by compressed air, but when retreating the coal can be easily extracted without machines.

Ventilation is produced by a small fan of the Guibal type, driven by a steam-engine, and at my last inspection was producing 27,000 cubic feet of air a minute for the use of twenty-two men, running at a speed of 200 revolutions a minute, with a 1-inch water gauge.

During the year the mine has been fairly free from explosive gas and all the working-places and roadways have been fairly well timbered. Plenty of timber was provided for the use of the workmen and the condition of the mine with respect to coal-dust was fair.

Unfortunately, in the earlier stages of mining, very little attention was paid to keeping the mine free from accumulations of slack coal and debris, with the result that fires have been a fruitful source of trouble for some years past.

Lately an attempt to mine the coal on a panel system has given more satisfactory results, but in the older workings, owing to the light cover and open texture of the coal, it has been found difficult to keep these under control, much less to extinguish them.

The explosives used for blasting are those permitted under the order issued for this purpose, and certificated officials superintend the use of the same.

The surface equipment consists of a tippie with a link-belt screening plant having a capacity of about 400 tons a day. The coal is loaded into cars with a capacity of 1.5 tons and is hauled up the Main slope by a 50-horse-power hoist, steam-driven, to the tippie, where a Robinson self-acting rotary dump unloads them into the picking-tables, where the coal is sized for market purposes. The tippie machinery is driven by a 50-horse-power steam engine, while the loader and conveyor attached is driven by a separate engine.

The power plant consists of three boilers, with a combined capacity of 200 horse-power; two Canadian Rand low-pressure air-compressors, which furnish power for the mining-machines, pumps, and hoists in the mine; and a 60-kw. 3-phase, alternating-current dynamo furnishes light for the mines and the town of Princeton.

A well-equipped machine, carpenter, and car-repair shop is maintained, and a new wash-house was erected during the year to replace that destroyed by fire. Unfortunately, during the past summer, a fire destroyed the lamp-room, mine offices, and warehouse, and so far these have not been replaced.

With the destruction of the lamp-room, all the lamps, including the miners' electric head-lights, which were of the Wico type, were destroyed, and the Edison safety electric lamp has replaced them, while the inspection is made with the Wolf safety-lamp.

Copies of the "Coal-mines Regulation Act," special rules, "Timbering orders," and plans of the mine are posted at the mine entrance.

The following are the official returns of the Princeton Coal and Land Company for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada.....	14,193			
" export to United States.....	1,817			
" " other countries.....				
Total sales.....		16,010		
Used in making coke.....				
Used under colliery boilers, etc.....	5,062			
Loss and waste.....	1,141			
Total for colliery use.....		6,203		
		22,213		
Stocks on hand first of year.....	85			
" last of year.....	65			
Difference taken from stock during year.....		20		
Output of colliery for year.....		22,193		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		\$		\$		\$
Supervision and clerical assistance.....	4		5	5.50	9	
Whites—Miners.....	14	5.75-10.00			14	5.75-10.00
Miners' helpers.....	10	4.75			10	4.75
General underground men.....	16	4.75-5.00	7	4.00	23	4.00-5.00
Mechanics and skilled labour.....			7	4.80-5.00	7	4.80-5.00
Boys.....			4	2.00-3.00	4	2.00-3.00
Japanese.....						
Chinese.....						
Indians.....						
Totals.....	44		23		67	

Name of seams or pits—As last year, with the addition of No. 3 mine, which is in the prospecting stage. We have driven a tunnel, practically on the crop, for a distance of 250 feet. This is an exceptionally clean coal, about 3 feet 9 inches thickness of seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Same as previous year.

Description and length of tramway, plant, etc.—Same as previous year.

## Coalmont Collieries, Limited.

Head Office—Vancouver, B.C.

Capital, \$3,000,000.

### *Officers.*

W. J. Blake-Wilson, President,  
W. L. Parrish, Vice-President,  
A. H. Douglas, Secretary-Treasurer,  
Donald McLean, Manager,

### *Address.*

Vancouver, B.C.  
Winnipeg, Man.  
Vancouver, B.C.  
Coalmont, B.C.

### COALMONT COLLIERY.

Donald McLean, Manager and Overman; Thos. Bysouth, Fireboss.

This colliery is situated about twelve miles south of Princeton and five miles from the townsite of Coalmont, on the Kettle Valley Railway. The mine is driven in on the north bank of Granite creek and has been operating during the entire year. The output has averaged about 50 tons a day and is hauled by auto-trucks in summer and sleighs in winter to the Kettle Valley Railway siding near the town of Coalmont, a distance of about five miles, and this at present necessarily limits the production to the capacity of the haulage.

The No. 2 tunnel has now reached a distance of 3,600 feet from the portal, blocking out a considerable amount of coal, and is still being driven ahead in a very good seam of coal averaging 10 feet thick, with an inclination of 18 degrees, dipping to the south. A 25-horse-power boiler supplies steam for the fan, and so far no mechanical haulage has been required, all the workings being above water-level.

A cook-house, bunk-house, and about eight small cottages are maintained at the mine, while the principal workshops, offices, and living accommodation are situated at Coalmont.

During my inspections in 1919 I have found no trace of explosive gas and the mine is very well timbered throughout. Plenty of timber is provided convenient for the use of the workmen, and due to the nature of the coal very little coal-dust is created.

A 36-inch Comstock blower-fan, driven by a 8- x 10-inch steam-engine, capable of producing 16,000 cubic feet of air a minute, is maintained for ventilation purposes, but during the past summer natural ventilation has produced 4,500 cubic feet of air a minute, sufficient for the requirements of seven men and one horse.

This is the only mine in this district using open lights, generally carbide-lamps, the examination being made with a safety-lamp of the Wolf type, and, as already mentioned, no trace of methane has been found.

The coal is of a fairly firm nature and is blasted with Monobel with electric detonators under the supervision of certificated shotlighters.

### MINE-RESCUE APPARATUS.

Two apparatus of the old negative 2-hour type are maintained at this colliery, but there are no persons holding certificates for this work within eighteen miles. The condition of the apparatus is anything but satisfactory, and in the event of an accident would be practically useless, if not a positive danger.

Copies of the "Coal-mines Regulation Act," special rules, and plans of the mine are kept posted at the mine entrance.

The following are the official returns of the Coalmont Collieries for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR THE YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada .....	7,091			
" export to United States.....	2,898			
" " other countries .....				
Total sales .....		9,989		
Used in making coke .....				
Used under colliery boilers, etc.....	200			
Total for colliery use .....		200		
Stocks on hand first of year.....	1,000			
" last of year.....	1,000			
Difference added to stock during year.....				
Output of collieries for year.....		10,189		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	2	\$ 6.00			2	\$ 6.00
Whites—Miners .....	10	8.50			10	8.50
Miners' helpers .....						
Labourers.....	4	5.00	2	4.50	6	
Mechanics and skilled labour .....			2	5.50	2	
Boys .....	1	3.00	1	3.00	2	
Japanese .....						
Chinese .....						
Indians .....						
Totals.....	17		5		22	

Name of seams or pits—Nos. 1 and 2 tunnels.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 1 tunnel, in rock, 500 feet in length. No. 2 tunnel: Driven on strike; general direction, N. 29° 50' W. (ast.); coal average, 9 feet; average pitch, 22 degrees; length of level, 3,600 feet.

Description and length of tramway, plant, etc.—No. 1 tunnel tramway, 800 feet; No. 2 tunnel tramway, 4,000 feet. Three boilers—two 120 horse-power and one 22 horse-power; air-compressor, 120 lb. pressure.

## EAST KOOTENAY INSPECTION DISTRICT.

REPORT OF ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report of the coal-mines operating in the Crow's Nest Pass Inspection District during the year 1919.

These consisted of Coal Creek Colliery of seven mines—the Michel Colliery with three mines, which are owned by the Crow's Nest Pass Coal Company, Limited, of Toronto, and four mines (including the open-cut) at Corbin Colliery, owned by the Corbin Coal and Coke Company, of Spokane, U.S.A.

No attempt was made to reopen either the Carbonado Colliery, of the Crow's Nest Pass Coal Company, Limited, at Morrissey, which was shut down in 1909, or the Hosmer mines, belonging to the Canadian Pacific Railway Natural Resources Department, closed in 1914.

There were only two companies operating during the year, the Crow's Nest Pass Coal Company, Limited, working the Coal Creek Collieries and the Michel Collieries, and the other company, the Corbin Coal and Coke Company, working the mines at Corbin, including the open-cut termed the "Big Showing."

In the early part of the year the mines worked short time, due to lack of demand for coal, and in May they were practically shut down owing to a dispute between the companies and their workmen over the adjustment of wages resulting from the reduction by Statute of the hours of employment of outside employees; this later developed into a deadlock over the question of the recognition of which organization the workmen should belong to, whether the United Mine Workers of America or the One Big Union. It was August 25th before work was resumed after three months of idle time, during which no attempt was made to operate the mines, and in the early part even the fans were shut down.

The output of coal of the district for the year was 558,806 tons, showing a decrease of 175,065 tons, the cause of which has already been explained. The decrease is fairly distributed: Coal Creek, 96,272 tons; Michel, 33,544 tons; Corbin, 45,249 tons. The Corbin Colliery shipped during the stoppage about 12,000 tons from the stock accumulated the previous year.

An interesting point is the decrease in tonnage per day worked per mine, showing at Coal Creek a decrease from 7.02 tons in 1918 to 4.835 tons in 1919. Michel shows a similar falling-off, but not so great, being, in 1918, 6.01 tons per miner per day worked and only 4.844 tons in 1919; therefore the decrease in Coal Creek is 2.185 tons and in Michel 1.66 tons. In Corbin it is very hard to find the tonnage per man owing to the coal being mined on the caving system and the amount produced at the "Big Showing" by the steam-shovel.

The amount of coke produced during 1919 was 57,067 tons, also showing a decrease, due partially to the stoppage of work, but more so to the closing-down of the smelter at Grand Forks.

## ACCIDENTS.

Only one fatal accident was reported during the year; six serious and one slight. The fatal accident and five of the serious occurred in Coal Creek mines, one serious accident at Michel, and the slight at Corbin.

The fatal accident and one of the serious were due to falls of coal, and in both cases while the miner was attempting to hew it down. The practice of withdrawing the sprags and then getting under the overhanging coal to cut it down is a pernicious one, and can only be prevented by stricter discipline in the mine with the view of trying to protect the workmen from their own foolish actions.

The other five serious accidents were due to haulage-cars getting off the track and drivers getting caught between the sides and the moving car. More attention to the condition of the track, with a reasonable amount of space between the sides and the cars, should remedy this condition, and should be given more consideration, especially when we consider that this class provides 62 per cent. of our accidents.

The slight accident occurred in Corbin mines, due to a workman sticking his pick in a piece of timber to haul it; the pick glanced off the timber, puncturing his leg, and illustrates that greater caution is required by the workmen in using even his ordinary tools.

The list of accidents, it is pleasing to report, is very much shorter than last year, showing for all classes of accidents a reduction of 48 per cent. and in the fatal class a reduction of 80 per cent.

The general condition of the mines has been fairly good, and, although large volumes of methane are given off, careful inspection shows that only in one case has the air-current carried a larger percentage than that allowed by the standard of withdrawal provided for in section 11 of the 1919 amendment to the "Coal-mines Regulation Act," and this was owing to a derangement in the ventilation system, which was rapidly adjusted.

In future a more general use of the Burrell gas-detector is to be made by the firebosses by testing the mine-air current at fixed points and keeping a record of the same; this, if carried out consistently, with the measurement of the ventilation and careful observation of the barometrical reading, should give us a lot of information as to whether the amount of methane given off is simply due to the breaking-down of the coal or whether it is increased owing to the fall in the barometer.

Another item which I think should be given consideration is the means of communicating between the fan and the interior of the mine. In the event of a break-down in the ventilating machinery a long time must necessarily elapse before information can be conveyed to the men at the working-faces, so as to enable them to retreat, and it should be remembered that in mines with a methane production such as is found in this district every minute is of value.

No new fans have been installed during the year, although at least two have been under consideration for some time.

#### BUMPS.

No severe bumps have been experienced during the year, although many small knocks or jars have been felt without any serious damage. The repair-work on the Main Level district of No. 1 East mine, Coal Creek, where the bump was experienced in 1916, is now within 150 feet of the face. In this mine the term "bump" has become so common that almost everything heard or felt is ascribed to a bump and leads to very many misapprehensions.

#### BLOW-OUTS.

Several blow-outs have been experienced during the year, varying from the displacement of a few tons of coal to as much as 260 tons of very fine dust. The most severe or largest blow-out occurred on December 1st last in the No. 6 room, North side of No. 10 East slope, but fortunately sufficient warning was given to allow the workmen to escape. In every case these blow-outs are accompanied by the effusion of large volumes of methane, and are generally understood to be the result of gases under high pressure.

In the latter part of the year an attempt was made to relieve this gas under high pressure by drilling boreholes ahead in suspected areas, with very encouraging results so far as the areas experimented with were concerned. After careful observations by the management it was agreed that when certain conditions appeared in the coal strata a blow-out could nearly always be anticipated, and the drilling was used to allow the gases to bleed off. The results on the South side of the No. 10 East slope have been very encouraging, and even on the North side almost ten hours before the blow-out occurred it was anticipated.

The work of drilling is carried out on the midnight shift, when the minimum number of workmen are in the mine, and although the same amount of gas is given off by the drilling as by the blow-out, it is to a certain extent under control and allowed to bleed freely off at a time when it can do the least harm. The present outfit for drilling consists of an ordinary auger with extensions to allow of drilling 20 feet; in the future it may be found advisable to use larger diameter holes and of greater length.

In dealing with this question the careful observations of the firebosses and overman have been of great value in determining the means of reducing the danger from the blow-outs.

#### MINE FIRES.

No new mine fires have been reported during the year, although that at Corbin has required careful watching and extensive concrete stoppings have been built to prevent it spreading.

#### LIGHTING.

No open lights are used in any of the mines and the majority of the workmen are furnished with the Edison electrical safety-lamp, while the Wolf safety-lamp is used for examining the mine and the Burrell gas-detector is used for determining in the mine-air lower percentages of gas than can ordinarily be determined with the use of the Wolf safety-lamp. There are 1,022

electric mine-lamps and 168 Wolf safety-lamps in use, while there are ten Burrell gas-detectors. At all the collieries substantial lamp-rooms are provided for dealing with the lamps and testing the same before they are issued to the workmen.

Although searches were made regularly during the year, no matches or other articles contrary to Rule 9, section 91, of the "Coal-mines Regulation Act" were found, and only one prosecution was made during the year for breach of the special rule in going beyond a fence erected to prevent workmen from going into a dangerous place. A separate list shows the name of the party prosecuted, the penalty, and date of offence.

#### THE USE OF EXPLOSIVES.

Explosives are used very sparingly at Coal Creek and only for rock-work; to a greater extent for the production of coal, both at Michel and Corbin.

The total amount of explosives used was 12,550 lb., made up of: Monobel, 7,333 lb.; Polar Permitite, 1,730 lb.; Dynobel, 1,000 lb.; 40-per-cent. dynamite, 87 lb.; and 2,300 lb. stumping-powder.

At Coal Creek 1,088 lb. of Polar Permitite was used in 1,696 shots, showing an average of 0.64 lb. a shot in rock-work.

At Michel 5,714 lb. of Monobel was used in 10,774 shots, an average of 0.53 lb. a shot; 1,000 lb. of Dynobel in 1,050 shots, with an average of 0.94 lb. a shot; and 281 lb. of Polar Permitite was used in 260 shots, an average of 1.08 lb. a shot.

At Corbin 1,719 lb. of Monobel, 361 lb. of Polar Permitite, and 87 lb. of 40-per-cent dynamite was used in 2,724 shots, allowing 0.79 lb. a shot. This was mostly used in the underground operations, and 2,300 lb. of stumping-powder was used in 120 holes at the "Big Showing" or open-cut, allowing 19.16 lb. a shot.

Only one miss-fire was reported, and this was at Corbin with fuse, and practically all the shots were fired with electric detonators, with the exception of the 120 at the open-cut or "Big Showing" at Corbin.

I have not tried to show how many tons of coal was produced to the pound of explosives used, as this would be very unreliable owing to the fact that in Coal Creek, the largest producer, no coals are brought down with explosives, while in Michel explosives are used in every mine to bring down the coal, and at Corbin a large amount of explosives is used in stripping the cover off at the open-cut.

#### COAL-CUTTING MACHINES.

Very few coal-cutting machines are in use owing to the soft nature of the coal. At Coal Creek two machines of the post type, driven by compressed air, produced 630 tons of coal, while in Michel three of the same type produced 7,053 tons, or a total of 7,683 long tons.

At Corbin a large quantity of coal is produced by a steam-shovel, but this has not been generally termed a coal-cutting machine, rather being of the nature of a loader.

#### MINE-RESCUE TRAINING AND FIRST AID TO THE INJURED.

In the work of mine-rescue training only five new workmen took a full course of training, of whom four were successful in obtaining certificates. Twenty-six, all from Coal Creek mines, took sufficient lessons to make themselves acquainted with the Gibbs mine-rescue apparatus, six of which have been installed at the Government mine-rescue training-station at Fernie. The work of first aid has been very well maintained during the year, in spite of the discouragement due to the idle time.

An effort was made to establish a Safety-first Association in the latter part of the year, and thanks to the financial assistance of the Vancouver Island Safety-first Association and W. R. Wilson, general manager of the Crow's Nest Pass Coal Company, a team of six was enabled to take part in the safety-first and mine-rescue contest at Nanaimo on September 1st, in which the Fernie team took third place and was only surpassed by the two teams from the United States. I am enclosing a photo of the team which you might be able to use in the Annual Report.

The amount of mine-rescue apparatus at the various mines is similar to last year, and I think it is almost time efforts were made to bring it up to date, most of it consisting of the Draeger type, which has been condemned in nearly every mining country where rescue apparatus has been in line with other mining developments.

I have already in previous reports pointed out the lack of interest in this work, and can only repeat the same story; even in the case of the Gibbs mine-rescue apparatus, which is generally conceded to be up to date, only the workmen from Coal Creek have gone to the trouble of making themselves acquainted with it. In the case of Michel and Corbin the excuse is the cost of coming to Fernie and the lack of payment for this kind of work.

I should very much like if the work of this Department could be made elastic enough to visit both Michel, Coal Creek, and Corbin, preferably by having a railway-car fitted up as is done in the neighbouring Province of Alberta and in several of the States south of the line.

In the last month of the year a safety inspector has been appointed by the Crow's Nest Pass Coal Company for the Coal Creek Colliery, and should be of great assistance in reducing our accident list.

In conclusion, I wish to thank the workmen and the officials of the various collieries for their assistance in carrying out our duties during the year, and trust for a continuation of the same during 1920, so that we may all work together in an earnest endeavour to make the condition safer and better in what is admittedly a most dangerous occupation.

Attached is a list of the accidents reported, prosecutions, and a brief description of the various mines by Inspector of Mines William Lancaster, accompanied by charts showing the gas production in several of the most dangerous mines, and charts showing accident-rate for the past ten years and the output of coal and coke for the past two years.

### Crow's Nest Pass Coal Company, Ltd.

Capital, \$3,500,000.

<i>Officers.</i>	<i>Address.</i>
Elias Rogers, President,	Toronto, Ont.
E. C. Whitney, Vice-President,	Ottawa, Ont.
R. M. Young, Secretary,	Fernie, B.C.
Elias Rogers, Treasurer,	Toronto, Ont.
W. R. Wilson, General Manager,	Fernie, B.C.
Bernard Caulfield, Colliery Manager, Coal Creek Collieries,	Fernie, B.C.
Thomas H. Williams, Colliery Manager, Michel Collieries,	Michel, B.C.

The above company is now operating the following extensive collieries on the western slope of the Rocky mountains in the East Kootenay District, namely:—

**COAL CREEK COLLIERY**, situated on Coal creek, about five miles from the town of Fernie, on a branch railway to the mines, connected at Fernie with the tracks of the Canadian Pacific Railway and also those of the Great Northern Railway.

**CARBONADO COLLIERY**, situated on Morrissey creek and connected by a branch railway with the Canadian Pacific Railway and the Great Northern Railway at Morrissey. The colliery is about fourteen miles from Fernie by rail in a south-easterly direction. This colliery has been shut down since 1909.

**MICHEL COLLIERY**, situated on both side of Michel creek, on the line of the Canadian Pacific Railway, being twenty-three miles in a north-easterly direction from Fernie. This last colliery is in the Northern Inspection District.

The amount and disposition of this combined output of the company's collieries is fully shown in the following table:—

COMBINED RETURNS FROM CROW'S NEST PASS COAL CO.'S MINES FOR YEAR 1919.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	39,791		48,996	
" export to United States .....	311,469		8,134	
" " other countries .....				
Total sales .....		351,260		57,130
Used in making coke .....	85,735			
" under colliery boilers, etc. ....	42,087			
Total for colliery use .....		127,822		
Stocks on hand first of year .....	121	479,082	375	
" last of year .....	98		312	
Difference taken from stock during year .....		23		63
Output of colliery for year. ....		479,059		57,067

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance .....	40		14		54	
Whites—Miners .....	489				489	
Miners' helpers .....						
Labourers .....	145		155		300	
Mechanics and skilled labour .....	250		133		383	
Boys .....	11		18		29	
Japanese .....						
Chinese .....						
Indians .....						
Totals .....	935		320		1,255	

COAL CREEK COLLIERY.

Bernard Caulfield, Manager; James Taylor, Assistant Manager.

This colliery, the mines of which are situated on both sides of Coal creek, is connected to both the Canadian Pacific and Great Northern Railways by five miles of track termed the Morrissey, Fernie & Michel Railway.

The mines operated during the year were: On the North side, No. 1 North, No. B North, and No. 9; on the South side, No. 1 South, No. 1 East, and No. 2 seam.

No. 2, 3, and 9 mines are working the No. 2 seam, which varies in thickness from 5 to 8 feet; the No. 1 mines are all working the No. 1 seam, which varies in thickness from 30 to 40 feet generally; only 10 feet of the bottom portion of the seam is worked. B North seam is about 5 feet thick; the height for the roads is gained by taking up 5 feet of bottom, which is inferior coal. The method of work is pillar and stall in all the mines; entries and rooms are driven

in pairs, leaving a large pillar between each pair; no pillars have been drawn during the year. The direction of dip of the above seams generally is east, varying from 8 to 12 degrees.

The haulage inside the mines generally is by horses gathering from the working-faces; the main haulage comprises compressed low-pressure air-hoists, compressed-air locomotives, endless rope, and gravity-inclines. No. 1 North, No. 1 South, and B North mines being situated higher than the tippie, gravity-inclines lower the cars down to the level of the tippie, from each incline the coal is taken to the tippie by steam and compressed-air locomotives.

The tippie is of steel construction and is 840 feet in length, extending across the valley; it comprises two separate and independent circular dumps, each driven by electric motors, delivering the coal into feed-conveyors that supply the shaking screens; the slack passes through the screens into hoppers, from which it is drawn and loaded into slack-cars; the screened coal is delivered on to a picking-table, which enables the foreign matter to be picked out before the coal passes into the railroad-car. Provision is made for the loading of coal both into open and box cars, and to reduce the breakage to a minimum two Smith hydraulic box-car loaders are provided.

The main power plant is situated on the north side of the creek; it consists of fourteen boilers, also an auxiliary plant on the south side consisting of three boilers; the total capacity of the whole of the plant is 2,200 horse-power. Three air-compressors have a total capacity of 6,000 cubic feet of free air a minute, compressing the air to 100 lb. a square inch; also a Canadian Rand high-pressure compressor with a capacity of 1,346 cubic feet of free air a minute, compressing the air to 1,100 lb. a square inch; the low-pressure provides power for the pumps and hoists inside of the mines; the high-pressure provides power for the air-locomotives.

The electric plant consists of two 400-ampere, 250-volt generators and one Crocker-Wheeler 280-ampere, 220-volt generator; all the above are driven by two separate Robb-Armstrong engines, 20 x 20 inches, which provide power for No. 1 South, No. 1 North, and B North fans, motors for the tippie, and lighting purposes.

A very well-equipped lamp-room is provided. There are now in use 670 electric head-lamps of the Edison type and ninety Wolf safety lamps, forty-five of which are used alternately. Wash and change room is provided for 950 workmen, steel lockers being used, and each workman provides his own soap and towel.

Large stable accommodation on the surface is provided for all the mine-horses. Adequate machine, blacksmith, carpenter, and repair shops are maintained at the mines in addition to those at Fernie; there are also large and commodious offices and warehouses built of hollow concrete blocks.

A large number of workmen's houses have been erected at Coal Creek for the convenience of the workers, and a very good train service is maintained with the town of Fernie, where the remainder of the workmen reside and the principal offices of the company are situated.

#### No. 1, EAST MINE.

John Caulfield, Overman; Hy. Dunlap, Jas. Duncan, Thos. Reid, and Jas. Maltman, Firebosses.

This mine is on the south side of the valley, east of the tippie, at an elevation of 800 feet. The seam is reached by a crosscut tunnel at a distance of 215 feet from the entrance. Since the occurrence of the bump in November, 1916, which destroyed most of the workings, work has been going on to recover the Main tunnel and is now about 150 feet from the face; also a new airway, counter to the above, is being made. The present production of coal is from the dip, which is reached by two slopes, No. 10 and No. 14.

Ventilation is produced by a double-inlet fan of the Guibal type, driven by belt from a 125-horse-power steam-engine, capable of producing 140,000 cubic feet of air a minute, with a 3.6-inch water-gauge.

The mine is ventilated by three separate splits. North split: 18,000 cubic feet of air a minute for the use of thirty men and three horses, or 461.5 cubic feet for each unit. South split: 40,000 cubic feet of air a minute for the use of thirty men and four horses, or 952.4 cubic feet for each unit. West split: 16,000 cubic feet of air a minute for the use of twelve men and one horse, or 1,066 cubic feet for each unit.

Highest percentages of methane we found by the Burrell gas-detector was in the South split, which varied throughout the year from 1 to 1.8 per cent.

During our inspection throughout the year we found explosive gas six times, generally in cavities above the timbers; owing to the soft nature of the coal it is very difficult to prevent

having these cavities. The roadways were well timbered and the "systematic timbering" order was well maintained at the working-faces. Generally, conditions were good.

#### No. 1 SOUTH MINE.

This mine is situated half a mile west of the tippie and works the west portion of the No. 1 seam on the south side of the valley. Ventilation is produced by a 4- x 8-foot Keith fan driven by an electric motor, producing 39,000 cubic feet of air a minute, running 254 revolutions a minute, with a 2.9-inch water-gauge. The ventilation of this mine is all on one circuit; the above quantity is for the use of sixty-six men and twelve horses, or 382 cubic feet a minute for each unit.

During the year we found explosive gas on five occasions, generally in cavities above the timbers, and the percentage of methane in the air-current has always been kept below the adopted standard. Roadways were well timbered and the "systematic timbering" order was well maintained by the miners at the working-faces. Generally, conditions throughout the mine were good.

#### No. 1. NORTH MINE.

Jos. Worthington, Overman; Ed. Rutledge, Matthew Turnbull, and John Charnock, Firebosses.

This mine is on the north side of the valley, working the west portion of the No. 1 seam. Owing to being under lighter cover and near the outcrop, no trouble is experienced in bumps or the giving-off of high percentages of methane.

Ventilation is produced by a 4- x 7-foot Keith fan driven by an electric motor, producing 27,000 cubic feet of air a minute for the use of fifty men and eight horses, or 365 cubic feet a minute for each unit.

During the year we found explosive gas on two occasions in small quantities, and the percentage of methane in the air-current has always been below 0.7 per cent. Roadways and working-places are all very well timbered, and generally conditions throughout the mine are very good.

#### B NORTH MINE.

Wm. Commons, Overman; Jas. White, Herbert Parsons, and Evan Jones, Firebosses.

This is the only mine that is working the B seam, it is situated east of the tippie and about 200 feet vertical above No. 1 seam.

Ventilation is produced by a 10- x 3-foot Brazil fan, driven by an electric motor, producing 36,000 cubic feet of air a minute, with a 1-inch water-gauge.

Ventilation is divided into two separate splits. Incline split: 17,400 cubic feet of air a minute for the use of twenty men and two horses, or 670 cubic feet a minute for each unit. Slope split: 14,000 cubic feet of air a minute for the use of thirty men and four horses, or 333 cubic feet a minute for each unit.

During the year we found explosive gas three times in very small quantities, generally from feeders in the roof. The percentage of methane in the return air-current has been kept below the adopted standard; it varied from 0.8 to 1.5 per cent., shown by the Burrell gas-detector. Roadways and working-places generally have been kept in good condition; also the mine has been kept fairly free from coal-dust.

#### No. 2 MINE.

Carmichael McNay, Overman; Jas P. Bushnell, Walter Clarkestone, and Ernest Ward, Firebosses.

This mine is situated on the south side of the valley, the Main tunnel being on the same level and in an almost direct line with the tippie, and is working the south and west portion of No. 2 seam.

Ventilation is produced by an 8- x 16-foot Wilson fan, driven by a 125-horse-power steam-engine, capable of producing 150,000 cubic feet of air a minute, against a 4-inch water-gauge.

The ventilation is divided into two separate splits. Rock Tunnel split: 14,000 cubic feet of air a minute for the use of forty-five men and five horses, or 233 cubic feet a minute for each unit. High Line split: 10,000 cubic feet of air a minute for the use of seven men and one horse, or 1,000 cubic feet a minute for each unit.

Explosive gas has been found three times during our inspection throughout the year, and the percentage of methane in the air-current has been kept below 1 per cent. Roadways are in good condition, but parts of the airway are small and same is being enlarged; timbering in the working-faces was good. Generally, conditions throughout the mine were good.

#### No. 3 MINE.

John Biggs, Overman; W. A. Brown, Ed. Caufield, and R. S. Phillips, Firebosses.

This mine is working the dip portion of No. 2 seam on the south side of the creek.

Ventilation is produced by an 8- x 16-foot Wilson fan, which is producing 60,000 cubic feet of air a minute, with a 3.5-inch water-gauge, and driven by a 125-horse-power steam-engine.

The ventilation is divided into two separate splits. Incline split: 18,000 cubic feet of air a minute for the use of thirty men and four horses, or 430 cubic feet a minute for each unit South Level split: 23,000 cubic feet of air a minute for the use of thirty-four men and five horses, or 450 cubic feet a minute for each unit.

Throughout the year explosive gas has been found by us three times in small quantities, and the percentage of methane in the return air-current has been kept below the adopted standard. The roadways and working-places are all very well timbered, and generally conditions throughout the mine are very good.

#### No. 9 MINE.

Robert Fowler, Fireboss.

This mine is of the same seam as Nos. 2 and 3 mines, but on the north side of the creek. The present work is driving the Main level (which is in faulty ground) and improving the airway.

Ventilation is produced by a 7- x 16-foot fan of the Guibal type, capable of producing 100,000 cubic feet of air a minute. Very little active mining is being done and the fan is only running about half-speed. The measurement in the last crosscut was 10,000 cubic feet of air a minute for the use of seven men and one horse, or 1,000 cubic feet a minute for each unit. The percentage of methane has always been below 0.5 per cent., and we found explosive gas twice; this was in small quantities in cavities above timbers. General conditions have been good.

The following are the official returns from the Coal Creek Collieries for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.  (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada .....	25,848	.....	12,640	.....
" , export to United States .....	234,797	.....	988	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	260,645	.....	13,628
Used in making coke .....	17,806	.....	.....	.....
" under colliery boilers, etc. ....	27,763	.....	.....	.....
Total for colliery use .....	.....	45,569	.....	.....
Stocks on hand first of year .....	121	306,214	134	.....
" last of year .....	98	.....	.....	.....
Difference taken from stock during year .....	.....	23	.....	134
Output of collieries for year .....	.....	306,191	.....	13,494

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.\*

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	25	.....	8	.....	33	.....
Whites—Miners.....	315	.....	.....	.....	315	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	96	.....	60	.....	156	.....
Mechanics and skilled labour....	171	.....	79	.....	250	.....
Boys.....	9	.....	9	.....	18	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	616	.....	156	.....	772	.....

\* Does not include Fernie coke-ovens; not operated since April 4th, 1919.

The following shows the number of days Coal Creek Colliery worked each month during 1919:—

January.....	26	August*.....	9
February.....	12	September.....	25
March.....	19	October.....	26
April.....	17	November.....	25
May*.....	16	December.....	25
June*.....	.....		
July*.....	.....	Total.....	200

\* Miners on strike from May 24th to August 18th.

Name of seams or pits—No. 1 North, No. 1 South, and No. 1 East, same seam; No. B, Nos. 2, 3, and 9, same seam.

## MICHEL COLLIERY.

Thomas H. Williams, Manager.

This colliery, operated by the Crow's Nest Pass Coal Company, Limited, is situated on both sides of Michel creek, and is about twenty-four miles east of Fernie, on the Crow's Nest Pass branch of the Canadian Pacific Railway, the Great Northern Railway's Rexford branch also connecting to the mines. The mines operated during the year were No. 3 and No. 3 East on the south side of the creek and New No. 8 on the north side.

No. 3 and No. 3 East mines are working the upper portion of No. 3 seam, which varies in thickness from 7 to 12 feet; No. 8 seam is about 12 feet thick; the above seams have an average dip of 12 degrees to the south. Method of work in all the mines is pillar and stall; some pillar-work has been done in No. 3 East and No. 8.

The haulage consists generally of horses gathering cars from the working-places to the landings, where it is hauled up the slopes or lowered down inclines by compressed-air hoists and then hauled to the tippie by compressed-air locomotives.

No. 8 mine is situated 500 feet above the tippie. The coal is dumped in a bunker at the top of the incline, from which a skip is loaded, taking the coal down to another bunker at the bottom of the incline on the same level as the tippie; mine-cars are reloaded and taken to the tippie by endless-rope haulage.

The tippie is built of steel and is 664 feet long and 14 feet wide. All the coal from the South side is weighed at the foot of the tippie incline; here there is a Green car-haul consisting of double endless-chain arrangement, which travels on car-wheels with axles which acts as spreader-bars, as pushers, and as retarders of the mine-cars when on the incline. Tracks for the mine-cars are inside the tracks for the cross-bar wheels, and when the car is delivered to the chain-haul the cross-bar moves up to the rear car-wheels and pushes the car up the incline to the

dump. The dump, which is simply a continuation of the track, increases from 20 to 60 degrees pitch, and when on this pitch the door of the car opens and the coal is discharged into the dump; the crossbar, continuing to travel around a large sprocket-wheel, carries the rear end of the car with it over the sprocket to the upper or overhead track, by which the car returns down the incline.

On the North or No. 8 side the cars are dumped by automatic dump, and after being dumped a transfer arrangement allows them to return underneath the loaded track to the endless rope, which takes the cars to the bin at the foot of No. 8 incline.

The tippie is fully equipped with picking-tables and screens, and the slack is taken by a belt-conveyor to the slack-bins, from which it is drawn and hauled by steam-locomotives to the coke-ovens. All the machinery around the tippie is driven by electric motors; there are also Smith gravity box-car loaders, which allow the handling of coal into the cars with a minimum breakage.

The boiler plant consists of eleven boilers with a total capacity of 1,600 horse-power; both boiler and power plant are housed in a fire-proof building of brick construction. Power is provided for the hoists and pumps inside of the mine, also to No. 8 fan, by both a Walker and Rand compressor with a total capacity of 8,000 cubic feet of free air a minute, compressing to 100 lb. a square inch; also a high-pressure Rand compressor with a capacity of 1,450 cubic feet of free air a minute, compressing to 1,100 lb. a square inch. This provides power for the air-locomotives.

The electric-power plant consists of two 250-kw. generators; each supplies the tippie motors and other machinery, and also for lighting purposes around the plant and the town of Michel.

A very well-equipped lamp-room is maintained, and 331 Edison electric head-lamps are in use, also thirteen Wolf safety-lamps for testing purposes. Burrell gas-detectors are in use in all the mines to determine very low percentages of methane, which cannot be detected by the ordinary safety-lamp.

Large stables are provided for both mine and surface horses. A large wash-house and change-room with steel lockers is provided for all the workmen, who provide their own soap and towels. There are machine, blacksmith, carpenter, and car-repair shops, besides warehouses and offices.

#### No. 3 MINE.

Matthew Littler, Overman; Andrew Frew, Thos. James, and Alfred Davies, Firebosses.

The upper portion of this seam is being worked; it is reached by the Main tunnel, which intersects Nos. 3, 4, and 5 seams; Nos. 4 and 5 being abandoned.

Ventilation is produced by a 6- x 12-foot fan of the Guibal type, driven by a 125-horse-power steam-engine, producing 50,000 cubic feet of air a minute, fan running 118 revolutions a minute, with a 1.6-inch water-gauge.

The mine is ventilated by two separate splits. East split: 14,000 cubic feet of air a minute for the use of fourteen men and two horses, or 700 cubic feet for each unit. West split: 24,000 cubic feet of air a minute for the use of forty-eight men and two horses, or 444 cubic feet for each unit.

In our inspections during the year we have never found explosive gas in any of the active workings; only once found gas in the old works, and the percentage of methane has been kept well below the adopted standard. The roadways were well timbered and timbering in the faces has been fairly well maintained. Generally, conditions have been good.

#### No. 3 EAST MINE.

Thos. Davies, Overman; Ben. Ball, Alfred Ball, and Wm. Picton, Firebosses.

This mine is working the east portion and Upper seam of No. 3 on the east side of the valley.

Ventilation is produced by a 8- x 16-foot Wilson fan, driven by a 125-horse-power steam-engine, producing 75,000 cubic feet of air a minute, with a 2.2-inch water-gauge.

The mine is ventilated by two separate splits. East split: 18,200 cubic feet of air a minute for the use of forty men and two horses, or 400 cubic feet a minute for each unit. West split: 36,000 cubic feet of air a minute for the use of forty-two men and four horses, or 667 cubic feet a minute for each unit.

Throughout the year we found explosive gas on two occasions; this was in small quantities, and the percentage of methane in the air-current has been kept below the adopted standard. The roadways were always kept in good condition and timbering in the faces good. Generally, conditions throughout the mine were very good.

#### No. 8 MINE.

Thos. Baybutt, Overman; Alec. Almond, John Marsh, M. McLean, and Ed. Ainsworth,  
Firebosses.

This mine is situated on the north side of the valley at an elevation of 535 feet above the tippie and is working the north portion of Old No. 8 seam, which was sealed off in 1911 owing to fire in the mine.

Ventilation is produced by a 4- x 8-foot Murphy fan, driven by a 40-horse-power compressed-air driven engine, producing 42,000 cubic feet of air a minute, with a 1.25-inch water-gauge, running 220 revolutions a minute.

The mine is ventilated by two separate splits. No. 6 Incline split: 18,000 cubic feet of air a minute for the use of fifty-six men and six horses, or 243 cubic feet a minute for each unit. No. 1 Incline split: 14,000 cubic feet of air a minute for the use of forty-six men and eight horses, or 200 cubic feet a minute for each unit.

Only once did we find explosive gas during the year, and this was a small quantity in a cavity in the roof; also the percentage of methane in the air-current has always been below 1 per cent. Roadways and working-faces were well timbered. Generally, conditions throughout the mine were good.

The following are the official returns from the Michel Collieries for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada .....	13,943		36,356	
"    export to United States .....	76,672		7,146	
"    "    other countries .....				
Total sales .....		90,615		43,502
Used in making coke .....	67,929			
Used under colliery boilers, etc .....	14,324			
Total for colliery use .....		82,253		
Stocks on hand first of year .....			241	
"    last of year .....			312	
Difference added to stock during year .....				71
Output of collieries for year .....		172,868		43,573

## NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC. (INCLUDING COKE-OVENS).

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	15		6		21	
Whites—Miners.....	174				174	
Miners' helpers.....						
Labourers.....	49		95		144	
Mechanics and skilled labour.....	79		54		133	
Boys.....	2		9		11	
Japanese.....						
Chinese.....						
Indians.....						
Totals.....	319		164		483	

The following shows the number of days Michel Colliery worked each month during 1919:—

January.....	26	August*.....	5
February.....	15	September.....	25
March.....	22	October.....	25
April.....	19	November.....	25
May*.....	17	December.....	26
June*.....			
July*.....		Total.....	205

\* Miners on strike from May 24th to August 25th.

Name of seams or pits—New No. 3 (top section of No. 3 seam); Old No. 3 (lower section of No. 3 seam); New No. 8 (Old No. 8 seam continued).

## Corbin Coal and Coke Company, Limited.

Head Office—Spokane, Wash.

Capital, \$10,000,000.

### Officers.

D. C. Corbin, President,  
 J. K. O. Sherwood, Vice-President,  
 Wm. Weaver Heaton, Secretary-Treasurer,  
 A. M. Allen, Assistant Treasurer,  
 R. S. Ord, General Manager,  
 E. L. Warburton, Mine Manager,

### Address.

Spokane, Wash.  
 New York, N.Y.  
 New York, N.Y.  
 Spokane, Wash.  
 Spokane, Wash.  
 Corbin, B.C.

Value of plant, \$400,000.

### CORBIN COLLIERY.

E. L. Warburton, Manager.

This colliery is situated on the East branch of the South fork of Michel creek, about fourteen miles from McGillivray Junction, on the Crownsnest branch of the Canadian Pacific Railway, and is connected to this by the branch line called the British Columbia Eastern Railway.

The colliery consists of Nos. 1, 3, and 4 mines. The whole of the coal produced during the year was from Nos. 3 and 4 mines. No. 1 seam has been sealed off on account of fire since the year 1913.

The No. 3 mine is situated 800 feet higher than the town of Corbin and at a distance of two miles away. This mine is reached by a standard-gauge switchback railway about six miles long, and is owned by the Coal Company; the hauling of the cars is by Shay locomotives, which are built specially for heavy grades.

To overcome some of the difficulties in the use of the snow-plough in winter, three turntables have been installed at the most convenient points along the road to enable the plough to be worked both ways, instead of having to back down to a wye to turn, which would mean a lot of time wasted, as the foremost point on the above railroad from the wye is about seven miles.

No. 3 mine being an open one, the coal is loaded directly into railroad-cars by the steam-shovel. The tippie is built of wood, and consists of coal-bins with a total capacity of 1,000 tons; also includes a Marcus screen for screening purposes.

The power plant consists of two 50-horse-power boilers of the locomotive type; two 120-horse-power boilers, tubular type; one 80-horse-power engine and dynamo, mostly used for lighting purposes around the plant, also for the town. There is a wash-house for the workmen, blacksmith and carpenter shops, warehouse and offices. There are now in use a few Edison electric head-lamps in addition to the Wolf safety-lamp, and a Burrell gas-detector for use in the mine.

#### Nos. 4, 5, AND 6 MINES.

Jas. Blair, Overman; Geo. Luck, Geo. Elmes, and Hugh Osborne, Firebosses.

No. 4 seam is on the west side of No. 1 seam, and the upper workings are reached by an incline direct from the tippie. The seam varies from 50 to 200 feet in thickness and is vertical, and the work is retreating, extracting the pillars by the system of caving; this is easily done as the coal is very friable; chutes are so specially arranged that the coal falls towards them and very little of it is lost.

In the early part of the year fire broke out in the old No. 4 level; this was successfully sealed off by a stopping built of concrete.

Ventilation is produced by a 4- x 12-foot fan of the Guibal type, driven direct by a steam-engine, producing 21,000 cubic feet of air a minute, fan running 95 revolutions a minute, with a 0.5-inch water-gauge. The above quantity is for the use of eighteen men and one horse, or 1,000 cubic feet a minute for each unit.

This mine makes very little gas; we have never found explosive gas and the percentage of methane has never exceeded 0.5 per cent. The roadways are all well timbered. Generally, conditions are good. Nos. 4 and 5 are only in their prospect stages.

#### No. 3 MINE, OR "BIG SHOWING."

This mine is situated about two miles south of Corbin and about 800 feet higher. The operating portion of the seam has very little cover; it is composed of surface soil and coal-blossom; this is taken off and loaded into dump-cars by a steam-shovel.

Work is proceeded by a series of benches, the uppermost bench being in advance of the one below; where the coal is firm it is blasted, and the loose coal is loaded by the steam-shovel into railroad-cars. It is impossible to operate throughout the whole of the year; in the latter part of winter, generally there is a heavy snowfall which stops all operations for a time.

This being an open mine, there is nothing to mention with respect to ventilation; the work of supervision with respect to safety of the employees is very well maintained.

The following are the official returns for the Corbin Coal and Coke Company for the year ending December 31st, 1919:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Tons of 2,240 lb.				
Sold for consumption in Canada.....	26,136			
"    export to United States.....	61,879			
"    "    other countries.....				
Total sales.....		88,015		
Used in making coke.....				
Used under colliery boilers, etc.....	4,538			
Total for colliery use.....		4,538		
		92,553		
Stocks on hand first of year.....	16,825			
"    last of year.....	4,019			
Difference taken from stock during year.....			12,806	
Output of colliery for year.....		79,747		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	5		4		9	
Whites—Miners.....	23				23	
Miners' helpers.....	7				7	
Labourers.....	30		35		65	
Mechanics and skilled labour.....			10		10	
Boys.....						
Japanese.....						
Chinese.....						
Indians.....						
Totals.....	65		49		114	

Name of seams or pits—No. 3 mine or "Big Showing," open work; No. 4 mine, "A" tunnel, underground mining; No. 5 mine, underground mining; No. 6 mine, prospect underground mining.

Description of seams, tunnels, levels, shafts, etc., and number of same—As per last annual report. Dirt-stripping during the year at No. 3 mine has been under contract to H. H. Boomer and about 150,000 yards of dirt removed. Average of thirty men employed since May, and these not shown on our return. Corbin Creek prospected and two seams located and 250 feet of tunnel-work put in, showing coal of good grade. Steam ash-blower installed at power-house. Main and tail rope haulage working at 400 level, No. 4 mine, displacing eight horses. Eighty per cent. of underground coal produced from pillar-work, No. 4 mine.

SUMMARY—TABLE SHOWING ACCIDENTS OCCURRING IN B.C. COLLIERIES IN TEN YEARS—1910 TO 1919.

For the year.....	1910.				1911.				1912.				1913.				1914.				1915.				1916.				1917.				1918.				1919.				Total for 10 years.							
	Fatal.	Serious.	Slight.	Total.																																												
Output of coal..... tons	3,139,235				2,193,062				3,026,709				2,570,760				1,810,967				1,972,580				2,485,580				2,398,715				2,578,724				2,408,948				24,583,244							
Number of persons employed.....	7,758				6,873				7,130				6,671				5,732				4,991				5,060				5,170				5,427				5,966				60,778							
Nature of Injury and Cause of Accident.																																																
Gas explosions.....	6	6		10	10	7	2	3	12	13	13		13	13	1	2	3	23	23	2	2	33	12			12	38			38					1	1							80	5	43	128		
Falls of coal.....	5	16	5	26	3	5	6	14	4	7	9	20	6	4	2	12	2	6		8	1	3	3	7	3	5	2	10	1	6	11	18	3	3	1	7	4	3	1	8	32	58	40	130				
Falls of rock.....	8	15	12	35		5	24	29	5	9	10	24	11	9	3	23	2	14		16	4	7	4	15	7	6	7	20	2	4	14	20	4	10	3	17	4	11	3	18	47	90	80	217				
Mine cars and horses.....	11	49	23	83	5	7	18	30	5	10	10	25	4	28	9	41	5	18	2	25	3	21	2	26	5	15	7	27	1	11	5	17	4	14	5	23	4	14	10	28	47	187	91	325				
Powder, etc., explosion.....	1	1	3	5		1	2	3	2	1		3		2		2	2	2		5		1	1			1		1		1		1		2	2		1	1	5	8	8	11		24				
Hoisting, ropes, etc.....	2	4	2	6		1	1	2	3	7	6	16	1	2		3	2	1	1	4	1	4	4	9		5	4	9	1	5	5	11	16		2	18		3		3	24	30	27	81				
Mine timber.....	1	4	2	7			5	5	1	2	2	5	3	6	1	10		2	2	4						2	2	4		1	3	4	1	2	3	6			2	2	6	19	22	47				
Underground, miscellaneous.....	1	4	4	9	4		5	9		4	4	8			6	6	3			3	19	1	3	23	1	3	5	9	1	2	5	8		1	2	3			4	4	29	15	38	82				
On surface, miscellaneous.....	1	4	7	12	4	4	11	19	1	2	3	6	2	6	1	9	1	8	1	10	1	3	1	5				1	1								2	3	5	10	29	29		68				
Totals.....	28	95	66	189	16	23	82	121	28	44	47	119	27	57	35	119	17	53	8	78	52	41	26	119	28	36	29	93	44	29	45	118	28	30	19	77	12	33	24	69	280	441	381	1,102				

ACCIDENTS IN BRITISH COLUMBIA COLLIERIES DURING 1919.

Cause of Accident and Nature of Injury.	NAME OF COLLIERY.																Total for 1919.		
	C.C.	C.C.	C.C.	W.F. Co.	P.C.C. M.	B.C.C. M.	G.M.S. & P. Co.	N.C. Co.	T.C. Co.	M.C.C.	P.C. Co.	P.C. & L. Co.	C.C. Co.	C.N.P. C. Co.	C.N.P. C. Co.	C.C. & C. Co.	Total.	Total.	
	Cumber-land.	Exten-sion.	S. Wel-lington.	Nanai-mo.	S. Wel-lington.	E. Wel-lington.	Cassidy.	Nanoose	Telkwa.	Middle-boro.	Merritt.	Prince-ton.	Coal-mont.	Coal Creek.	Michel.	Corbin.			
Gas—Explosion of																			
Fatal																			
Serious														1				1	
Slight																			
Falls of Coal																			
Fatal	1		1		1									1				4	
Serious	2				1													3	
Slight																			
Falls of Rock or Roof																			
Fatal	1				3													4	
Serious	3		1		2		1											11	
Slight			1		1													3	
Mine Cars and Horses																			
Fatal	3																	4	
Serious	3		1		3		2							4		1		14	
Slight		3			3		2											10	
Shots and Powder																			
Fatal																			
Serious																			
Slight																			
Ropes, Hoisting or Haulage																			
Fatal																			
Serious	1				1													3	
Slight																			
Post or Timber																			
Fatal																			
Serious																			
Slight																			
Miscellaneous—Underground																			
Fatal																			
Serious																			
Slight		1																	
Miscellaneous—Surface																			
Fatal																			
Serious	1		1																
Slight																			
Totals	5 10 4 2 8 2	1 1 4 6 8	1 1	4 6 8	1 1	1 1	4 5	1 7 8	2	6	1 1	1	22	1 5	1	1 14	1 12	34 24	70
Number of men employed.	1,383	589	199	1,493	231	91	1 53	178	6	164	73	67	22	772	483	114	1 12	34 24	5,966

## ANALYSES OF ACCIDENTS DURING 1919.

District.	NO. OF ACCIDENTS PER 1,000 MEN EMPLOYED.				TONS OF COAL MINED PER ACCIDENT.			
	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.
East Kootenay.....	0.73	4.38	0.73	5.84	558,306	98,194	558,306	69,850
Coast.....	2.41	5.65	5.00	13.48	154,486	82,939	70,806	27,409
Total for Province.....	2.01	5.53	4.00	11.73	200,746	70,851	96,358	34,413

## PER CAPITA PRODUCTION OF COLLIERIES.

District.	Gross Tons of Coal mined in 1919.	Total Number of Men employed by Producing Collieries.	Tons of Coal mined per Man employed at Collieries.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Man employed Underground.
East Kootenay.....	558,306	1,369	403	1,000	558
Coast.....	1,850,142	4,597	402	3,145	588
Total for Province.....	2,408,948	5,966	403	4,145	581

## ACCIDENTS IN MINES DURING 1919.

## COAL-MINES.

District.	Fatal.	Serious.	Slight.	Total.
East Kootenay.....	1	6	1	8
Nicola.....	1	1	2	3
Coast.....	11	26	22	59
Totals.....	12	33	25	70

## METAL-MINES.

West Kootenay-Similkameen.....	1	2	7	10
Coast.....	5	1	5	11
Totals.....	6	3	12	21
Grand totals of all accidents.....	18	36	37	91

DETAILED STATEMENT OF ACCIDENTS IN B.C. COLLIERIES  
DURING 1919.

COAST COLLIERIES.

REPORTED BY HENRY DEVLIN, JOHN NEWTON, AND JAMES DICKSON, INSPECTORS.

No.	Colliery.	Date.	Name.	Occupation.	Details.
1	Comox..... (C.C.)	Jan. 6	Wong Sun .....	Miner .....	Fatally injured by trip of car, which became derailed while running into siding off slope.
2	Wellington-Ex- tension (C.C.)	" 11	William Clifford...	Fireboss .....	Piece of rock fell from face and hit him, causing slight fractures of three ribs on right side.
3	Reserve .....	" 14	Peter Dwarski.....	Miner .....	Slipped on rail and fell, breaking bone in ankle.
4	Granby No. 1... (G.C.M.S. & P.C.)	" 16	Joe Motti .....	" .....	Piece of rock falling fractured right tibia about 3 inches above ankle.
5	Comox .....	" 27	Mah Len .....	Loader.....	Piece of centre rock fell off face, causing fatal injuries.
6	No. 1 .....	Feb. 3	Sandy Fulla.....	Brusher .....	Right leg broken by being hit by runaway car.
7	Granby No. 1... (G.C.M.S. & P.C.)	" 17	Mah Sue.....	Labourer (sur- face)	Thrown against post on side of track by moving car.
8	No. 1..... (C.W.F.C.)	" 18	John Dean .....	Miner .....	Fractured left ankle, caused by falling coal.
9	Harewood .....	" 20	William Tait.....	" .....	Piece of rock fell out between timbers, breaking his left leg.
10	Reserve .....	" 26	Ralph Smith .....	Shotlighter...	Lacerated wound and torn muscles of left leg; struck by flying coal when firing shot.
11	Wellington-Ex- tension (C.C.)	Mar. 3	David Gourlay, Jr..	Labourer (sur- face)	Knocked down by runaway car, fracturing skull.
12	No. 1..... (C.W.F.C.)	" 13	Charles Baird .....	Miner .....	Loaded car jumped off track, fracturing left leg.
13	Wellington-Ex- tension (C.C.)	" 24	Patrick Noon.....	" .....	Compound fracture of left leg and three ribs broken by being hit by empty car.
14	No. 1..... (C.W.F.C.)	" 24	Daniel Buchanan..	Machine-run- ner's helper	Caught by machine through wearing loose jumper or blouse; broke three ribs and out leg.
15	Comox .....	April 17	George Luchanski..	Pusher.....	Simple fracture of right leg; hit by rope when lowering car.
16	Harewood..... (C.W.F.C.)	" 24	Henry Clark .....	Miner .....	Fatally injured by fall of top coal and clod.
17	Comox..... (C.C.)	" 26	S. Kimoto.....	" .....	When chopping piece of timber with axe, accidentally chopped top part of left thumb.
18	Comox..... (C.C.)	" 26	Chow Wing.....	Labourer (sur- face)	Run over by two loaded mine-cars on tippie-landing and fatally injured.
19	Reserve .....	May 2	John Konopka.....	Labourer.....	Bruised spine and compression of nerves; struck by rock which fell from face when he was helping to replace timber which had been displaced by a shot.
20	Wellington-Ex- tension (C.C.)	" 8	John Orr, Jr.....	Miner .....	Fall of rock caused fracture of left scapula; two ribs broken on left side; sprained ankle and contusion of back and left thigh.
21	Comox..... (C.C.)	" 10	James Smith .....	Driver.....	Squeezed between car and post and crushed in region of pelvis.
22	Wellington-Ex- tension (C.C.)	" 10	Rocco Polifram....	" .....	Cuts on legs and body and internal injuries; caught between cars and posts by jumping off trip of cars when in motion.
23	Comox..... (C.C.)	" 17	Minola Kobayashi.	Loader.....	Crushed between two cars, causing fractured pelvis and internal injuries

## COAST COLLIERIES—Continued.

No.	Colliery.	Date.	Name.	Occupation.	Details.
24	Granby No. 1... (G. C. M. S. & P. C.)	May 29	J. Baird .....	Rope-rider...	Knocked down by trip and received internal injuries.
25	Reserve .....	" 29	Gustave Liebiecht..	Miner .....	Fractured forearm, caused by a falling piece of coal.
26	Comox .....	June 9	Archibald Marshall	Timberman...	Squeezed between motor and car, causing broken left leg.
27	Grant .....	" 10	Chin Suey.....	Rock-picker... (surface)	Three fingers lacerated by having hand caught in pinion-gears.
28	Comox .....	" 12	Fang Jung .....	Miner's helper.	Fractured femur of right leg, caused by falling rock.
29	No. 1.....	" 23	Thomas Christian..	Brusher .....	Fatally injured by fall of rock.
30	Comox .....	July 9	John Zanina .....	Rock-picker... (surface)	Compound fracture of calsis of right foot, which was squeezed between picking-table and post.
31	Comox .....	" 9	Gust Spiron.....	Timberman's helper	Two fractured ribs on right side, caused by being squeezed between cars.
32	Granby No. 1... (G. C. M. S. & P. C.)	" 15	Robert Gregory....	Pusher.....	Fractured femur above right knee, caused by car being derailed and hitting him.
33	Comox .....	" 17	Him Hang .....	Miner's helper.	Fracture of left leg below knee, caused by piece of coal rolling over from rib.
34	Comox .....	" 21	Chin Tan .....	"	Struck by loaded trip of cars at mine tunnel entrance and fatally injured.
35	No. 1.....	" 21	Charles Callow ....	Miner .....	Right collar-bone fractured and breast crushed; squeezed between two cars while coupling them.
36	Granby No. 1... (G. C. M. S. & P. C.)	" 23	Joe Petrowskey ...	Tracklayer...	Ankle wrenched and small bone of right leg broken; scaffold on which he was standing broke.
37	Harewood. ....	" 31	John Hitchen .....	Miner .....	Left leg broken by fall of rock.
38	Comox .....	Aug. 12	Emanuel Michaluk.	Tracklayer...	Fractured rib, caused by being hit by loaded car.
39	Comox .....	" 18	T. Kinura.....	Miner .....	Fatally injured by fall of coal.
40	Comox .....	" 18	Mah Sin.....	Miner's helper.	Fractured left leg above knee and scalp-wound, caused by fall of rock.
41	Wellington-Ex- tension (C. C.)	Sept. 6	Charles McLaughlin	Hoistman.....	Ends of three fingers of right hand cut off through having them caught between rope and drum.
42	Wellington-Ex- tension (C. C.)	" 10	Alex. Kulai.....	Miner .....	Fatally injured by fall of coal.
43	No. 1.....	Oct. 2	Robert Seggie....	Fireboss .....	Killed by fall of rock.
44	Comox .....	" 3	Wong Foy .....	Loader.....	Injuries to back and head, caused by fall of coal.
45	No. 1.....	" 9	Charles Killeen....	Haulageman...	Riding on trip of cars, the first one jumped off track and caught his leg between buffers of first and second cars, causing compound fracture of right leg above ankle.
46	Reserve .....	" 10	John Nazoroff....	Pusher.....	While helping to put car on track got squeezed between car and post, fracturing ribs.
47	Granby No. 1... (G. C. M. S. & P. C.)	" 18	Robert Nisbet.....	Tipple foreman (surface)	Broken left leg below the knee, caused by being hit by empty car.
48	East Wellington. (V. C. N. C.)	" 21	Joseph Summers....	Miner .....	Both bones in left leg and ankle broken by fall of rock.
49	Morden.....	" 25	William Wallace ..	" .....	Fractured left tibia, caused by fall of rock.
50	Granby No. 1... (G. C. M. S. & P. C.)	" 28	Jas. Clarkson, Sr..	" .....	Broken left foot and bruised side of chest by fall of clay.
51	Granby No. 1... (G. C. M. S. & P. C.)	Nov. 1	Joe Bardick.....	" .....	Compound comminuted fracture of right metacarpus and bruised ribs, right front; hit with shackle on end of rope.

## COAST COLLIERIES—Continued.

No.	Colliery.	Date.	Name.	Occupation..	Details.
52	Comox . . . . . (C.C.)	Nov. 6	Pistuo Galliazzi....	Miner . . . . .	Dislocated right knee, rupture of ligaments, compound fracture of ribs on right side, and puncture of lungs made by ribs, caused by fall of rock.
53	Granby No. 1.... (G.C.M.S. & P.C.)	" 6	William Eastgate..	Machinist's Helper	Sprained ankle; foot caught by wheel of car, which caused him to fall.
54	Grant. . . . . (N.W.C.C.)	" 8	August Bullens....	Miner . . . . .	Bruised back, caused by fall of dirt which swung on sprag.
55	No. 1 . . . . . (C.W.F.C.)	" 10	James Harley.....	Rope-rider....	Collar-bone broken, caused by being squeezed between two cars.
56	Wellington-Ex- tension (C.C.)	" 14	George Radford ...	Switcher.....	Fatally injured by runaway trip of cars.
57	Wellington-Ex- tension (C.C.)	Dec. 18	Andrew Patterson..	" . . . . .	Slight fracture of left leg above ankle; was thrown off car on which he was riding.
58	Comox . . . . . (C.C.)	" 18	N. Gigenoff . . . . .	Driver.....	Fractured ribs on right side; car jumped off track, swung around and bit him.
59	Reserve. . . . . (C.W.F.C.)	" 26	Thos. Sanders . . . .	Miner . . . . .	Fatally injured by fall of top coal while preparing to tamp a shot in it.

## NICOLA COLLIERIES.

REPORTED BY ROBERT STRACHAN, SENIOR INSPECTOR.

60	Coal Hill. . . . . (F.C.C.)	Jan. 6	William Skelton...	Pusher.....	Unloading car of timber and slipped, falling into car, twisting his right arm.
61	Middlesboro. . . . (M.C.C.)	Feb. 25	Wm. Cumberland..	Miner . . . . .	Large toe on right foot broken by falling timber.
62	Middlesboro. . . . (M.C.C.)	Aug. 8	David Fairley ....	" . . . . .	Fractured pelvis, lacerated urethra, and bruised back, caused by falling rock.

## CROWSNEST PASS DISTRICT.

REPORTED BY ROBERT STRACHAN AND WILLIAM LANCASTER.

63	Michel . . . . . (C.N.P.C.C.)	Jan. 27	S. Marchi . . . . .	Miner . . . . .	Fracture of right tibia and fibula, caused by fall of coal.
64	Coal Creek . . . . (C.N.P.C.C.)	Feb. 18	George King . . . . .	Driver.....	Fractured right leg above ankle by being knocked down by car.
65	Coal Creek . . . . (C.N.P.C.C.)	April 11	Joseph Bella . . . . .	" . . . . .	Fractured ankle, caused by horse falling on him.
66	Coal Creek . . . . (C.N.P.C.C.)	May 9	Daniel Bohi . . . . .	Rope-rider....	Compound fracture of right big toe; also two cuts on sole of foot.
67	Coal Creek . . . . (C.N.P.C.C.)	Sept. 15	Maria Oliva . . . . .	Miner . . . . .	Fatally injured by fall of coal.
68	Coal Creek . . . . (C.N.P.C.C.)	Oct. 9	William Stockwell.	Fireboss . . . . .	Fractured left leg above ankle, caused by being knocked down by horse.
69	Coal Creek . . . . (C.N.P.C.C.)	" 20	Peter Piola . . . . .	Rope-rider....	Fractured lower right arm, caused by having arm caught between car and post.
70	Corbin . . . . . (C.C.C.C.)	Dec. 9	William Walhalla..	Miner . . . . .	Punctured wound to left leg between knee and ankle, caused by his hitting his leg with pick.

PROSECUTIONS UNDER "COAL-MINES  
REGULATION ACT."

As is incumbent upon the Inspector, he has laid information before the local Magistrates in the following cases of infractions by the workmen in the mines of the General and Special Rules and Regulations which are provided for the safety of all underground employees. The carelessness of one man endangers the lives of his fellow-workmen, and is treated as a criminal offence.

The following prosecutions have been brought during the year for the offences noted; the judgments given by the Magistrate being shown:—

Date.	Name.	Mine.	Occupation.	Offence charged.	Judgment.
Sept. 11	Ching Sing....	No. 4, Comox..	Miner .....	Attempting to unram a miss- fire shot, contrary to sec. 91, General Rule 11, C.M.R.A.	Fined \$10 and costs.
Sept. 11	Wong Hey....	No. 4, Comox..	" .....	Attempting to unram a miss- fire shot, contrary to sec. 91, General Rule 11, C.M.R.A.	Fined \$10 and costs.
Dec. 22	Lugi Zavagno.	No. 1 South, Coal Creek..	" .....	Breach of Special Rule 61, going beyond fence	Fined \$5 and costs.

## METALLIFEROUS MINES SHIPPING IN 1919.

### SKEENA.

#### SKEENA MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Belmont Surf Inlet.	Surf inlet	Belmont Surf Inlet Mines, Ltd.	Surf Inlet	Gold, silver, copper.
Drum Lummon.	Douglas channel.	Drum Lummon Mines, Ltd.	Vancouver	Gold, silver, copper.
Patterson Group.	Porcher Island.	F. T. Patterson.	Refuge Bay.	Gold, silver.

#### NASS RIVER MINING DIVISION.

Dolly Varden.	Alice Arm.	Taylor Engineering Co., Ltd.	Vancouver.	Silver.
Golkeish	Anyox	H. W. Heidman	Anyox	Gold, silver.
Hidden Creek	Anyox	Granby Cons. M. S. & P. Co.	Vancouver.	Gold, silver, copper.
La Rose	Alice arm	Mils Donald	Alice Arm.	Gold, silver, lead.
North Star.	Alice arm	J. McAleenan	Alice Arm.	Silver.

#### PORTLAND CANAL MINING DIVISION.

Premier	Salmon river	D. L. Pitt	Stewart	Gold, silver.
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#### QUEEN CHARLOTTE MINING DIVISION.

Ikeda.	Ikeda bay	Ikeda Mines, Ltd.	Vancouver.	Gold, silver, copper.
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#### BELLA COOLA MINING DIVISION.

Jacobson.	Dean channel.	Smelters Steel Co.	Seattle, Wash.	Iron.
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#### OMINECA MINING DIVISION.

Copper Queen	Leach mountain.	Fred Griffin.	Telkwa.	Silver, copper.
Cordillera	Kitsalas mountain.	A. J. Thompson.	Usk.	Gold, silver, copper.
M. & K.	Legate creek.	Mack Orr.	Pacific.	Gold, silver, copper.
Silver Standard.	Hazelton	W. G. Norrie-Lowenthal.	New Hazelton	Gold, silver, lead, zinc.
Victory.	Hudson Bay mountain.	D. C. Simpson.	Smithers.	Gold, silver, lead.

### EAST KOOTENAY.

#### FORT STEELE MINING DIVISION.

Guindon.	Moyie	Frank Guindon	Moyie	Silver, lead.
North Star	Kimberley	Thompson & McKinney.	Kimberley.	Silver, lead.
St. Eugene	Moyie	Consolidated M. & S. Co.	Moyie	Silver, lead.
Sullivan	Kimberley	Consolidated M. & S. Co.	Kimberley.	Silver, lead, zinc.

#### WINDERMERE AND GOLDEN MINING DIVISIONS.

Hot Punch (Star)	Toby creek	J. E. Stoddart	Windermere	Gold, silver, lead.
Lead Queen.	Frances creek.	Paul Denhart	Brisco.	Silver, lead.
Monarch (Golden)	Field	Wm. Adkins.	Field.	Silver, lead.
Paradise	Spring creek	R. R. Bruce	Invermere.	Silver, lead.
Sitting Bull.	Slade creek	W. A. Krippæhne	837 Henry Bld., Se-	Silver, lead.
Trojan	Slade creek	W. A. Krippæhne	837 Henry Bld., Se-	Silver, lead.

WEST KOOTENAY.  
AINSWORTH MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Bluebell	Riondel	S. S. Fowler	Riondel	Silver, lead.
Bonton	Jackson basin	D. Brandon	Silverton	Silver, lead.
Cork	Zwicky	W. E. Zwicky	Kaslo	Silver, lead, inc.
Florence	Ainsworth	F. E. Wolfe	517 Hutton Bldg., Slocan	Silver, lead.
Gallagher	Ainsworth	H. McVicar	Slocan	Gold, silver, lead.
Grant	Woodbury creek	C. F. Olsen	Ainsworth	Silver, lead.
Hardie	Ainsworth	H. Giegerich	Kaslo	Silver, lead.
Highland	Ainsworth	Consolidated M. & S. Co.	Trail	Silver, lead.
Jessie	Woodbury creek	E. Johnson	Kaslo	Silver, lead.
Maestro	Ainsworth	H. Giegerich	Kaslo	Silver, lead.
No. 1	Ainsworth	Consolidated M. & S. Co.	Trail	Silver.
St. Patrick	Hammill creek	J. J. Brochier	Argenta	Silver, lead.
Silver Bear	South fork, Kaslo creek	W. E. Newton	Kaslo	Silver.
Silver Bell	South fork, Kaslo creek	W. E. Newton	Kaslo	Silver, lead.
Skyline	Ainsworth	H. Giegerich	Kaslo	Silver, lead.
Spokane	Ainsworth	J. C. McDougall	Ainsworth	Silver, lead.
Tariff	Ainsworth	Kennedy & Bridge	Ainsworth	Silver, lead.
Ten Day Man	Adamant	R. J. Hughes	Kaslo	Silver, lead.
United	Ainsworth	J. W. Smith	Ainsworth	Silver, lead.
Utica	Adamant	C. F. Caldwell	Kaslo	Silver, lead.
Whitewater	Retalack	W. H. Burgess	Kaslo	Gold, silver, lead.

SLOCAN MINING DIVISION.

Black Colt	Sandon	G. A. Petty	Sandon	Silver, lead.
Bosun	New Denver	J. P. McFadden	Sandon	Gold, silver, lead.
Capella	New Denver	W. R. Will	New Denver	Gold, silver.
Echo	Silverton	L. J. McAtee	Spokane	Silver, lead, zinc.
Eureka	Sandon	C. Cunningham	Sandon	Silver, lead.
Freddie Lee	Sandon	A. W. McCune	Box 275, Nelson	Gold, silver, lead.
Galena Farm	Silverton	H. J. Armstrong	Silverton	Silver, lead.
Gem	Carpenter creek	M. J. Byrne	Sandon	Silver, lead.
Hewitt	Silverton	C. Cunningham	Sandon	Silver, lead, zinc.
Idaho	Sandon	C. Cunningham	Sandon	Silver, lead.
Ivanhoe	Sandon	J. P. McFadden	Sandon	Gold, silver, lead, zinc.
Jo-Jo	Carpenter creek	Thos. Treney	Rosebery	Silver, lead.
Lucky Jim	Zincton	A. W. B. Allen	Victoria	Silver, zinc.
Mollie Hughes	New Denver	H. Cleaver	New Denver	Gold, silver, lead.
Movitch	New Denver	T. J. Lloyd	New Denver	Gold, silver.
Noonday	Sandon	O. V. White	Sandon	Silver, lead.
Number One	Sandon	J. M. Harris	Sandon	Silver, lead.
Ocean	Sandon	W. G. Clark	Sandon	Gold, silver, lead.
Omega	Sandon	J. M. Harris	Sandon	Silver, lead.
Queen Bess	Sandon	C. Cunningham	Sandon	Silver, lead.
Rambler-Cariboo	Three forks	W. A. Cameron	Sandon	Silver, lead.
Reco	Sandon	J. M. Harris	Sandon	Silver, lead, zinc.
Ruth	Sandon	J. Anderson	Kaslo	Silver, lead.
Silverite	Sandon	C. Cunningham	Sandon	Silver, lead.
Silversmith	Sandon	J. B. White	Spokane	Silver, lead.
Sovereign	Sandon	J. B. White	Spokane	Silver, lead.
Standard	Silverton	G. H. Aylard	Victoria	Silver, lead, zinc.
Surprise	Sandon	J. P. McFadden	Sandon	Gold, silver, lead, zinc.
Van-Roi	Silverton	C. Cunningham	Sandon	Silver, lead, zinc.
Wakefield	Silverton	C. Cunningham	Sandon	Silver, lead.
Wonderful	Sandon	C. Cunningham	Sandon	Silver, lead.

SLOCAN CITY MINING DIVISION.

Arlington	Springer creek	H. D. Curtis	Slocan	Silver, lead.
Black Prince	Springer creek	C. E. Cartwright	Vancouver	Silver.
Eastmount	Slocan	H. D. Lea	Slocan	Silver, lead.
Enterprise	Enterprise creek	S. S. Fowler	Riondel	Silver, lead.
Meteor	Slocan	W. A. Buchanan	Nelson	Gold, silver.
Neepawa	Enterprise creek	E. F. Roche	New Denver	Silver, lead.
Ottawa	Slocan	A. L. McPhee	Slocan	Silver.

NELSON MINING DIVISION.

California	Nelson	W. H. Turner	Nelson	Gold, silver.
Emerald	Salmo	J. Waldbeser	Salmo	Silver, lead.
Eureka	Granite	Vincent Development Co.	Granite	Gold, silver, copper.
Molly Gibson	Kokanee	Consolidated M. & S. Co.	Trail	Silver, lead.
Relief	Erie	A. D. Westby	Erie	Gold, silver.

## ARROW LAKE MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Millie Mack.....	Burton.....	H. E. Forster.....	Wilmer.....	Gold, silver, lead.

## TRAIL CREEK MINING DIVISION.

Centre Star.....	Rossland.....	F. S. Peters.....	Rossland.....	Gold, silver, copper.
I.X.L.....	Rossland.....	John S. Baker.....	Tacoma.....	Gold, silver, copper.
Le Roi.....	.....	.....	.....	.....
Le Roi No. 2.....	Rossland.....	P. S. Coudrey.....	Rossland.....	Gold, silver, copper.
Mountain Chief.....	Renata.....	J. W. Evans.....	Nelson.....	Silver, copper.
War Eagle.....	Rossland.....	F. S. Peters.....	Rossland.....	Gold, silver, copper.
White Bear.....	Rossland.....	Consolidated M. & S. Co.....	Rossland.....	Gold, copper.

## REVELSTOKE AND TROUT LAKE MINING DIVISIONS.

Lanark.....	Illecillewaet (Revelstoke)	W. R. Dornberg.....	Illecillewaet.....	Gold, silver, lead.
Silver Cup.....	Ferguson (Trout lake)...	J. Anderson.....	Kaslo.....	Gold, silver, lead.

## BOUNDARY.

## GRAND FORKS MINING DIVISION.

Killarney.....	Lightning peak.....	W. J. Banting.....	Edgewood.....	Silver, lead.
Rock Candy.....	Kennedy creek.....	Consolidated M. & S. Co.....	Trail.....	Fluorite.
Union.....	Franklin camp.....	Lewis Johnson.....	Grand Forks.....	Gold, silver.

## GREENWOOD MINING DIVISION.

Bell.....	Wallace mountain.....	F. F. Ketchum.....	Beaverdell.....	Gold, silver, lead.
Bounty.....	Beaverdell.....	P. E. Crane.....	Beaverdell.....	Gold, silver, lead.
Buster.....	Beaverdell.....	J. P. Kelly.....	Spokane.....	Silver.
Castor.....	Beaverdell.....	G. Hambly.....	Beaverdell.....	Silver, lead.
Don Pedro.....	Greenwood.....	L. Sortolne.....	Greenwood.....	Gold, silver.
Duncan.....	Wallage mountain.....	J. McKellar.....	Beaverdell.....	Silver, lead.
Emma.....	Eholt.....	Consolidated M. & S. Co.....	Trail.....	Gold, silver, copper.
Granby.....	Phoenix.....	Granby Cons. M. S. & P. Co.....	Vancouver.....	Gold, silver, copper.
Motherlode.....	Greenwood.....	Canada Copper Corporation, Ltd.	Allenby.....	Gold, silver, copper.
Napanee.....	Wallace mountain.....	E. G. Cummings.....	Beaverdell.....	Silver, lead.
Providence.....	Greenwood.....	A. J. Morrison.....	Greenwood.....	Gold, silver, lead.
Revenge.....	Beaverdell.....	P. E. Crane.....	Beaverdell.....	Gold, silver, lead.
Sally.....	Beaverdell.....	H. B. Morley.....	Penticton.....	Gold, silver, lead.
Standard Frac.....	Beaverdell.....	E. Nordman.....	Beaverdell.....	Silver.
Stemwinder.....	Phoenix.....	J. Cunningham.....	Phoenix.....	Gold, silver, copper.
Sunnyside.....	Kettle river.....	E. Williamson.....	Rock Creek.....	Gold, silver, lead.
Waterloo.....	Lightning peak.....	G. A. Rendell.....	Greenwood.....	Silver, lead.

## OSOYOOS MINING DIVISION.

Golconda.....	Olalla.....	D. McEachern.....	Keremeos.....	Gold, silver, copper.
Horn Silver.....	Keremeos.....	E. W. Oondit.....	Similkameen.....	Gold, silver.
Nickel Plate.....	Hedley.....	Gomer P. Jones.....	Hedley.....	Gold, arsenic.
Spotted Lake.....	Kruger mountain.....	F. Calvert.....	Oroville, Wn.....	Magnesium sulphate.

## SIMILKAMEEN, NICOLA, AND VERNON MINING DIVISIONS.

Copper Farm.....	Princeton.....	F. F. Foster.....	Princeton.....	Silver, copper.
Joshua.....	Stump lake.....	F. M. Hawkes.....	Quilchena.....	Gold, silver, lead, copper.
Mary Reynolds.....	Stump lake.....	R. R. Hedley.....	Nicola.....	Gold, silver, lead.

## YALE, ASHCROFT, AND KAMLOOPS MINING DIVISIONS.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Basque.....	Basque.....	J. G. Miller.....	Vancouver.....	Magnesium sulphate.
Iron Mask.....	Kamloops.....	A. Wallinder.....	Kamloops.....	Gold, silver, copper.
Queen Bess.....	Kamloops.....	C. E. Max.....	Kamloops.....	Silver, lead.
Emancipation.....	Yale.....	W. Thompson.....	Jessica.....	Gold, silver.

## LILLOOET AND CLINTON MINING DIVISIONS.

Ada B. ....	Clinton. ....	Stewart Calvert Co. ....	Oroville, Wn. ....	Magnesium sulphate.
Ida May. ....	Cadwallader creek .....	F. A. Brewer .....	Vancouver .....	Gold.
Lorne. ....	Cadwallader creek .....	A. F. Noel .....	Lorne Mine. ....	Gold, silver.
Pioneer .....	Cadwallader creek .....	A. Ferguson .....	Vancouver. ....	Gold, silver.

## SOUTH COAST.

## VANCOUVER MINING DIVISION.

Britannia. ....	Britannia Beach .....	E. J. Donohue. ....	Britannia Beach ....	Gold, silver, copper.
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## NANAIMO MINING DIVISION.

Annex. ....	Vananda .....	James Forbes. ....	Vananda .....	Silver, copper.
Cornell. ....	Vananda .....	James Raper. ....	Vananda .....	Silver, copper.
Ingersoll .....	Quathiaski. ....	F. H. Rosher. ....	Victoria .....	Silver, copper.
Marble Bay. ....	Vananda. ....	A. F. Eastman. ....	Vananda .....	Gold, silver, copper.
Puget Sound Iron Co	Vananda .....	W. H. Lee. ....	Vananda .....	Iron.

## VICTORIA MINING DIVISION.

Blue Grouse. ....	Cowichan lake. ....	G. H. Kilburn .....	Vancouver. ....	Gold, silver, copper.
Hill 60 .....	Cowichan lake. ....	C. H. Dickie. ....	Duncan .....	Manganese.

## LIST OF CROWN-GRANTED MINERAL CLAIMS.

## CROWN GRANTS ISSUED IN 1919.

## CASSIAR.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Betsay	Atlin	John Dunham	1262	38.97	Nov.
Crackerjack	"	Clarence Marmaduke Sands, Daniel Leary Sullivan, and Robt. Leonard Pelton	3286	36.74	July 26
Deadwood	"	John Hartman Senn	917	51.38	Nov. 1
Gold Bullion	"	Clarence Marmaduke Sands, Daniel Leary Sullivan, and Robt. Leonard Pelton	3288	48.20	July 26
Gold Hill	"	Clarence Marmaduke Sands, Daniel Leary Sullivan, and Robt. Leonard Pelton	3287	38.65	July 26
Golden Hope	"	John Dunham and Benjamin Green Nicoll	1263	30.26	Nov. 1
Hill Fraction	"	Royal Trust Co., Administrators of the estate of James Alexander, deceased	1264	15.32	Mar. 12
Mountain Boy	"	William McMath Roxborough	230	46.17	Nov. 29
Philadelphia Fraction	"	Royal Trust Co., Administrators of the estate of J. Alexander, deceased	207	1.90	Mar. 12
Sweepstake No. 1 Frac.	"	John Dunham and Benjamin Green Nicoll	3283	39.14	Nov. 3
Sweepstake No. 2	"	John Dunham and Benjamin Green Nicoll	3284	51.64	Nov. 3
Sweepstake No. 3	"	John Dunham and Benjamin Green Nicoll	3285	48.11	Nov. 3
Wiesel	"	Edward Hartrick Harrison	231	46.00	Oct. 11
Black Bear	Nass River.	John H. McMullin, Official Administrator of the estate of Chas. Swanson, deceased, intestate	3811	51.65	Dec. 1
Ferro Fraction	"	John Walford Strombeck	3822	15.85	Feb. 19
Red Point Extension	"	Ole Evinsen	3810	47.62	Oct. 10
Red Point No. 1	"	Ole Pearson	3809	34.78	Oct. 10
Anderson	Omineca	Chas. S. Anderson	2490 R. 5	51.65	Dec. 9
Boulder	"	Katerine A. Knauss	6817 R. 5	46.94	Dec. 9
Coral Queen	"	Joseph E. Oppenheimer	532	17.96	Jan. 9
Golden Fleece	"	Delta Copper Co., Ltd.	1001	44.83	July 10
Indicator	"	Katerine A. Knauss	6818 R. 5	47.20	Dec. 5
Intrusive	"	Katerine A. Knauss	6819 R. 5	51.65	Dec. 9
Joe Fraction	"	Daniel J. Williams	533	18.99	Feb. 19
Silver Fox	"	Chas. S. Anderson	4097 R. 5	51.65	Aug. 14
Falls View	Portland Canal.	Daniel Lindeborg	3223	43.92	Dec. 29
G. T. Fraction	"	Laura McEwan, Administratrix, etc., and Daniel Lindeborg	3222	24.18	Dec. 29
J. P. Fraction	"	Laura McEwan, Administratrix, etc., and Daniel Lindeborg	3211	7.74	Dec. 29
Union Fraction	"	Andrew Lindeborg	3215	35.21	Dec. 29
Unum Fraction	"	Duncan Cameron Barbrick	3216	11.66	Dec. 29
Win Fraction	"	Laura McEwan, Administratrix, etc., and Daniel Lindeborg	3224	5.49	Dec. 29
Big Thing	Skeena	Drum Lummon Mines, Ltd.	2597 R. 4	43.22	Sept. 16
Blue Bell	"	Robert Nowell	2485 R. 4	49.00	Oct. 10
Bunker	"	Drum Lummon Mines, Ltd.	2604 R. 4	51.65	Sept. 16
Caledonia	"	"	2595 R. 4	45.60	Sept. 16
Cuprite	"	"	2602 R. 4	44.69	Sept. 15
Drum Lummon	"	"	2592 R. 4	51.65	Sept. 10
Dumfries	"	"	2598 R. 4	26.80	Sept. 15
Grey Copper	"	"	2603 R. 4	51.65	Sept. 15
Ibis	"	"	2593 R. 4	51.65	Sept. 10
Index	"	"	2801 R. 4	25.24	Sept. 16
I. X. L.	"	"	2591 R. 4	51.11	Nov. 3
Kitchener	"	"	2596 R. 4	51.65	Sept. 10
Malachite	"	"	2600 R. 4	44.80	Sept. 15
Marcia	"	Robert Nowell	2484 R. 4	41.85	Oct. 10
Mavis	"	Drum Lummon Mines, Ltd.	2594 R. 4	49.24	Sept. 10
Moniaive	"	"	2599 R. 4	44.24	Sept. 15
Wharf	"	"	2805 R. 4	51.65	Sept. 15

## EAST KOOTENAY.

Canton	Fort Steele	Consolidated Mining & Smelting Co. of Canada, Ltd.	5630 G. 1	41.56	Mar. 21
Cromarty	"	Edgar Gordon Montgomery	5632 G. 1	51.38	Mar. 22
Full House	"	Edgar Gordon Montgomery	5631 G. 1	48.94	Mar. 22
Notre Dame	"	Norman William Burdett	2993 G. 1	45.61	Mar. 22
Rowan	"	Consolidated Mining & Smelting Co. of Canada, Ltd.	4085 G. 1	51.65	Mar. 21

## WEST KOOTENAY.

Broughton	Ainsworth	Francis Helme	12416 G. 1	33.66	Dec. 5
Gallagher Fraction	"	Alfred Demeau Wheeler	12418 G. 1	13.26	Jan. 23
Number Nine (9) Frac.	"	Consolidated Mining & Smelting Co. of Canada, Ltd.	9661 G. 1	50.04	Dec. 9
Six Friends	"	Patrick Joseph Sheran	3669 G. 1	41.70	Oct. 17

WEST KOOTENAY—Continued.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Black Cap	Nelson	John William Mulholland	12654 G. 1	27.20	Dec. 9
Black Diamond	"	William Thomas McDowell and William Ward, the younger	3413 G. 1	41.05	Jan. 9
Bullion	"	Geo. Thomas Webster	2190	47.19	April 14
Carthage	"	Cecil Robert Adams	2197 G. 1	49.76	April 14
Empress	"	Thos. Gallon, John Marshall McVay, Frederick Peter Drummond, and William Henry Rhomberg	12496 G. 1	45.71	Oct. 31
Excelsior	"	John William Mulholland	12657 G. 1	47.62	Dec. 9
Fern	"	John William Mulholland	12656 G. 1	50.00	Dec. 9
Garnet	"	Percy Ferdinand Horton	10809 G. 1	44.84	Sept. 25
Gem	"	John William Mulholland	12652 G. 1	50.69	Dec. 9
Golden Fawn	"	Thos. Gallon, John Marshall McVay, Frederick Peter Drummond, and William Henry Rhomberg	12493 G. 1	26.50	Oct. 31
Gordon	"	George Hopkins Green and Katherina McAvoy	12175 G. 1	18.05	Nov. 3
Iva	"	John William Mulholland	12655 G. 1	39.07	Dec. 9
Jewel	"	John William Mulholland	12653 G. 1	34.67	Dec. 9
Josie	"	Maximilian Henry Baskin	3925 G. 1	28.04	Nov. 25
Lucky Boy	"	Lincoln Rhodes Clubine and William Richard Salisbury	12600 G. 1	30.80	Oct. 4
Mint	"	Thos. Gallon, John Marshall McVay, Frederick Peter Drummond, and William Henry Rhomberg	12495 G. 1	45.10	Oct. 31
Mountain View	"	Thos. Gallon, John Marshall McVay, Frederick Peter Drummond, and William Henry Rhomberg	12494 G. 1	31.31	Oct. 31
Nelson	"	George Hopkins Green	12177 G. 1	22.03	Nov. 3
Pat	"	Cecil Robert Adams	2198 G. 1	48.38	April 14
St. Louis	"	George Hopkins Green and Katherina McAvoy	12176 G. 1	33.12	Nov. 3
Salmo	"	Lincoln Rhodes Clubine and Fred Arthur Denne	12601 G. 1	44.55	Nov. 25
Silver Dollar	"	Lincoln Rhodes Clubine and William Richard Salisbury	12599 G. 1	22.70	Nov. 4
Silver Dollar Fraction	"	Lincoln Rhodes Clubine and Fred Arthur Denne	12602 G. 1	6.43	Nov. 4
Standard	"	John William Mulholland	12658 G. 1	40.58	Dec. 9
Volunteer	"	Patrick Joseph Sheran	3670 G. 1	20.23	Oct. 17
Westminster Fraction	"	George Hopkins Green	12184 G. 1	6.07	Nov. 3
Wild Horse	"	Gertrude Kendall	4212 G. 1	47.01	April 14
X Ray	"	Gertrude Kendall	4213 G. 1	51.65	April 14
Zincfon	"	Agnes Billings	10810	51.27	Oct. 14
Chief	Slocan	Henry John Wooley	2908 G. 1	33.23	Aug. 14
Denver	"	Henry John Wooley	2807 G. 1	36.48	Aug. 14
Mowitch	"	Dorethea C. Lloyd	4558 G. 1	49.42	Aug. 14
Rose Marie	"	John Cechelero, Joe Beher, Emil Betali, Attilio Calgario, and August Morgenlate	4003	20.52	Dec. 1
St. Clair	"	John Cechelero, Joe Beher, Emil Betali, Attilio Calgario, and August Morgenlate	4559 G. 1	7.27	Dec. 1
Tornado	"	John Peter Wilson	5637 G. 1	44.12	Oct. 14
Buckeye Fraction	Trail Creek	Consolidated Mining & Smelting Co. of Canada, Ltd.	12277 G. 1	17.85	Oct. 14
Carn Brea	"	John T. Brunskill	3399 G. 1	48.90	Mar. 22
Ollie Fraction	"	Consolidated Mining & Smelting Co. of Canada, Ltd.	12276 G. 1	0.75	Oct. 14
Parker Fraction	"	John T. Brunskill	4607 G. 1	30.70	Mar. 22
Umatilla	"	William R. Braden	4242 G. 1	26.28	Sept. 29
Wallaroo	"	Roy Manley Turner	3400 G. 1	45.00	Mar. 22

BOUNDARY.

Back Tail	Grand Forks	J. W. Graham, G. Wilson, Fridolph Werner, and R. Graham	1850 S.	51.20	Sept. 9
Canyon	"	William H. Stewart	2990 S.	49.88	April 25
Decimal Fraction	"	Consolidated Mining & Smelting Co. of Canada, Ltd.	1651 S.	37.80	Feb. 28
Denver	"	Maurice Wallace Elliott	2169 S.	43.15	Sept. 27
Dominion	"	William H. Stewart	2386 S.	51.11	April 25
Dont Know	"	John Cory Cruse	2374 G. 1	23.20	Feb. 8
Evening Star	"	Margaret M. Kerman (wife of Herbert G. Kerman) and Kathleen S. Dewdney (wife of Walter R. Dewdney)	1321 S.	42.79	Sept. 27
Fluorspar	"	Consolidated Mining & Smelting Co. of Canada, Ltd.	1650 S.	51.65	Mar. 13
Mammoth	"	William H. Stewart	2385 S.	15.41	April 25
Mastadon	"	William H. Stewart	2384 S.	44.90	April 25
Mastadon Fraction	"	William H. Stewart	2383 S.	6.07	April 25
Merrimack	"	J. W. Graham, G. Wilson, Fridolph Werner, and R. Graham	1851 S.	46.00	Sept. 9
Monitor	"	J. W. Graham, G. Wilson, Fridolph Werner, and R. Graham	1852 S.	39.40	Sept. 9
Pan	"	William H. Stewart	2387 S.	23.16	April 25
Portal No. 1	"	Christian M. Tobiasen, Burt J. Averill, and John S. Boyce	1648 S.	33.00	Mar. 1
Rabbit	"	Christian Mayer Tobiasen and Burt Jerome Averill	1647 S.	25.60	Mar. 1
Rock Candy No. 1	"	Christian M. Tobiasen, Burt J. Averill, and John S. Boyce	1646 S.	45.10	Mar. 1
Tadanac	"	Consolidated Mining & Smelting Co. of Canada, Ltd.	1649 S.	41.20	Feb. 20
Monday	Greenwood	Hugh McCutcheon	3335	39.76	Aug. 14
Sunday	"	Peter Hay McCurraoch	3334	32.10	Aug. 14
Toney Fraction	"	James Henry Goodeve	1907 S.	34.87	Mar. 13
Golden Eagle	Kamloops	John B. MacKenzie	1882 G. 1	16.46	May 28
Exchange Fraction	Lillooet	Coronation Mines, Ltd.	673 G. 1	21.85	May 28
Casino No. 1 Fraction	Similkameen	Canada Copper Corporation	2270 S.	17.60	Oct. 11
Pisure Maiden No. 2	"	Inland Development Co., Ltd.	3779 G. 1	29.68	Nov. 24
Helena	"	Canada Copper Corporation, Ltd.	2288 S.	23.24	Sept. 25
Jumper	"	"	2289 S.	36.11	Sept. 25
Leon	"	"	2281 S.	27.70	July 7
Michigan	"	"	2285 S.	33.63	Sept. 25
Mother Lode	"	"	2290 S.	21.33	Oct. 11
Princess Dorthia No. 1	"	"	2282 S.	44.06	July 11
Princess Louise	"	"	2273 S.	51.65	July 17
Wisconsin	"	"	2283 S.	46.04	Sept. 25
Thomas William Glad	Vernon	Robert John Hogg	1002 S.	51.65	May 23

VANCOUVER ISLAND AND COAST.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Bobby Burns	Nanaimo	Oliver E. Bolger	201A	43.34	Sept. 10
Butterfly	"	Henry Twidle	1123	51.65	Mar. 17
Daniel Webster	"	Percy N. Anderson	203A	28.70	Aug. 14
Golden Era	"	Hugh A. McMillan	104	44.00	Oct. 17
Hetty Green	"	William N. Anderson	202A	35.83	Aug. 14
R.A.M.	"	William McDonald	147	48.40	Feb. 19
Retriever	"	William H. Lee	150	38.34	Feb. 7
Trilby	"	Polly Fox	998	50.71	Dec. 8
West Gate Fraction	"	William H. Lee	148	7.46	Mar. 7
Blue Bird No. 1.	Quatsino	William Edward Anderson	1558	45.16	Feb. 7
Blue Bird No. 2.	"	Jane Richmond Halliday	1539	38.18	Feb. 7
Blue Bird No. 3 Fraction	"	H. A. Titcomb, Executor of estate of F. Brignall, deceased	1542	43.90	July 10
Hemlock	"	Jane Cook	1536	25.15	Feb. 7
Merry Widow No. 2.	"	William Edward Anderson	1530	51.48	April 15
Merry Widow No. 3.	"	William May Halliday	1540	29.65	April 15
Merry Widow No. 4.	"	William Alfred Cook	1541	32.59	May 28
Merry Widow No. 5.	"	William James Vaughan	1533	51.48	May 28
Merry Widow No. 6.	"	William May Halliday	1534	35.98	April 15
Penstock Fraction	"	Coast Copper Co.	1471	37.50	July 10
Skookum	"	Coast Copper Co.	1475	35.62	July 10
Snow Line	"	Arthur William Corker	1535	33.15	Feb. 7
Whiskers Fraction	"	Coast Copper Co.	1474	26.33	July 10
Young Sports No. 1.	"	George Gustavas Hawkins	1531	17.23	July 10
Anvil Fraction	Vancouver	Britannia Mining & Smelting Co., Ltd.	4768	47.80	July 7
Baranba	"	"	4581 G. 1	51.54	May 10
Beach Fraction	"	"	4579 G. 1	37.03	May 10
Beaver	"	"	2128 G. 1	44.54	May 28
Bee	"	"	4048 G. 1	18.47	Aug. 14
Bee	"	"	2129 G. 1	47.69	May 28
Black Fraction	"	"	4230 G. 1	48.49	May 29
Blue Bird	"	"	4043 G. 1	16.44	Aug. 14
Brown Fraction	"	"	4403 G. 1	44.94	June 28
B. V. Annex	"	"	4226 G. 1	51.24	May 29
Cascades	"	Lynn Creek Zinc Mines, Ltd.	3752 G. 1	50.81	Sept. 17
Clipper Fraction	"	Britannia Mining & Smelting Co., Ltd.	3588 G. 1	51.19	June 26
Crescent	"	Robert Bruce Kirk	4965 G. 1	36.64	July 11
Drury Fraction	"	Britannia Mining & Smelting Co., Ltd.	4769 G. 1	48.75	July 7
Evening Star	"	John Wilson Thornton	4984 G. 1	40.48	July 11
Fleming	"	Lynn Creek Zinc Mines, Ltd.	4025 G. 1	50.15	Sept. 17
Goose Fraction	"	Britannia Mining & Smelting Co., Ltd.	4401 G. 1	48.06	July 7
Gower Fraction	"	"	4764 G. 1	50.42	July 7
Green	"	"	4404 G. 1	50.99	June 26
Grey Fraction	"	"	2902 G. 1	49.00	May 28
Ironides Fractional	"	"	4576 G. 1	49.74	Nov. 24
Jack	"	"	3833 G. 1	51.65	Aug. 14
Jane	"	"	3831 G. 1	48.98	Aug. 14
Jersey Fractional	"	Lynn Creek Zinc Mines, Ltd.	3749 G. 1	51.53	Sept. 17
Joe	"	Britannia Mining & Smelting Co., Ltd.	3830 G. 1	51.65	Aug. 14
Keats Fractional	"	"	4771 G. 1	50.93	July 7
Lake Fraction	"	"	4406 G. 1	50.80	June 26
Loyd Fraction	"	"	4906 G. 1	45.69	Aug. 14
Lynn Fraction	"	Lynn Creek Zinc Mines, Ltd.	3750 G. 1	5.40	Sept. 17
Mask	"	Britannia Mining & Smelting Co., Ltd.	4644 G. 1	51.65	May 10
Mercer	"	"	4582 G. 1	50.81	May 10
Moon Fraction	"	"	2125 G. 1	38.20	May 28
Nalau Fraction	"	"	4789 G. 1	49.03	July 7
Nigel Fraction	"	"	4777 G. 1	44.12	July 7
Numas	"	"	4790 G. 1	51.65	July 7
No. 100	"	"	4239 G. 1	42.97	June 25
No. 101	"	"	4240 G. 1	42.97	June 25
No. 102	"	"	4259 G. 1	51.62	June 25
No. 105 Fraction	"	"	4242 G. 1	50.86	June 25
No. 106	"	"	4241 G. 1	51.62	June 25
No. 107	"	"	2127 G. 1	37.19	May 28
No. 108 Fraction	"	"	4234 G. 1	51.44	June 25
No. 110	"	"	4228 G. 1	51.65	May 29
No. 131	"	"	4243 G. 1	51.50	June 25
Old Ironides	"	"	4396 G. 1	51.65	Nov. 24
Old Ironides No. 1.	"	"	4398 G. 1	51.65	Nov. 24
Old Ironides No. 2.	"	"	4395 G. 1	43.50	Nov. 24
Old Ironides No. 3.	"	"	4394 G. 1	33.95	Nov. 24
Onyx Fraction	"	"	4856 G. 1	49.49	Jan. 29
Opal	"	"	4878 G. 1	51.65	Jan. 29
Pretty Bess	"	Lynn Creek Zinc Mines, Ltd.	4026 G. 1	31.00	Sept. 17
Reo Fraction	"	Britannia Mining & Smelting Co., Ltd.	4983 G. 1	44.08	Aug. 14
Robert Fraction	"	"	2928 G. 1	49.61	May 28
Ruby Fraction	"	"	4877 G. 1	47.61	Jan. 29
Russel	"	Lynn Creek Zinc Mines, Ltd.	3748 G. 1	50.78	Sept. 25
Shoal	"	Britannia Mining & Smelting Co., Ltd.	4770	51.65	July 7
Steve	"	"	4405	50.26	June 26
Sun Fraction	"	"	2905	50.95	May 28
Swiss	"	"	4646	51.25	May 10
Tom	"	"	3832 G. 1	51.65	Aug. 14
White	"	"	4402 G. 1	35.49	June 25
Will Fraction	"	"	4560 G. 1	44.33	June 26
Ypres Fraction	"	"	4407 G. 1	45.53	June 26
Zayas	"	"	4775	51.06	July 7
Copper King	Victoria	William H. R. Collister and J. R. Collister	139	51.65	Dec. 5
Copper King Fraction	"	"	155	3.23	Dec. 5
Eureka	"	"	140	42.60	Dec. 5
Margaret	"	"	138	51.60	Dec. 5

DEPARTMENT OF MINES.

VICTORIA, B.C.

HON. WM. SLOAN, *Minister of Mines.*

R. F. TOLMIE, *Deputy Minister.*

WM. FLEET ROBERTSON, *Provincial Mineralogist and Assayer.*

GEO. WILKINSON, <i>Chief Inspector of Mines.</i>	D. E. WHITTAKER, <i>Provincial Analyst and Assistant Assayer.</i>
HENRY DEVLIN, <i>District Inspector, Nanaimo.</i>	J. D. GALLOWAY, <i>Resident Engineer, Hazelton.</i>
JOHN NEWTON, <i>District Inspector, Nanaimo.</i>	W. M. BREWER, <i>Resident Engineer, Nanaimo.</i>
ROBERT STRACHAN, <i>District Inspector, Fernie.</i>	GEO. A. CLOTHIER, <i>Resident Engineer, Prince Rupert.</i>
WM. LANCASTER, <i>District Inspector, Fernie.</i>	P. B. FREELAND, <i>Resident Engineer, Grand Forks.</i>
JAMES MCGREGOR, <i>District Inspector, Nelson.</i>	A. G. LANGLEY, <i>Resident Engineer, Revelstoke.</i>
THOS. J. SHENTON, <i>District Inspector, Prince Rupert.</i>	R. W. THOMSON, <i>Resident Engineer, Kamloops.</i>
H. H. JOHNSTONE, <i>Temporary Inspector, Nelson.</i>	

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin Mining Division.	Atlin	J. A. Fraser	W. G. Paxton	
Sub-office	Telegraph Creek			H. W. Dodd.
"	Haines (U.S.)		(Com. for taking Affidavits)	Risdon M. Odell.
Stikine Mining Division	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary	"	"	John Cargill.
Liard Mining Division	Telegraph Creek	"	"	
Sub-office	Porter			Chas. H. Smith.
"	McDame Creek			Mike Larsen.
"	Fort St. John			F. W. Beatton.
Skeena Mining Division	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Alice Arm			Telka Carney.
"	Kitimat			Rev. S. S. Peat.
"	Port Simpson			J. R. C. Deane.
"	Copper City			P. R. Skinner.
"	Terrace			T. J. Kirkpatrick.
"	Stewart (Portland Canal)			P. S. Jack.
Nass River	Anyox	J. H. McMullin	H. Andrew	
Portland Canal M.D.	Stewart	J. H. McMullin (at Prince Rupert)	P. S. Jack	
Bella Coola Mining Div.	Prince Rupert	J. H. McMullin	J. H. McMullin	Brynild Brynildsen.
Sub-office	Bella Coola			
"	Bella Bella			John A. Pauline.
"	Ocean Falls			A. H. Mogridge.
Queen Charlotte Min'g D.	Queen Charlotte	J. H. McMullin	John L. Barge	
Sub-office	Jedway			Isaac Thompson.
"	Masset			C. Harrison.
"	Lockeport			William Morgan.
Omineca Mining Division	Smithers	Stephen H. Hoskins	Jas. E. Kirby	
Sub-office	Fort Grahame			Einar Ursino.
"	Fort St. James			Alex. C. Murray.
"	Manson Creek			W. B. Steele.
"	Telkwa			T. J. Thorp.
"	Fort St. John			F. W. Beatton.

GOLD COMMISSIONERS AND MINING RECORDERS—Continued.

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca M.D.— <i>Con.</i>				
Sub-office	Copper City			P. R. Skinner.
"	Terrace			T. J. Kirkpatrick.
"	New Hazelton			L. B. Warner.
"	Fort Fraser			Fred Fraser.
"	Junction Finlay & Parsnip rivers.			Henry Stege.
"	Pacific			T. H. McCubbin.
"	Hazelton			Sperry Cline.
"	Burns Lake			R. C. Macdonald.
"	Houston			
"	Usk			Jas. L. Bethurum.
Peace River Mining Div.	Fort St. John	S. H. Hoskins	F. W. Beatton	
Sub-office	Hudson Hope	(at Hazelton)		John Gregg.
"	Pouce Coupe			G. J. Duncan.
Cariboo Mining Division	Barkerville	L. A. Dodd		
Sub-office	Quesnel	"		E. C. Lunn.
"	Fort George	"		T. W. Heme.
"	McBride	"		Thos. Van Dyk.
Quesnel Mining Division	150-Mile House	L. A. Dodd	R. M. McGusty	Hy. J. McDougall.
Sub-office	Quesnel	(at Barkerville)		E. C. Lunn.
"	Quesnel Forks			Wm. Lowden.
"	Barkerville			L. A. Dodd.
Clinton Mining Division	Clinton	Geo. Milburn		
Lillooet Mining Division	Lillooet	John Dunlop	John Dunlop	
Kamloops Mining Division	Kamloops	E. Fisher	L. S. Brown	
Sub-office	Chu Chua			George Fennell.
"	Vavenby			Hyde Finley.
"	Albas			C. O. Sjouquist.
Ashcroft Mining Division	Ashcroft	E. Fisher (at Kam.)	H. P. Christie	
Sub-office	Lytton			Thos. Somerville.
Nicola Mining Division	Merritt	E. Fisher (at Kam.)	J. A. Murchison	
Yale Mining Division	Yale	" "	H. Beech	
Sub-office	Hope	" "		Wm. Greenwood.
Similkameen Mining Div.	Princeton	Hugh Hunter	Hugh Hunter	
Sub-office	Hedley			T. H. Rotherham. ✓
Vernon Mining Division	Vernon	L. Norris	H. F. Wilmot	
Greenwood Mining Div.	Greenwood	W. R. Dewdney	W. R. Dewdney	
Sub-office	Vernon			H. F. Wilmot.
"	Rock Creek			S. T. Larsen.
"	Beaverdell			E. F. Ketchum.
Grand Forks Min. Div.	Grand Forks	S. R. Almond	S. R. Almond	
✓ Owyoco Mining Division	Fairview	J. R. Brown		
Sub-office	Olalla			R. W. Northey.
"	Hedley			T. H. Rotherham. ✓
Golden Mining Division	Golden	John Bulman	G. E. Sanborn	
Windermere Mining Div.	Wilmer	" (at Golden)	E. M. Sandilands	
Fort Steele Mining Div.	Cranbrook	N. S. A. Wallinger		
Sub-office	Steele			Joseph Walsh.
"	Fernie			R. J. Stenson.
"	Moyie			W. H. Laird.
"				
Ainsworth Mining Div	Kaslo	Ronald Hewat	A. McQueen	A. W. Anderson.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Ainsworth M.D.— <i>Con.</i>				
Sub-office . . . . .	Howser . . . . .			W. Simpson.
" . . . . .	Trout Lake . . . . .			Oscar Jacobson.
" . . . . .	Crawford Bay . . . . .			Thos. W. Lytle.
" . . . . .	Poplar . . . . .			Arthur G. Johnston.
Slocan Mining Division . . . . .	New Denver . . . . .	Ronald Hewat . . . . .	Angus McInnes . . . . .	
Sub-office . . . . .	Sandon . . . . .	(at Kaslo)		W. J. Parham.
Slocan City Mining Div. . . . .	Slocan . . . . .	Ronald Hewat . . . . .	Thos. McNeish . . . . .	
Trout Lake Mining Div. . . . .	Trout Lake . . . . .	" . . . . .	Oscar Jacobson . . . . .	
Nelson Mining Division . . . . .	Nelson . . . . .	E. Ferguson (Actg.) . . . . .	S. S. Jarvis . . . . .	
Sub-office . . . . .	Creston . . . . .			R. Lamont.
" . . . . .	Ymir . . . . .			Wm. Dowling.
" . . . . .	Sheep Creek . . . . .			Geo. Leece.
" . . . . .	Salmo . . . . .			M. C. Donaldson.
Arrow Lake Min. Division . . . . .	Nakusp . . . . .	E. Ferguson . . . . .	Walter Scott . . . . .	
Sub-office . . . . .	Vernon . . . . .	(at Nelson)		H. F. Wilmot.
Revelstoke Mining Div. . . . .	Revelstoke . . . . .	A. Johnson . . . . .	J. Lee . . . . .	Newton R. Brown.
Lardeau Mining Division . . . . .	Beaton . . . . .	" (at Revelstoke)	Frances I. Fraser . . . . .	
Trail Creek Mining Div. . . . .	Rossland . . . . .	H. R. Townsend . . . . .	M. S. Morrell . . . . .	
Nanaimo Mining Division . . . . .	Nanaimo . . . . .	S. McB. Smith . . . . .	S. McB. Smith . . . . .	
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Annual Report of the Minister of Mines for the year ending 31st December, 1919, being an account of mining operations for gold, coal, etc., in the Province. William Fleet Robertson, Provincial Mineralogist. 393 pp., plates, maps, 1919.

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