

ANNUAL REPORT
OF THE
MINISTER OF MINES

FOR THE
YEAR ENDING 31ST DECEMBER

1918

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.:

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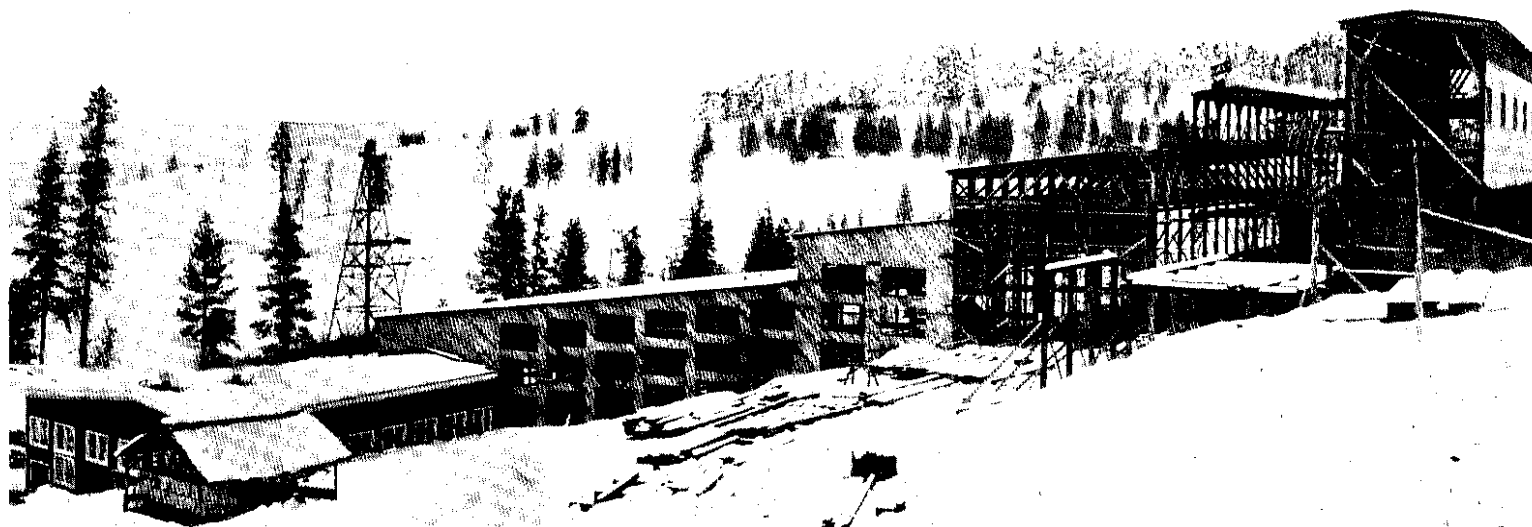
*To His Honour Sir FRANK STILLMAN BARNARD, K.C.M.G.,
Lieutenant-Governor of the Province of British Columbia.*

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1918 is herewith respectfully submitted.

WILLIAM SLOAN,
Minister of Mines.

*Minister of Mines' Office,
February 28th, 1919.*



B.C. Bureau of Mines.

Canada Copper Corporation's Concentrator, under construction at Allenby, Copper Mt.

*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, 1918.

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.,

February 28th, 1919.

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 1918.

Gold, placer.....	\$ 75,436,103
Gold, lode.....	97,121,786
Silver.....	46,839,631
Lead.....	42,294,251
Copper.....	145,741,069
Zinc.....	13,278,058
Coal and coke.....	187,147,652
Building-stone, bricks, etc.....	28,843,272
Miscellaneous minerals, etc.....	651,759
Total.....	\$637,353,581

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1918 (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
Total.....	\$637,353,581

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1916, 1917, and 1918. 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 1916, 1917, AND 1918.

	Customary Measure.	1916.		1917.		1918.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold placer	Ounces.	29,025	\$ 580,500	24,800	\$ 496,000	16,000	\$ 320,000
" lode	"	221,932	4,587,334	114,523	2,367,190	164,674	3,403,812
Silver	"	3,301,923	2,059,739	2,929,216	2,265,749	3,498,172	3,215,870
Lead	Pounds	48,727,516	3,007,462	37,307,465	2,951,020	43,899,661	2,928,107
Copper	"	65,379,364	17,784,494	59,007,565	16,038,256	61,483,754	15,143,449
Zinc	"	37,168,980	4,043,985	41,848,513	3,166,259	41,772,916	2,899,040
Coal	Tons, 2,240 lb.	2,084,093	7,294,325	2,149,975	7,524,913	2,302,245	11,511,225
Coke	"	267,725	1,606,350	159,905	959,430	188,967	1,322,769
Miscellaneous products.	"		1,326,273		1,241,575		1,038,202
			\$42,290,462		\$37,010,392		\$41,782,474

TABLE IV.

OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

NAMES.	DIVISIONS.			DISTRICTS.		
	1916.	1917.	1918.	1916.	1917.	1918.
CARIBOO DISTRICT				\$ 778,157	\$ 529,897	\$ 383,996
Cariboo Mining Division	\$ 162,000	\$ 137,756	\$ 62,500			
Quesnel	20,000	15,000	21,000			
Omineca	596,157	377,141	300,496			
CASSIAR DISTRICT				7,210,949	8,485,438	9,178,441
EAST KOOTENAY DISTRICT				6,810,926	5,056,782	7,259,897
WEST KOOTENAY DISTRICT				9,101,905	5,972,545	6,113,279
Ainsworth Division	754,902	750,514	663,388			
Slocan and Slocan City	3,761,091	3,554,055	3,675,762			
Nelson	619,376	403,436	396,697			
Trail Creek	3,935,836	1,197,283	1,357,571			
Other parts	30,700	67,257	19,861			
BOUNDARY-YALE DISTRICT				7,243,560	5,055,403	4,961,452
Osoyoos, Grand Forks, and Greenwood Divisions	6,592,991	4,253,965	3,897,826			
Similkameen, Nicola, Vernon	450,780	571,300	909,869			
Yale, Ashcroft, Kamloops	199,789	230,138	153,757			
LILLOOET DISTRICT				65,457	73,175	57,746
COAST DISTRICT (Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver)				11,079,508	11,837,152	13,827,663
				\$42,290,462	\$37,010,392	\$41,782,474

TABLE V.
MISCELLANEOUS PRODUCTS AND TOTALS OF PRODUCTION, 1918.

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	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$ 383,996
Cariboo		1,000			1,000	500			2,500		2,500		60,000	62,500	
Quesnel					500	500			1,000		1,000		20,000	21,000	
Omineca		500			500	500			1,500	2,400	3,900	2,350	294,246	300,496	
CASSIAR															9,178,441
Atlin, Stikine-Liard, Skeena, Nass River, Portland Canal, Queen Charlotte.					129,891	1,000	2,625		133,516		133,516		8,811,432	8,944,948	
EAST KOOTENAY															7,259,897
Fort Steele		500			1,000	500			2,000	21,670	23,670	3,631,345	3,342,136	6,997,151	
Windermere-Golden.					500	500			1,000		1,000		261,746	262,746	
WEST KOOTENAY															6,113,279
Ainsworth					500	500			1,000		1,000		662,388	663,388	
Slocan & Slocan City					500	500			1,000		1,000		3,674,762	3,675,762	
Nelson & Arrow Lake		1,000	20	1,000	1,075	2,014		2,400	7,509		7,509		389,188	396,697	
Trail Creek		500			1,000	1,000			2,500		2,500		1,355,071	1,357,571	
Other Divisions		500			500	500			1,500		1,500		18,361	19,861	
BOUNDARY-YALE															4,961,452
Grand Forks															
Greenwood		1,000		1,000	23,257	1,000	869		27,066	65,391	92,457		3,805,369	3,897,826	
Osoyoos															
Similkameen															
Nicola		1,000	225	1,000	1,000	1,000		1,670	5,895		5,895	895,895	8,079	909,869	
Vernon															
Yale															
Ashcroft		1,000		1,000	1,000	1,000		1,200	5,200		5,200		148,557	153,757	
Kamloops															
LILLOOET					500	500			1,000	4,250	5,250		52,496	57,746	57,746
COAST DISTRICT	288,526	21,536	4,192	5,520	24,614	47,524	69,951	284,842	746,705	3,600	750,305	8,304,404	4,772,954	13,827,663	13,827,663
Totals	288,526	28,536	4,437	9,520	187,337	59,038	73,385	290,112	940,891	97,311	1,038,202	12,833,994	27,910,278	41,782,474	41,782,474

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	1889.....	\$ 588,923	1904.....	\$1,115,300
1859.....	1,615,070	1875.....	2,474,004	1890.....	490,435	1905.....	969,300
1860.....	2,228,543	1876.....	1,786,648	1891.....	429,811	1906.....	948,400
1861.....	2,666,118	1877.....	1,608,182	1892.....	399,526	1907.....	823,000
1862.....	2,656,903	1878.....	1,275,204	1893.....	356,131	1908.....	647,000
1863.....	3,913,563	1879.....	1,290,058	1894.....	405,516	1909.....	477,000
1864.....	3,735,850	1880.....	1,013,827	1895.....	481,683	1910.....	540,000
1865.....	3,491,205	1881.....	1,046,737	1896.....	544,026	1911.....	428,000
1866.....	2,662,106	1882.....	954,085	1897.....	513,520	1912.....	555,500
1867.....	2,480,868	1883.....	794,252	1898.....	643,346	1913.....	510,000
1868.....	3,372,972	1884.....	736,165	1899.....	1,344,800	1914.....	565,000
1869.....	1,774,978	1885.....	713,738	1900.....	1,278,724	1915.....	770,000
1870.....	1,336,956	1886.....	903,651	1901.....	970,100	1916.....	580,500
1871.....	1,799,440	1887.....	693,709	1902.....	1,073,140	1917.....	496,000
1872.....	1,610,972	1888.....	616,731	1903.....	1,060,420	1918.....	320,000
1873.....	1,305,749						
				Total.....			\$75,436,103

TABLE VII.—PRODUCTION OF LOBE 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					104,813
1889.....			58,192	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	23,464	227,000	195,000	2,135,023	78,996					297,400
1894.....	6,252	125,014	746,379	470,219	5,662,523	189,875	324,680	16,234			781,842
1895.....	89,264	785,271	1,496,622	977,229	16,475,464	532,255	952,340	47,642			2,342,897
1896.....	62,269	1,244,180	3,185,343	2,100,639	24,199,977	721,384	3,813,556	190,926			4,257,179
1897.....	106,141	2,122,820	5,472,971	3,272,886	38,841,185	1,390,517	5,325,180	266,258			7,062,481
1898.....	110,061	2,201,217	4,292,401	2,375,841	31,693,559	1,077,681	7,271,678	874,781			6,529,420
1899.....	138,315	2,867,573	2,939,413	1,663,708	21,982,436	878,870	7,722,591	1,361,453			6,751,604
1900.....	167,163	3,453,851	3,963,175	2,800,200	63,338,621	2,691,367	9,997,080	1,615,289			10,069,757
1901.....	210,384	4,348,603	3,439,417	2,634,745	51,532,906	2,002,733	27,003,746	4,440,963			13,683,044
1902.....	236,491	4,838,269	3,517,317	1,941,323	22,536,381	824,532	29,636,057	3,446,673			11,101,102
1903.....	232,831	4,812,616	2,966,204	1,521,472	18,089,283	638,744	34,359,921	4,547,535			11,571,367
1904.....	222,042	4,589,608	3,222,451	1,719,516	36,046,244	1,421,874	35,710,128	4,578,037			12,909,035
1905.....	238,660	4,833,102	3,439,417	1,971,818	66,530,708	2,399,022	37,982,251	5,376,222			16,180,164
1906.....	224,027	4,630,639	2,290,262	1,897,320	62,408,217	2,667,578	42,990,488	8,283,565			17,434,102
1907.....	196,129	4,055,020	2,745,448	1,703,325	47,738,703	2,291,458	40,532,720	8,166,544			16,216,847
1908.....	258,632	5,282,980	2,631,339	1,321,483	43,195,733	1,732,799	47,274,614	6,240,249			14,477,411
1909.....	238,224	4,832,980	2,532,742	1,239,270	44,396,346	1,609,239	45,697,245	5,918,522	8,500,000	400,000	14,191,141
1910.....	267,701	5,533,890	2,450,241	1,245,016	84,668,746	1,896,350	38,243,984	4,871,512	4,184,192	192,473	13,228,731
1911.....	228,617	4,725,513	1,892,364	958,238	29,872,397	1,069,521	36,927,656	4,571,044	2,634,544	129,062	11,454,063
1912.....	257,496	5,322,442	3,132,108	1,810,045	44,871,464	1,895,027	51,456,537	8,403,513	5,358,230	316,139	17,662,766
1913.....	272,254	5,627,490	3,465,566	1,968,606	55,364,677	2,175,832	46,460,906	7,094,489	6,758,768	324,421	17,190,838
1914.....	247,170	5,109,004	3,602,190	1,876,738	50,625,048	1,771,877	45,009,699	6,121,819	7,868,467	346,125	15,225,061
1915.....	250,021	5,167,934	3,866,608	1,588,991	46,503,590	1,939,200	56,918,405	9,836,600	12,982,440	1,460,524	19,962,149
1916.....	221,932	4,587,334	3,301,923	2,059,739	43,727,516	3,007,462	65,379,364	17,784,494	37,163,980	4,043,956	31,423,014
1917.....	114,523	2,367,190	2,299,216	2,265,749	87,307,465	2,951,020	59,007,566	16,038,256	41,848,513	3,166,269	26,738,474
1918.....	164,674	3,403,812	3,498,172	3,215,870	43,899,661	2,928,107	61,483,754	15,143,449	41,772,916	2,899,040	27,590,278
TOT.....	4,709,423	97,121,756	79,586,712	46,838,631	968,096,628	42,294,251	587,996,994	145,741,069	169,075,100	13,278,058	346,274,795

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.....	842,854.....	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.....	6,872,472
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
Total.....	49,346,829	\$164,476,478
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.....	258,703.....	1,552,218
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
Total.....	3,964,337	\$22,671,174

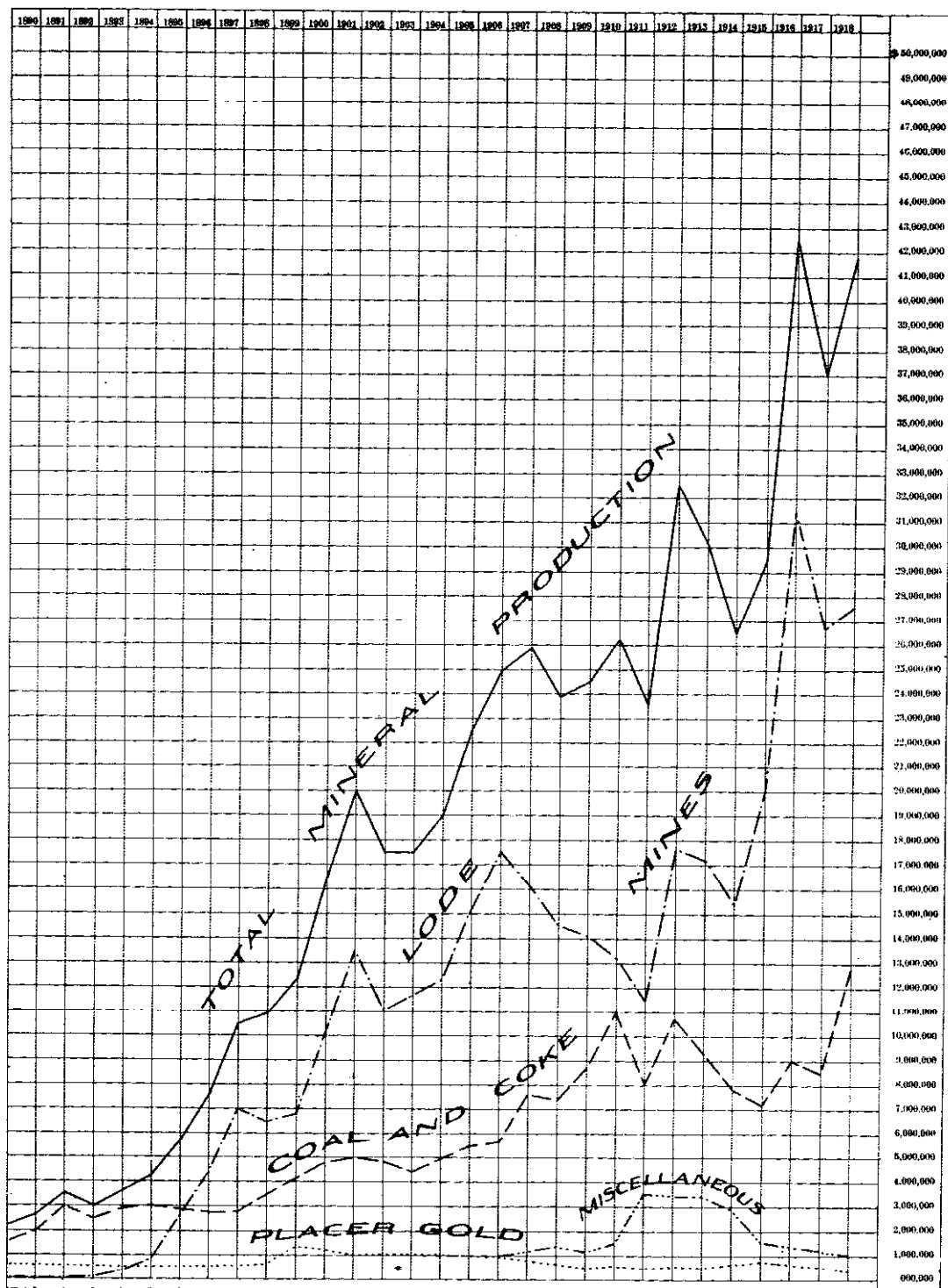
TABLE IX.—PRODUCTION IN DETAIL OF THE

DISTRICT.	YEAR.	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				\$		\$		\$
Cariboo	1915		15,000	800,000				
Cariboo and Quesnel Divisions	1916		8,900	178,000				
	1917		7,500	150,000				
	1918		4,000	80,000				
Omineca Division	1915	17,545	600	12,000	1,524	31,501	79,155	37,361
	1916	17,752	860	17,000	1,308	26,933	112,635	70,202
	1917	4,159	600	12,000	981	19,244	82,311	63,688
	1918	6,953	400	8,000	985	20,360	84,125	77,336
Cassiar	1915	320	20,300	406,000	875	18,086		
Atlin, Liard, and Stikine Divisions	1916	262	18,025	360,500	736	15,218	3,064	1,905
	1917	38	15,600	312,000	1,000	20,670		
	1918	73	11,025	220,500	446	9,219	1,115	1,025
Skeena, Nass, Queen Charlotte, and Portland Canal Divisions	1915	646,391			5,034	104,063	175,179	82,684
	1916	732,880			3,806	78,670	256,802	160,193
	1917	821,319			9,805	202,666	343,805	265,933
	1918	956,231			49,016	992,491	416,616	362,935
East Kootenay	1915	44,372	750	15,000			481,258	227,164
Fort Steele Division	1916	96,846	200	4,000			509,698	317,946
	1917	114,391	100	2,000			180,168	139,380
	1918	137,950	50	1,000			251,497	240,394
Windermere-Golden	1915	5,566					1,188	561
	1916	2,183					29,178	18,201
	1917	2,354					79,686	61,636
	1918	3,620					91,784	84,377
West Kootenay	1915	42,630			121	2,501	289,666	136,675
Ainsworth Division	1916	77,341			45	980	321,202	200,366
	1917	82,481			1	20	224,461	173,621
	1918	44,937			18	372	223,639	210,243
Slocan and Slocan City	1915	114,292			26	537	1,812,560	855,524
	1916	123,880			64	1,323	1,480,571	923,580
	1917	149,895			18	372	1,547,576	1,197,050
	1918	142,700			67	1,386	1,873,236	1,722,036
Nelson and Arrow Lake Divisions	1915	23,034	50	1,000	2,233	190,846	9,405	4,489
	1916	20,695	50	1,000	4,107	84,891	32,547	20,303
	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
Trail Creek Division	1915	338,568			142,595	2,947,439	159,584	75,324
	1916	308,924			129,790	2,682,759	132,090	82,391
	1917	100,171			33,290	688,104	47,112	36,441
	1918	112,349			43,745	904,209	47,203	43,394
Revelstoke, Trout Lake and Lardeau	1915	155	100	2,000	15	310	16,740	7,901
	1916	521	50	1,000	22	455	22,419	13,935
	1917	584	50	1,000	62	1,282	37,783	29,187
	1918	255	50	1,000	35	723	11,761	10,812
Boundary-Yale	1915	1,228,724	100	2,000	87,870	1,816,273	278,795	129,231
(Grand Forks, Greenwood and Osoyoos Divisions.)	1916	1,343,353	50	1,000	75,028	1,563,281	280,578	175,025
	1917	779,345	50	1,000	58,544	1,210,104	220,213	170,355
	1918	692,604	50	1,000	55,353	1,144,147	227,113	208,785
Similkameen, Nicola, and Vernon Divisions	1915	225	600	12,000	101	2,068	847	164
	1916	1,418	450	9,000	82	661	830	518
	1917	1,984	400	8,000	111	2,294	3,470	2,684
	1918	73	250	5,000	1	21	131	120
Yale, Ashcroft and Kamloops Divisions	1915	2,134	500	10,000	106	2,191	1,702	803
	1916	7,414	150	3,000	570	11,782	4,215	2,629
	1917	8,254	100	2,000	1,355	28,008	3,525	2,727
	1918	30,925	50	1,000	315	16,943	1,317	1,211
Lillooet	1915	50	400	8,000	31	641	5	2
Lillooet and Clinton Divisions	1916	2,400	250	5,000	2,625	54,259		
	1917	4,700	300	6,000	3,092	65,912	276	213
	1918	3,858	50	1,000	2,473	51,117	412	379
Southern Coast	1915	12,804	100	2,000	2,092	43,242	15,727	7,423
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria Divisions.)	1916	15,771	50	1,000	2,352	49,236	17,954	11,200
	1917	19,221	50	1,000	2,813	58,145	25,727	19,900
	1918	13,269	25	500	2,515	51,985	23,040	21,181
Mainland (Vancouver and New Westminster Divisions)	1915	213,150			398	8,226	50,306	23,745
	1916	434,064			822	16,091	98,165	61,235
	1917	682,100			980	20,257	86,925	67,286
	1918	731,900			3,050	63,043	93,365	85,949
Totals	1915	2,890,110	33,500	770,000	250,021	5,167,934	3,366,506	1,638,961
	1916	3,188,385	29,025	680,500	221,932	4,587,334	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	2,892,949	18,000	320,000	184,674	3,403,812	3,498,172	3,215,870

METALLIFEROUS MINES, ETC., FOR 1915, 1916, 1917, AND 1918.

LEAD.		COPPER.		ZINC.		TOTALS FOR DIVISIONS.				TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1915.	1916.	1917.	1918.	1918.
	\$		\$		\$	\$	\$	\$	\$	\$
						300,000	178,000	150,000	80,000	374,246
						580,502	594,157	375,641	294,246	9,044,525
249,279	10,395	2,381,279	489,245	168,616	18,345					
224,451	13,853	1,646,072	447,764	364,097	27,548					
271,885	21,506	852,373	231,675	313,112	21,730					
123,568	8,242	643,843	158,578			424,086	378,066	332,670	233,493	
7,260	448									
		11,160	2,749							
30,462	1,270	21,915,481	3,786,995			3,975,002	6,785,861	8,073,026	8,811,432	3,603,882
1,077	66	24,085,905	6,546,432							
		27,978,015	7,604,424							
		30,150,606	7,435,946							
				180,000	20,250	1,370,876	3,428,993	2,818,429	3,342,136	
26,582,050	1,108,472		1,583	14,840,000	1,614,592					
24,156,143	1,490,917	5,654	2,631	20,715,090	1,567,304					
13,090,640	1,107,134	9,679	435	26,704,806	1,853,313					
18,695,565	1,243,984	1,768		311,719	35,068	44,650	77,231	206,809	251,746	6,099,770
210,327	9,021	3,400	925	210,000	22,848					
571,244	35,257	12,640	3,436	18,000	1,862					
1,774,649	140,375									
2,663,210	177,369									
				678,940	76,381	358,846	753,402	749,014	662,368	
3,436,184	143,289			625,971	68,106					
7,841,869	484,000			918,601	60,501					
6,395,360	505,872			640,991	44,485					
6,106,262	407,268			8,684,572	977,014	2,455,462				
14,925,345	622,387			17,854,357	1,942,554		3,767,191			
14,415,645	889,734			18,789,573	1,421,619			3,553,055		
11,808,019	934,014	242	60	14,107,682	979,073				3,674,762	
14,575,379	972,178	30,240	5,225	3,127,209	351,811	598,077				
967,775	40,356	176,383	47,980	3,470,086	377,540		608,296			
1,240,784	76,582	50,946	13,847	982,309	74,822			383,144		
2,605,666	206,108	28,533	7,126						399,188	
1,611,166	107,465	4,651,681	803,811			3,826,574				
		4,200,745	1,142,686				3,907,836			
		1,730,088	470,238					1,194,783		
		1,654,356	407,468						1,355,071	
						13,924	28,200			
89,041	3,713			33,279	2,518			65,257		
298,741	12,760			5,325	439				18,361	3,962,005
395,321	31,270					4,954,981				
80,773	5,387						6,534,971			
		17,402,662	3,007,130					4,191,960		
7,127	297	17,626,623	4,794,794							
14,922	921	10,329,765	2,807,630							
30,548	2,891	9,940,125	2,448,253						3,805,369	
47,738	3,134	21,701	8,750			18,002				
		182,633	40,680				59,859			
10,097	846	87,326	23,785					37,559		
		11,923	2,938						8,079	
		295,164	51,004			63,998				
47,380	2,924	636,594	173,166				193,501			
12,690	1,004	709,199	190,314	27,564	2,085			226,138		
		525,780	129,500						143,557	52,496
						8,643				
							59,259			
								70,125		
									52,496	4,772,554
		712,152	123,060			173,725				
		869,877	236,624				298,060			
		1,461,704	397,291					476,336		
		923,886	228,292						301,558	
		9,058,045	1,565,230			1,597,201				
		15,965,888	4,342,905				4,421,131			
		15,794,830	4,293,035					4,380,528		
		17,543,127	4,322,104						4,470,996	
46,503,590	1,939,200	56,918,405	9,835,500	12,982,440	1,460,524	20,762,149				
48,727,516	3,007,462	65,379,364	17,784,494	37,168,980	4,043,985		82,063,514			
37,307,465	2,951,020	59,007,565	16,038,256	41,848,513	3,166,259			27,284,474		
43,899,661	2,523,107	61,483,754	15,143,449	41,772,916	2,899,040				27,910,278	27,910,278

TABLE X.—SHOWING MINERAL PRODUCTION OF BRITISH COLUMBIA.



PROGRESS OF MINING.

The gross value of the mineral production for 1918 was \$41,782,474, an increase from that of the year 1917 of \$4,772,082, or 12.9 per cent. The gross value of the metallic minerals recovered in 1918 was \$27,910,278, which represents an increase from last year of \$625,804, a percentage increase of 2.3 per cent.

Only once in the history of the Province's mineral statistics has this output been exceeded, and that was in 1916, when the year's mineral-output amounted to \$42,290,462, only 1.2 per cent. greater than 1918; and it must be remembered that 1916 was a phenomenal year, with metal prices temporarily inflated, due to war conditions. As compared with earlier years, the production of 1918 shows up even more favourably, for it exceeds the next highest recorded production—\$32,440,800, made in 1912—by \$9,341,674, or about 29 per cent.

As the value of the products of the metalliferous mines this year was only slightly greater than in the preceding year, the great increase made was therefore almost entirely attributable to the products of the collieries, which show outputs, both of coal and coke, exceeding those of the preceding year; the increased output of coal being some 152,270 tons, while that of coke was 28,062 tons.

In addition to this, the price of the coal has been raised by the exigencies of the war, and these two factors combined have caused the value of the colliery products this year to amount to \$12,833,994, an increase over the preceding year of \$4,349,651.

The increase in the selling-price of coal has been allowed at various times 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 approximately \$5 a ton, and the similar average price for coke about \$7 a ton. What additional value this increased selling-price gave to this year's output of coal and coke may be realized by comparison with the average selling-prices assumed in former years of \$3.50 a ton for coal and \$6 a ton for coke. This additional value this year would amount to \$3,642,334.

As regards the products of the metalliferous mines of the Province, as already noted, the combined values of these products shows an increase over the preceding year of \$625,804, an increase which under the many adverse conditions prevailing is very encouraging.

The combined output of placer and lode gold shows an increase of \$860,622—a rather pleasant surprise considering the greatly increased operating costs and the fact that the selling-price of gold remains stationary.

Of these products, the placer-gold production shows a decrease of \$176,000, while lode gold shows an increase of \$1,036,622, attributable to more active work in the Rossland camp and to a full year's output from the Surf Inlet mine—a new producer.

The value of the silver production this year was greater than that of the previous year by \$950,121, due to the materially higher market value of the metal, as well as an increased production of 568,956 oz.

The value of the production of both lead and copper are each lower this year than in 1917, although the quantity of lead and of copper produced are both materially greater than in 1917, the increase in quantity of copper over the previous year's production being 2,476,189 lb., and that of lead being 6,592,196 lb. This is accounted for by a lower average market value of each metal during the year than that prevailing during 1917.

The figures for zinc production show that the 1918 output was only 75,597 lb. less than in the previous year, but owing to the lowered market price the value was \$267,219 less than in 1917.

The value of the miscellaneous metals produced this past year was \$97,311, while the value of the building materials of mineral origin amounted to \$940,891, making a total for miscellaneous products of \$1,038,202, which is \$203,373 less than the 1917 output. The war conditions existing and the uncertainty as to the future caused an almost complete cessation of all building, with the exception of wooden structures.

As has been noted, the fluctuations of the market prices of the various metals and ores has been an uncertain factor during the war, and now that the war is over this uncertainty is very much greater. It is impossible to predict what demand there will be for the metals in the immediate future, and the transition stage between war conditions and peace conditions leaves the metal market in an entirely unsettled state.

Details of the market prices of metals will be found under the discussion of each metal, but it may be noted here that the rise in silver from an average of 50 cents an ounce in 1915 to an average of 97 cents in 1918 has proved very beneficial to the silver-lead mines of the Slocan.

The higher cost of labour and supplies—especially powder—has made the cost of new development very high, but in spite of this much work has been done.

Gold-mining also suffered from the increased costs of labour and supplies, with no corresponding increase in the value of the metal produced, thereby causing a smaller margin of profit, and, in many cases, making it unprofitable to mine gold.

For some time after the armistice was signed the market for copper, lead, and zinc practically disappeared. Nominal prices were maintained for a time, but inevitably, with no buyers, large accumulations of metals, and a steady though curtailed production, the market prices declined. By February (1919) copper had declined from the former maximum fixed price of 26 cents a pound to about 15 cents, and until the normal demand for this metal is resumed there is not likely to be either a material increase in the market price or a very heavy demand for it. Large stocks of copper were held by the Allied Governments at the time of the signing of the armistice, and until these are disposed of there will be but little demand for copper from European consumers.

The average market price for copper in 1918 was 24.63 cents, as compared with 27.18 cents in 1917.

The lead market is in a similar condition to the copper market, being dull and featureless. Since the armistice the nominal price has declined from about 8 cents to about 6 cents a pound. Large stocks of lead are reported in all the Allied countries, and it is apparent that it will be some time yet before the market demands will absorb these stocks.

Zinc is in much the same position as lead as regards market conditions. The nominal price declined from about 8.25 cents on November 12th to about 7.5 at the end of the year, and by February had dropped to about 6 cents.

Silver was the one metal which did not rise in price in the early stages of the war, as it was not directly used in war munitions or materials. In time, however, a serious shortage of silver occurred owing largely to the heavy demands for currency, occasioned by the rapid expansion of the world's monetary systems, and the almost complete withdrawal by the Governments of gold as a circulating medium of exchange. As might be expected with a steady and even abnormal demand for silver, the price rose, gradually at first and afterwards more quickly.

The average market price of silver in 1914 was 54.8 cents an ounce; in 1915, 49.7 cents; in 1916, 65.7 cents; in 1917, 81.4 cents; and in 1918 it was 96.77 cents.

The market outlook for silver is much better than for copper, lead, and zinc, and it seems reasonable to assume that the present price of about \$1 an ounce may be maintained for some time.

At present the market for what are commonly called "war minerals" is practically non-existent, and quotations cannot be obtained, as the future demand for such materials is unknown.

During the year 1918 labour troubles in the mines and smelters were not numerous. The most serious one was in the Crowsnest District, owing to a disagreement over the "single-shift" system of operating the coal-mines, and the mines were closed for about a month.

In the fall of the year the epidemic of Spanish influenza caused a dislocation of the staffs and working forces generally throughout the mines and smelters of the Province, and in many places seriously curtailed production.

The prospects for the year 1919 are, when metal and mineral prices again become stabilized, that the mining industry in British Columbia should continue to prosper. The established producers are generally in good shape to continue production even at lowered metal prices, and when settled conditions arrive much new development should take place.

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 legitimate mining development.

The total gross amount of coal mined in the Province during the year was 2,578,724 tons (2,240 lb.), of which there was used for making coke some 276,479 tons, leaving a net production of coal, used as such, of 2,302,245 tons. The amount of coke produced was 188,967 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 \$11,511,225 and of coke \$1,322,769, making the value of the production of the collieries \$12,833,994.

The following table shows the number of mines which shipped ore during the year 1918, 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 1918.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1918.	MEN EMPLOYED IN THESE MINES.		
				Below.	Above.	Total.
CARIBOO DISTRICT:						
Omineca	6,956	5	3	35	40	75
CASSIAR DISTRICT:						
Atlin, Stikine.	73	2	.....	4	6	10
Queen Charlotte, Portland Canal, Skeena, and Nass....	956,231	10	5	350	174	524
EAST KOOTENAY DISTRICT:						
Fort Steele	137,950	4	3	162	139	301
Windermere-Golden	3,620	5	2	34	15	49
WEST KOOTENAY DISTRICT:						
Ainsworth	44,937	23	11	158	71	229
Slocan and Slocan City	142,700	40	16	403	240	643
Nelson and Arrow Lake	15,348	13	6	81	58	139
Trail Creek	112,349	5	5	250	82	332
Revelstoke, Lardeau, and Trout Lake	255	9	.....	21	14	35
BOUNDARY-YALE DISTRICT:						
Greenwood, Grand Forks, and Osoyoos	692,504	37	15	356	313	669
Similkameen, Nicola, and Vernon	73	3	.....	4	3	7
Yale, Ashcroft, and Kamloops	30,826	4	2	38	27	65
LILLOOET DISTRICT	3,858	5	3	13	17	30
SOUTHERN COAST DISTRICT	745,169	10	9	580	460	1,040
Total	2,892,849	175	80	2,489	1,659	4,148

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	9	9	18	18	23	41
EAST KOOTENAY	3	8	11	12	7	19
AINSWORTH	6	17	23	8	5	13
SLOCAN	13	16	29	42	16	58
NELSON	7	14	21	10	13	23
TRAIL CREEK		8	8			
REVELSTOKE-LARDEAU	3	3	6	12	8	20
BOUNDARY-YALE	11	32	43	31	27	58
LILLOOET	1	3	4	2		2
SOUTHERN COAST	3	12	15	2	6	8
Total	56	122	178	137	105	242

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 1918 aggregating \$637,353,581. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of \$187,147,652; followed next in importance by copper at \$145,741,069, and next in order is lode gold at \$97,121,786, with placer gold in fourth place at \$75,436,103.

TABLE II. shows the value of the total production of the mines of the Province for each year from 1893 to 1918 (inclusive), during which period the output increased tenfold, and reached a gross production for the year 1918 of \$41,782,474.

The value of the total mineral production of the Province up to the end of 1918 was \$637,353,581.

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 \$176,000, but an increase in the output of lode gold of \$1,036,622, making a total increase of \$860,622 in the total production of the metal.

The amount of silver produced this year was 3,498,172 oz., having a gross value of \$3,215,870, an increase in the number of ounces of 568,956. The value of the silver production in 1918 was greater than in 1917, partly due to the prevailing high market price of silver in 1918.

The table shows an output of lead in 1918 amounting to 43,899,661 lb., valued at \$2,928,107, which is an increase from the production of the preceding year of 8,592,196 lb. of lead, but a decrease in value of \$22,913, due to the drop in price of the metal.

The production of copper this year was 61,483,754 lb., valued at \$15,143,449, an increase in amount of 2,476,189 lb., or about 4.2 per cent. The value of the product was less than that of the preceding year by \$894,807—a decrease of nearly 8 per cent., due to lower prices.

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 Cassiar, East Kootenay, 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 \$750,305, as shown in Table V.

TABLE V. is a table introduced seven years ago, and 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 \$1,088,202. 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 1918, and shows a total production of \$75,436,103. The output for 1918 was \$320,000, a decrease, as compared with the previous year, of 35.5 per cent.

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 \$345,274,795, this figure includes the zinc production of 1909 and all subsequent years.

Lately a new column was made in this table in which to record the zinc production, and the output since 1909 has been recorded therein. In former years the zinc production was small and was listed as miscellaneous material.

TABLE VIII. contains the statistics of production of the coal-mines of the Province. The total amount of coal produced to the end of 1918 was 49,346,829 tons (of 2,240 lb.), worth \$164,476,478. Of this, there was produced in 1918 2,302,245 tons valued at \$11,511,225, an increase of 152,270 tons in quantity and of \$3,986,312 in value compared with the preceding year. 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 1918 was 276,479 tons, from which was made 188,967 tons of coke, having a value of \$1,322,769, an increase in amount over the preceding year of 29,062 tons, or about 18.1 per cent., with an increase in value of \$363,339. The total value of the output of the collieries of the Province in 1918 was \$12,833,994.

The average selling-prices taken this year in the calculation of value of product are much higher than those used last year. Increases in the selling-price of coal have been allowed at various times 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 approximately \$5 a ton, and the similar average price for coke about \$7 a ton. What additional value this increased selling-price gave to this year's output of coal and coke may be realized by comparison with the average selling-prices assumed in former years of \$3.50 a ton for coal and \$6 a ton for coke. This additional value this year would amount to about \$3,650,000. The prices used in calculations prior to 1907 were \$3 and \$5 respectively.

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 1915, 1916, 1917, and 1918, 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 1918 was 2,892,849 tons, having a gross value of \$27,590,278, and, with the placer gold, a total value of \$27,910,278.

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

	Tons.
Cassiar and Omineca District	963,260
Southern Coast District	745,169
Boundary-Yale District	723,403
Slocan Mining Division	142,700
East Kootenay District	141,570
Trail Creek Mining Division	112,349
Ainsworth Mining Division	44,937
Nelson Mining Division	15,348
Other Mining Divisions	4,113
Total	2,892,849

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 below that line.

GOLD.

The production of placer gold during the past year was worth about \$320,000 **Placer Gold.** as nearly as can be ascertained; great difficulty is found in obtaining reliable figures, since the work is, in many cases, carried out by individuals or unorganized groups of men who keep no books, frequently paying wages, or for supplies, in gold-dust, which, being readily transported, is scattered, and the tax imposed thereon by law is thus evaded. This year's output shows a decrease, as compared with 1916, of \$84,500.

The production of placer gold is nearly all from the Atlin and Cariboo Districts, about 96 per cent. of the total coming from these two sections.

In hydraulic placer-mining, from which about 90 per cent. of the placer gold obtained in British Columbia is derived, it has been pretty well demonstrated that the gold-output is in direct proportion to the number of days in which water was available for piling.

In the Atlin Division water conditions were normal, so far as is known, but the shortage of labour handicapped operations. So many men have left the district for active service in the war that not only were the larger companies short of labour, but also the number of individuals mining in a small way was materially less than in former years.

In the Cariboo District water conditions were not good owing to the snowfall of the previous winter, which melted off suddenly, and this was followed by a dry summer. The output for the Cariboo and Quesnel Divisions was less than in 1917.

Gold-mining in all forms has suffered by the war, due to the fact that the cost of labour and supplies has materially increased, while the price of the product remains standard; hence operating costs are higher and profits lower.

Due to the greatly enhanced market price of the base metals, such mines operating on a sliding scale of wages, regulated by the prices of metals, have been paying abnormally high wages, which has drawn miners away from gold-mining, both placer and lode.

In addition to the increased cost of all supplies, etc., the war conditions have also rendered it almost impossible to obtain new equipment at any price. There has therefore been less inducement for capital to enter into new placer-mining enterprises, either hydraulic or dredging. The development of new placer enterprises in the Cariboo and Atlin fields and elsewhere in the Province can therefore hardly be expected until conditions again become normal.

Complete news has not been received from the Omineca District, where considerable work has been going on, most of which, however, was of a preparatory nature, and it is not expected that any great output was made this year, probably not more than about \$8,000 all told.

In the Liard-Stikine District the Boulder Creek Hydraulic Mining Company did not work on Thibert creek. Ball and Finn and Mitchell Bros., working in the same vicinity, made small outputs.

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

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

As was noted last year, two or three parties were working down the Liard river, at McDame creek, and on Rosella creek, a section that has been practically abandoned of late years.

Considerable work in connection with placer-mining was done in the Similkameen District, although the actual production was small.

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

Yale Mining Division made an unusually small output, and the Fort Steele Mining Division made a smaller output than last year.

The value of the gold produced from lode-mining in the Province during the year 1918 was \$3,403,812, an increase, as compared with the previous year, of \$1,036,622, or about 43.7 per cent. It must be remembered, however, that the 1917 gold production was abnormally low, the output for the years preceding the war varying from \$4,000,000 to \$5,000,000. The increase in 1918 over the preceding year is largely due to the entry into the producers' list of a new mine—the Surf Inlet property of the Belmont-Surf Inlet Mines—which made an output of about 41,600 oz. But for this added production the gold-output for 1918 would have been practically the same as in 1917.

The Rossland mines, which prior to 1917 contributed annually about one-half of the output of lode-gold, made about the same production in 1918 as in the preceding year; during these two years about one-quarter the normal output was made. The mines were worked somewhat irregularly during the first six months of the year; after that development was continued and shipments were renewed, resulting in an increased tonnage as compared with 1917.

The following table shows the gold productions of 1917 and 1918:—

	1917. Oz.	1918. Oz.
Boundary-Yale	60,010	55,353
Rossland	33,230	43,745
Skeena	9,805	48,016
Coast (Southern)	3,793	5,565
Lillooet	3,092	2,473
Nelson	2,521	7,155
All others	2,012	2,367
Totals	114,523	164,674

From the above table it will be seen that there are increases in Skeena, Rossland, Coast (Southern), and Nelson Districts, while there are decreases in the gold production from Boundary-Yale and Lillooet Districts.

The increase in the Nelson Division is due to a larger tonnage from the *Yankee Girl* mine, near Ymir. The production from the *Nickel Plate* mine, at Hedley, about 35,000 oz., was practically the same as in the previous year. The small decrease in the Boundary-Yale District as compared with 1917 is due to a smaller tonnage of copper ore carrying low gold values being treated at the Granby smelter.

SILVER.

The total amount of silver produced in the Province during the year 1918 was 3,498,172 oz., valued at \$3,215,870, an increase in amount, as compared with the previous year, of 568,956 oz., and an increase in value of \$950,121, partly due to the high price of the metal.

The market price of silver gradually rose during the year, the average for January being 88.702 cents an ounce, while in December it was about 101.125 cents. The average for the year was 96.77 cents, the highest that silver has been for many years back. The prospect of silver maintaining its present price of about \$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 silver production of the various districts for the year has been as follows:—

	Oz.
Slocan and Slocan City	1,873,236
Skeena	416,616
Fort Steele	261,497
Ainsworth	228,699
Boundary-Yale	228,561
Nelson	136,738
Southern Coast	116,425
Windermere-Golden	91,784
Omineca	84,125
Trail Creek	47,203
All others	13,288
Total	3,498,172

As will be noted from the above table, the Slocan District again leads all others in the production of silver, having produced 47 per cent. of the total output. As compared with 1917, the production from this district was greater in 1918 by 325,660 oz.

The largest producer in the Slocan was the *Surprise*, followed by the *Queen Bess* and the *Standard*. There were nearly 40 shipping mines in the district in 1918.

The figures for the year show small increases in output from Skeena, Ainsworth, Boundary-Yale, Fort Steele, Coast, Omineca, and Windermere-Golden Districts.

About 50 per cent. of the silver-output from the Boundary District comes from the Granby Company's mines at Phoenix. Other mines contributing are the *Mother Lode*, *Sally*, and *Union*.

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 Skeena production comes almost entirely from the Granby Company's *Hidden Creek* mines, at Anyox.

The Coast production of silver comes from the smelting of copper ores carrying low values in the precious metals. As a larger tonnage of copper ore was smelted, the silver-output shows an increase.

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 gold-copper ores carrying silver.

LEAD.

The total amount of lead produced in 1918 was 43,899,661 lb., valued at \$2,928,107. This represents, as compared with the previous year, an increase in quantity of 6,592,196 lb., but owing to the lower market price of lead a decrease in value of \$22,913.

The market price of lead rose and fell during the year; the average for January was 6.782 cents a pound; in July a fixed price of 8.05 cents was established, which was held until the armistice was signed. Since then the lead market has been very dull; the producers hold large stocks and very few sales are being made. The nominal price declined to somewhere about 6 cents at the end of the year. The average price for the year was 7.413 cents a pound.

The following table shows the production of lead according to districts:—

	Lb.
Fort Steele	18,695,565
Slocan	14,575,379
Ainsworth	6,106,262
Windermere-Golden	2,659,210
Nelson	1,611,166
All others	252,079
Total	43,899,661

The above figures show, as compared with the previous year, that the lead production in 1918 was increased in Fort Steele, Slocan, and Windermere-Golden Districts, and decreased in the Ainsworth and Nelson outputs.

Fort Steele Division again leads all other districts. The *Sullivan* mine contributes nearly all of this production as a rule, but this year over 860,000 lb. came from the *North Star*.

In the Slocan District the heaviest producer in 1918 was the *Queen Bess*, followed by the *Surprise*, *Van-Roi*, *Galena Farm*, and *Standard*.

In the Ainsworth Division the largest producer was the *Florence*, with an output of about 2,500,000 lb., followed by the *Blue Bell*, with approximately 1,300,000 lb.; the *Highland* and *Cork-Province*, each with over 600,000 lb.; and about fifteen smaller shippers.

The lead production of Nelson Division comes almost entirely from the *Emerald* mine, and this mine produced about the same as in the previous year.

The production from Windermere-Golden is nearly twice that of the previous year, due to an increased output from the *Paradise* mine and a production of about 800,000 lb. from the *Couverapee* mine, at Field.

COPPER.

The amount of copper produced in 1918 shows, as compared with the previous year, an increase in quantity, but, owing to the lower market selling-price, a decrease in value. The production was 61,483,754 lb., which is 2,476,189 lb. greater than the 1917 output; the value for this year is \$15,143,449, which, compared with \$16,038,256 made in 1917, shows a decrease of \$894,807. It is most encouraging, however, that, notwithstanding lowered market prices, the Provincial production of copper shows an increase in the quantity of metal produced of about 4.2 per cent. over the previous year.

During the whole of 1918 the price of copper in the United States was controlled by the maximum price fixed by the United States War Industries Board. From January to July the fixed price was 23.5 cents a pound, and from July until the end of the year it was 26 cents, the average for the year being 24.63 cents.

The following table shows the production of copper according to districts:—

	Lb.
Skeena Division	30,190,606
Southern Coast District	18,475,013
Boundary-Yale District	9,940,125
Trail Creek Division	1,654,356
Omineca Division	643,843
All others	578,811
Total	61,483,754

The *Hidden Creek* mines and the smelter at Anyox of the Granby Consolidated Mining and Smelting Company were operated practically continuously throughout the year, although closed for a short time by a strike, which was soon settled. A larger tonnage was treated than in 1917, amounting to approximately 858,000 tons, together with quartz and limestone flux to the extent of some 73,000 tons. With the increased tonnage handled there was a corresponding increase in the output of copper, 29,692,376 lb. being produced, as compared with 27,661,301 lb. in 1917.

In the Boundary District the Granby Company's mines at Phoenix were unable to supply the smelter at Grand Forks with sufficient ore to run the smelter at capacity. The ore reserves of these mines are approaching exhaustion, so that the large-scale production of former years cannot be maintained. Also the high operating costs during 1918 left but little margin of profit in working the low-grade ores at Phoenix. Or, to quote the Granby Company's annual report: "The old Phoenix mine has been run more from patriotism than hope of profits." The tonnage mined and smelted was approximately 444,000 tons, containing 7,347,273 lb. copper (recovered content), which is an increase of 488,555 lb. over the production figures of 1917; the 1917 output was only about one-half that of former years.

The Canada Copper Corporation, operating the *Mother Lode* mine and smelter at Greenwood, treated a slightly smaller tonnage than in 1917. About 154,000 tons was handled, from which 1,832,382 lb. of copper was recovered, together with low gold and silver contents. Towards the end of the year the smelter was closed, the ore reserves at the *Mother Lode* mine being exhausted.

The *Britannia* mine had a very successful year, approximately 731,000 tons of ore being milled, the production of copper from which was 17,548,127 lb. This is nearly 1,767,297 lb. greater than the 1917 production.

The *Marble Bay* mine, on Texada island, made about the same production as in 1917, the output being 626,442 lb.

Half a dozen smaller shippers are listed from the Southern Coast District, but the total copper from this source only amounts to 300,000 lb.

The Omineca Division produced less copper than in 1917, the output being 643,843 lb.

Copper-mining is now firmly established as the most important form of mining in the Province, and from all indications it should maintain this place for years to come. In 1918 the value of the copper mined exceeded by over \$2,000,000 the combined values of all other metals mined, and it formed 55 per cent. of the total value of the metallic mineral production for the year.

It is also to be noted that about 80 per cent. of the copper-output is produced on the Coast, which has become the centre of the copper-mining industry, thus replacing the Boundary District, the old centre.

On Vancouver island the amount of copper produced has been very small comparatively, but there are under development at present at Jordan river and near Quatsino sound two properties on which active development has been carried on with such success as to indicate a large production within a few years.

ZINC.

The quantity of zinc produced in 1918 amounted to 41,772,916 lb., compared with 41,848,513 lb. produced in 1917. This production is valued at \$2,899,040, which shows a still further proportionate decrease as compared with the 1917 value, due to the decreased market price of the metal.

The price of zinc on the New York metal market did not fluctuate greatly during the year. The average price for January was 7.836 cents a pound, and in November 8.491 cents. Since the armistice the market has been inactive, with practically no sales, so that quotations have been nominal. At the end of the year the price had declined to about 7.5 cents a pound, while the average price for the year was 8.159 cents.

The following table shows the production of zinc according to districts:—

	Lb.
Fort Steele	26,704,806
Slocan	14,107,682
Omineca	313,112
Ainsworth	640,991
All others	6,325
Total	41,772,916

These figures show, as compared with 1917, an increase in the Fort Steele production of nearly 6,000,000 lb., and a decrease of about 4,500,000 lb. in the Slocan output.

The Fort Steele production comes entirely from the *Sullivan* mine. The ore is treated in the electrolytic zinc plant at Trail.

In the Slocan District the heaviest shipper was again the *Standard*, with a production of over 7,000,000 lb., which, however, is 3,000,000 lb. less than in 1917. The next largest shipper was the *Surprise*, followed by the *Lucky Jim* and the *Galena Farm*.

The production of Ainsworth is only about two-thirds of last year's production.

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

OTHER MINERALS.

The demands made by the recent great war caused a great and insistent demand for many of the minerals little known to the public, while the conditions brought about by the war, in shutting off former sources of supply, with a general interruption of the world's markets and transportation channels, forced upwards the market values of many minerals, which under these conditions could be and were worked to a profit where formerly they were commercially unworkable.

Since peace may be said to be again established, this urgent demand has ceased, and until experience has shown what the demands of the new conditions will prove to be, the markets and the market prices are so disrupted that very few sales are taking place.

Iron Ore.

The past year has seen a very great demand for iron and steel on the Pacific Coast, the normal demand having been greatly increased by the need for steel in ship-building and munitions work, while the usual outside sources have been monopolized by war needs in other parts of the world and the high freight rates have made the lack of local production more pronounced. Consequently, 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 on this Coast. 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.

The magnetite-deposits of the Coast have therefore had some attention bestowed on them during the past year; this, however, was mainly confined to examination, with but little development. Bulletin No. 3, 1917, of this Department describes the more important magnetite-deposits of the Coast.

A few hundred tons of bog-iron ore was shipped from a deposit near Mons, on the Pacific Great Eastern Railway, to Irondale, Wash., where it was smelted in conjunction with mill cinder and scrap. This ore ran from 40 to 50 per cent. of iron, but was above the Bessemer limit in phosphorus.

Some magnetite ore was also shipped from Texada island to the Irondale furnace.

During the summer months the Provincial Government engaged Dr. Alfred Stansfield, of Montreal, to make a report on the commercial feasibility of smelting British Columbia magnetites in an electric furnace; the abnormal price of iron due to war conditions offering a seeming field for that class of smelting. Dr. Stansfield's report has been published as Bulletin No. 2, 1919.

Platinum. The very insistent demand for platinum for war purposes caused a most exhaustive search to be made for it in commercial quantities by the Dominion

Government officials: the well-known fact of its wide distribution throughout the Province in connection with our placer-gold deposits giving reasonable hope for such investigations. In connection with this search a number of drill-holes were sunk in the Similkameen District, the final results of which are not yet available.

A small amount of crude platinum was saved as a by-product from placer-gold workings, the exact quantities not being known.

Arsenic. A production of arsenic valued at \$20,000 was made by the *Nickel Plate* mine in 1917, and in 1918 about \$40,000 worth was recovered from the arsenical

iron pyrites forming the mill concentrates, thus forming a by-product to the gold-mining operations of the company. These concentrates have been going to the smelter for years, but until the recent installation of an arsenic-burner the arsenic content was not recovered.

Molybdenite.—The urgent demand for molybdenite for war purposes continued throughout the first half of the year, but gradually the market fell away. Since the armistice the market is dormant, like other metal prices, but nominal quotations vary from 75 cents to \$1 a pound.

During the year a car-load of molybdenite ore, carrying also gold, cobalt, and arsenic, was shipped from the *Hazelton View* mine, Hazelton, to the Ottawa Mines Department for treatment; the gross returns from this car were about \$2,400. A small shipment of molybdenite was made from the *Golconda* claim, Osoyoos Mining Division. No other molybdenite shipments have been reported.

Chromite.—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 made.

With the end of the war the market for chromite has temporarily collapsed, as large stocks are available, with no purchasers in sight.

Manganese.—Fifteen car-loads of ore, containing from 35 to 50 per cent. manganese, was shipped from the *Curle Manganese* group, near Kaslo.

A large deposit of high-grade manganese ore was discovered during the summer near Cowichan lake. No shipments were made.

Non-metallic Minerals.—One hundred tons of fluorspar was shipped from the *Rock Candy* group, in the Grand Forks Division. This property is now 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 Trall smelter and is used for making hydrofluoric acid, which is used in the lead-refinery.

Shipments of magnesium sulphate (Epsom salt) were made from Spotted lake, Osoyoos Division, but figures have not been obtained. One hundred and seventy tons of magnesium sulphate was shipped from deposits of this material near Clinton.

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.

The production of miscellaneous minerals in British Columbia in 1918 was valued at \$97,311.

COAL.

The gross production of coal in 1918 was 2,578,724 long tons, of which 276,479 tons was made into coke, leaving the net production at 2,302,245 tons. These figures show an increase, as compared with 1917, of 180,009 tons gross and of 152,270 tons net. The quantity of coke made was 188,967 tons, which is an increase of 29,062 tons as compared with 1917. For purposes of comparison the following table is shown:—

	1913.	1914.	1915.	1916.	1917.	1918.
Coal, gross.....tons, 2,240 lb..	2,570,760	2,166,428	1,972,580	2,485,580	2,398,715	2,578,724
Less made into coke .. "	433,277	355,461	361,451	401,487	248,740	276,479
Coal, net..... "	2,137,483	1,810,967	1,611,129	2,084,093	2,149,975	2,302,245
Coke made..... "	286,045	234,577	245,871	267,725	159,905	188,967

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

	1915.	1916.	1917.	1918.
Vancouver Island mines.....tons, 2,240 lb..	1,020,942	1,492,761	1,695,721	1,666,211
Nicola and Similkameen mines..... "	99,066	110,549	151,243	179,179
Crowsnest mines..... "	852,572	882,270	551,751	732,864
Omineca-Telkwa..... "				470
Total quantity of coal mined..... "	1,972,580	2,485,580	2,398,715	2,578,724
Less made into coke..... "	361,451	401,487	248,740	276,479
Net quantity of coal produced..... "	1,611,129	2,084,093	2,149,975	2,302,245

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

	1915.	1916.	1917.	1918.
Vancouver Island collieries.....tons, 2,240 lb..	5,450	27,604	30,406	24,887
Nicola and Similkameen collieries... "	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>
Crowsnest District collieries..... "	240,421	240,121	129,499	164,080
Total coke production..... "	245,871	267,725	159,905	188,967

As will be seen from the above figures, the net coal production this year is 152,270 tons more than it was in 1917, and greater than it has been since 1912.

This output would have been considerably greater had not there been during the year a serious shortage of labour—partly caused by the heavy enlistment of the younger men—and in the early part of the year there were 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 1918 was 188,967 tons (2,240 lb.), which is 29,062 tons greater than the preceding year. Of this gross coke production, 164,080 tons was made by the Crow's Nest Pass Coal Company in East Kootenay, and the remaining 24,887 tons was made by the Canadian Collieries at Comox, V.I.

The greater part of the gross Provincial production is still being mined by three companies—the Crow's Nest Pass Coal Company of East Kootenay, the Canadian Collieries, and the Western Fuel Company of Vancouver island, which mined, collectively, 82.7 per cent. of the gross output, their respective production representing 23.6 per cent., 30.7 per cent., and 28.4 per cent. of such total.

Of the other collieries: In the Coast District, on Vancouver island, the Pacific Coast Coal Mines, Limited, produced 82,629 tons; the British Columbia Coal Mining Company 14,068 tons; the Nanoose Collieries, Limited, 28,804 tons; and the Granby Company, from a new colliery near Cassidy, produced 16,958 tons. In the Nicola Valley section of the district, the Middlesboro Colliery Company mined 101,559 tons; the Fleming Coal Company 33,203 tons; the Princeton Coal and Land Company 38,673 tons; and the Coalmont Colliery some 5,744 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 470 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 608,875 tons, the Corbin Coal and Coke Company produced 123,989 tons.

In addition to those companies actually shipping, several other companies have been installing plant and have approached the shipping stage, mention of which will be made elsewhere in this Report.

The collieries of the Coast District, including the Nicola-Princeton fields, are to be credited this year with about 71.5 per cent. of the total coal-output.

The gross output of the collieries of the Province for the past year was, as already stated 2,578,724 tons, of which 40,902 tons of coal was added to stock.

Of this gross amount, there was sold for consumption in Canada, 1,010,938 tons; sold for consumption in the United States, 752,821 tons; sold in other countries, 58,417 tons; making the total coal sales for the year 1,822,176 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 276,479 tons, and used under companies' boilers, etc., 200,698 tons; while 238,469 tons was lost in washing and screening.

The coke sales of the Province for the past year amounted to 189,680 tons, of which 828 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.	933,296	77,642	1,010,938
" export to United States "	410,603	342,218	752,821
" export to other countries "	58,417	.....	58,417
Total coal sales.....	1,402,316	419,860	1,822,176
COKE.			
Sold for consumption in Canada tons, 2,240 lb.	24,510	147,725	172,276
" export to United States ..... "	.....	17,404	17,404
" export to other countries..... "	.....	.....	.....
Total coke sales.....	24,510	165,179	189,680

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 in Telkwa District, mined 1,845,860 tons of coal in 1918, of which 22,845 tons was added to stock, making 1,823,015 tons distributed from these collieries in 1918. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	933,296	
Sold as coal in United States	410,603	
Sold as coal in other countries	58,417	
Total sold as coal		1,402,316
Used under companies' boilers, etc.		142,058
Used in making coke		40,172
Lost in washing, etc.		238,469
		<u>1,823,015</u>
Plus coal added to stock		22,845
Gross output		<u>1,845,860</u>

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, a decrease of 26,288 tons, equivalent to over 1.9 per cent.

The coal sold in Canada by the collieries of the Coast District this year shows an increase of 71,624 tons, or about 8.3 per cent. from the preceding year; the amount exported to the United States was 118,118 tons less, and 58,417 tons of coal was exported to other countries.

Only one company in the Coast District—the Canadian Collieries, Limited—has ever made coke; in 1916 the ovens were again put in operation after several years of inactivity, and in 1918 this company produced 24,887 tons (2,240 lb.) of coke, 115 tons was burned under the company's boilers, of which 271 tons was added to stock, making the total sales for the year 24,501 tons.

On Vancouver Island six companies produced coal this year—the Canadian Collieries, Limited, the Western Fuel Company, the Pacific Coast Coal Mines, the British Columbia Coal Mining Company, the Nanoose Collieries, Limited, and the Granby Colliery; the majority of these companies each operate two, or more, collieries. The combined gross output of the Island collieries was 1,666,211 tons.

In the Nicola and Princeton coalfields of the Coast District, the Middlesboro Colliery Company produced 101,559 tons of coal; the Princeton Colliery, 38,673 tons; the Fleming Coal Company, 33,203 tons; and the Coalmont Collieries, 5,744 tons.

The total output of this portion of the sub-district was 179,179 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 608,875 tons; and the Corbin Coal and Coke Company, which made an output of 123,989 tons; making a gross output for the district for 1918 of 732,864 tons of coal.

Of the coal mined, 18,057 tons was added to stock, making the amount of coal distributed from the collieries 714,807 tons.

Of this gross tonnage, 236,307 tons was used in the manufacture of coke, of which there was produced 164,080 tons (2,240 lb.).

The coke sold this year amounted to 165,179 tons, of which 1,099 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	77,642	
Sold as coal in United States	342,218	
Total sold as coal		419,860
Used by the companies in making coke		236,307
Used by the companies under boilers, etc.		58,640
		<u>714,807</u>
Plus coal added to stock		18,057
Gross output		<u>732,864</u>

BUILDING MATERIALS.

The production of building materials in 1918 was less than in the preceding year, being \$940,891 as compared with \$1,204,546. The statistical returns are not yet as complete as could be desired, due to the reluctance of a few producers to give returns, but it is believed the figure given above approximates very closely to the actual output. Since 1912, when a production, amounting to \$3,435,722 was recorded, the output of building materials has 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 have now reached a minimum, and that an output amounting from \$1,000,000 to \$1,500,000 represents the steady yearly demand for these materials for use in repairs, renewals, and various small demands, without any 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. The diminution of production has been general in all kinds of material.

The outputs of sand and gravel, of brick, pottery, and cement are all slightly less than in 1917, but the decrease is not serious. The output of fire and face bricks shows an increase, due to a slightly larger production by the Clayburn Company. 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" is now "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 production of red brick during the past year was about 3,600 M.; the price varies from \$10 to \$12 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 a little greater than in 1917. Firebrick is the principal manufactured article produced by this company, but, in addition, considerable quantities of common brick, paving-brick, tiles, drain-pipe, and prepared fireclay are made. The output for the year is valued at over \$250,000.

Pottery Drain-pipe and Tile. The British Columbia Pottery Company at Victoria West, which manufactures drain and sewer pipes, chimney-tiles, etc., made a smaller production in 1918 than in the previous year. The Port Hancy Brick Company, besides manufacturing common brick, also makes drain-pipe, partition-blocks, etc.

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 are kilns 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.

The production of lime and limestone for 1918 is valued at \$28,536, as compared with \$102,223 in 1917, and in addition nearly \$100,000 worth of limestone was quarried for use as smelter flux by the Granby and Consolidated Companies.

Portland Cement. There are two large and well-equipped cement plants in the Province, both situated on Saanich inlet. The Vancouver Portland Cement Company, of Tod inlet (R. P. Butchart, president, Board of Trade Building, Victoria), made an output of Portland cement, of a value of nearly \$300,000. This company also manufactured for the Associated Cement Company, whose works at Bamberton were not operated this past year.

Crushed Rock and Gravel. The returns for crushed rock and gravel indicate a falling-off in the demand for this material. Some of the plants which have been in operation for the past two or three years ceased operations, and others made a smaller output than in the previous year.

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.

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.

John D. Galloway, M.Sc., who was Assistant Provincial Mineralogist until June, 1917, when he was appointed Resident Engineer of the North-eastern Mineral District, with headquarters at Hazelton, rendered most valuable assistance in the preparation of the Annual Report.

Aside from his usual duties, the Provincial Mineralogist was occupied for four months investigating causes of breakage of wire cables, about two months of which time he was in the East, making tests in McGill University Laboratory.

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.

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:—

(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, 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.

(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.

(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.

(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.

(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.

(6.) The Western Mineral Survey District shall consist of that portion of the Province contained within the following Mining Divisions, that is to say: Nanaimo, 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 1918 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1918 there were made by the staff in the Government Assay Office 3,472 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	\$ 809 00
Fees for assaying	189 65
Fees for assayers' examinations	45 00
Total cash receipts	\$1,043 65
Determinations and examinations made for other Government departments for which no fees were collected:—	
Attorney-General's Department	\$ 467 00
Agricultural Department	300 00
Board of Health	180 00
Treasury Department	52 60
Other departments	25 00
	\$1,024 60

Value of work done outside of Department work \$2,068 25

The value of gold melted during the year 1918 was \$4,276 in 33 lots, as against \$6,647 in 20 lots in 1917.

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 1918 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."

An examination was held in Victoria, in the Government Laboratory, on May 17th and the following days. Two candidates came up for examination, and one obtained the required number of marks; the Board recommended that a Certificate be granted to him. No candidates applied for exemption under section 2, subsection (2), of the Act.

A meeting of the Board of Examiners was held on December 16th in Victoria, but as there were no candidates for examination or applications for licence by exemption, it was unnecessary to hold the usual semi-annual examination in that month.

In accordance with the recommendations of the Board, a Certificate has been duly issued by the Honourable the Minister of Mines to the one candidate.

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

Under section 2, subsection (1)—Concluded.

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

Under section 2, subsection (2).

Archer, Allan		McDiarmid, S. S.	
Blaylock, 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 ...		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.		MacLennan, F. W.	
Cayers, 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, O. 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.

NORTH-WESTERN DISTRICT (No. 1).

REPORT OF GEO. A. CLOTHIER, RESIDENT ENGINEER.

INTRODUCTORY.

District No. 1 includes eight Mining Divisions of the Province—namely, Bella Coola, Queen Charlotte, Skeena, Portland Canal, Nass River, Atlin, Stikine, and Llard—and embraces all the north-western portion of the Province from Seymour inlet to the northern boundary of British Columbia.

The Nass River Mining Division is a new one created on September 1st, 1918. It comprises that portion of the Skeena Mining Division from the watershed between the Nass and Skeena rivers and from the mouth of Portland Inlet just south of Pearce island, north to the southern boundary of the Stikine Mining Division. The recording office is at Anyox, B.C. A portion of the production from the old Skeena Division will therefore now be included in that of the Nass River Division.

There are many features of this North-western District which make it probably the most desirable one in the Province, from an operating as well as a prospecting standpoint. The most important feature, I think, is the accessibility of the greater portion of the District. A glance at the map will convince any one that the innumerable islands and miles upon miles of waterways cutting into the mainland, for a distance of 400 miles from Seymour inlet to the head of Portland canal, furnish unlimited areas most accessible to the prospector, and eliminates the generally prohibitive handicap of the lack of transportation. Prospecting is therefore not expensive (a gun and fishing tackle will provide 75 per cent. of the prospector's grub) and is attended with less difficulties and hardships than many other districts. It is surprising how little systematic prospecting has been done along the coast and the very small portion of the total area that has been gone over; the majority of claims staked are on croppings accidentally discovered by fishermen, lumbermen, and trappers. Because of the ideal transportation conditions, the large operating companies are always in the market for, and willing to exploit, prospects of big, low-grade ore-bodies, while with high-grade smaller bodies the prospector always has the possibility of shipping his own ore.

Geologically, the distribution of the rock formations in the entire district is considered conducive to the deposition of ore. The main granodiorite batholith, constituting the core of the Coast range, extends through the district from Bella Coola to Alaska.

Within this granite range, which varies in width from thirty to one hundred miles, are enclosed many areas of sedimentary and altered rocks which are well worth the prospector's attention. The immense deposit on the Ecstall river of iron pyrites, carrying a small percentage of chalcopyrite with small gold and silver values, occurring in a belt of sedimentary rocks about a mile wide, contained in the Coast granodiorite, exemplifies this class of ore-deposit. Also, within the granite are many intrusions or dykes of igneous rocks, along or in the vicinity of which are conditions favourable for the circulation of mineral-bearing waters and the deposition of their contents, such as is found in the *Drum Lummon* property, now under development, on Douglas channel. There are also many zones of shearing action in the granites which have rendered the rocks open and porous, and thus suited to water-circulation and to the deposition of such ore-bodies as those found in the Belmont-Surf Inlet Mines Company's property on Princess Royal island. A fourth characteristic deposit is the filled fissure in the granite; such veins as those of the *Dardanelles* group on Zymoetz (Copper) river and the *Outsider* group at Maple bay, on Portland canal, are examples of valuable deposits of this class.

Bordering the main granite-mass on either side is a broad belt of altered sedimentaries, with unaltered sedimentaries farther away from the contact, through which have intruded dykes of all kinds, spurs, isolated peaks, and short ranges from the main granite batholith, throughout which are ore-deposits of every description. This district includes the west contact-zone, from Bella Coola north to the mouth of Portland inlet, on the southern boundary of the Alaskan strip. The east contact-belt extends from the Zymoetz (Copper) river near Terrace, on the Grand Trunk Pacific Railway, north to the Alaska-British Columbia boundary-line.

The Coast range is penetrated to the eastern contact by the Skeena river, the Nass river, Portland canal, and Observatory inlet, and through the Alaska strip by the Unuk river, the Stikine river (with its principal tributary, the Iskut), and the Taku river, admitting of a lot of prospecting north of the Portland canal. The value of the eastern contact has already been demonstrated by the discovery of such properties as the *Hidden Creek* mines of the Granby Consolidated at Anyox; the *Dolly Varden* and others in the Alice Arm country; the *Bush, Big Missouri*, and others of the Salmon River section of Portland canal; and the *Engineer* mine in the Atlin district. It should be noted that, almost without exception, the ore-bodies occur in the greenstones or andesites, more or less altered where mineralized, and carry all the mineral-bearing metallics, such as gold, gold-silver, silver-lead, gold-copper, copper, and silver.

PRODUCTION FOR 1918 FROM DISTRICT No. 1.

Shipper.	Ore mined.	Gold.	Silver.	Copper.
	Tons.	Oz.	Oz.	Lb.
Granby Consolidated Mining, Smelting & Power Co.	857,871	5,934	381,859	29,692,376
Belmont-Surf Inlet Mines, Ltd.	97,830	41,618	27,326	432,313
Ikedo Mines, Ltd.	210	58	795	62,933
Lucky Seven (Terrace)	100	200		
Black Bear (Alice Arm)	13		2,700	
La Rose (Alice Arm)	11	1	1,543	
Salmon-Bear River Mining Co.	26	182	182	
Maid of Erin (Rainy Hollow)	25		875	11,160

The total value of the lode mines of this district amounted in value to \$9,044,925.

The value of the mineral-output of the North-western District has increased from \$2,006,577 in 1914 to \$8,405,696 in 1917. The production for 1918 was 866,304 tons, producing 30,201,766 lb. copper, 48,462 oz. gold, 417,731 oz. silver, having a total value of \$9,044,925, an increase of \$639,229 over last year. The increase in copper production for this year was due to the greater output of the Granby Consolidated and the production of nearly 500,000 lb. by the Belmont-Surf Inlet Mines, Limited. The greater gold production is due to the Belmont-Surf Inlet Mines, Limited, whose output for the year was over 41,618 oz.

The outlook of the mining industry in No. 1 District for the future is exceptionally favourable; several properties have been proven to the shipping-point, and the coming year should show a marked increase of production. The adjustment of the Dolly Varden railroad difficulties will put the Dolly Varden Mines Company on the shipping-list, together with several small shippers in that section. The Portland Canal Division will have a shipper in the *Bush* property from now on, with two or three other properties showing up well with development. The *Engineer* mine, in the Atlin Division, may also be expected to become an important gold-producer, probably within the coming year. The above-mentioned sections will greatly increase the silver-gold output.

With the war over and the return of many of the men who have enlisted from this north country, together with others who are well fitted for the life and are alive to the many opportunities of this particular portion of the Province, I look for an extensive revival of prospecting and mining activities.

The following review of the prospects, mines, mining conditions, and activities will be considered, for the purposes of this report, under the following headings:—

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.

Nass River Division—Alice Arm Section; Kitsault River Section; Illiance River Section; Observatory Inlet Section.

Portland Canal Division—Portland Canal Section; Bear River Section; Salmon River Section.

Stikine Mining Division.

Atlin Mining Division—Rainy Hollow Section; Atlin Section.

BELLA COOLA MINING DIVISION.

I had the opportunity of examining only one property in this Division during the year. I am informed that there has been very little active mining, but that options have been secured on several claims by one of the large operating mining companies, which will commence work at an early date.

A group consisting of three claims is situated at the head of Evans arm, on King island, about twenty miles from Ocean Falls. The group belongs to J. A. Pauline, of Bella Bella; Mr. Smabey, of Ocean Falls; and others.

The showing is a mineralized belt of basic intrusives in the granodiorites, consisting of bands of magnetite, hornblende, feldspathic rock, streaks of quartz, greenstone, etc., some of the magnetite being sparingly mineralized with chalcopyrite. The only work done is the stripping of the showing and a shot put in here and there where the magnetite crops. A cross-section of the outcrop 60 feet wide shows 2 feet of magnetite on the foot-wall; then 6 feet of dyke-rock; then 3 feet of dyke with bunches of magnetite in it; then 10 feet of dyke; the balance of mixed rock with bands and bunches of magnetite.

The zone appears to strike about with the arm, N. 10° E., and not more than 100 feet depth could be obtained for some distance by drifting, as the ground at the head of the arm is low.

A sample of the best-looking iron assayed: Iron, 52.5 per cent.; sulphur, 0.31 per cent.; phosphorus, trace; insoluble, 11.9 per cent.; copper, 0.2 per cent. The showing justifies more work.

I have no information as to the work done on the *Alexander* group or the *Kitchener* group, both magnetite-showings, on Seymour inlet, mentioned in last year's report.

QUEEN CHARLOTTE MINING DIVISION.

The lumbering industry, in the production of aeroplane spruce, requiring the employment of a great number of men, has resulted in considerable prospecting for mineral being done and some little mining activity.

The beach placers on the north coast of Graham island have been worked to some extent by Mr. Flynn and associates, but no gold production has been reported as yet.

A centrifugal-action gold-amalgamating machine invented by a Mr. Haskell, of Seattle, Wash., was installed early in the spring on three leases owned by R. R. Smith. This ground is situated at the old mouth of the Oeanda river, on the east coast of Graham island, about forty miles north of Skidegate. The principle of the machine is along the lines of a cream-separator. About 15 lb. of mercury is placed in the bottom of a double conical drum having a greatest diameter of 16 inches. The drum, revolving at from 750 to 850 r.p.m., causes the mercury to rise to the inner circumference of the drum and form a ring around it. Sand and water in the proportion of 1 to 3 are pumped into the top of the machine against an inverted dome provided with three knuckles or projections which break up the flow of sand and distribute it all over the drum. The centrifugal motion then forces the heavier-than-sand particles of gold into the ring of mercury, where it is amalgamated. The heavier particles of platinum, if present, will be forced through the mercury and collect on the drum. The sand will be forced down by the incoming feed and discharge at the bottom. The clean-up is made by stopping the machine and removing the amalgam.

The machine is driven by a 12-horse-power Witte gas-engine and is supposed to have a capacity of 300 tons in eight hours. I have been informed that the inventor was called in the United States Army draft, and that the machine has therefore not been in operation yet.

The owners of the ground claim to have proven to their own satisfaction that the sand will average 60 cents to the yard, some of it running as high as \$4 a yard. No platinum has been found in this ground, but about three miles farther south, on three leases owned by Mr. Ferguson, some platinum is obtained in the concentrated black sand.

The trial of the machine described will be of great interest, and, if successful, will prove very profitable on the grade of sand, as the cost of operation is small.

The South Easter Mining Company is a subsidiary company of the Northern Customs Concentrators, Limited, of Cobalt, Ont. A. S. Holmes is manager of the operations on the islands.

The property consists of seven claims—namely, *South Easter*, *Lion*, and *Triangle Fraction*, originally owned by McLellan, Gordon & Bourne, and the *Blue Jay*, *Cobalt*, *North Bay*, and *Toronto*, staked by the present Company. The first three claims, the original *South Easter* group, are Crown-granted. The seven claims are situated about one mile from the Indian village of

Skidegate, at the entrance of Skidegate Inlet, along the northern boundary of the Indian Reserve. A fair wagon-road suitable for taking in the machinery was built by the company with Government assistance. The road would have to be altered and improved for hauling out ore.

There are three quartz veins on the property, only one of which, however, shows commercial value. The values are in gold, about 40 per cent. of which will amalgamate; some very rich ore has been sorted out from development-work. The three veins are contained in a fissured zone about 30 feet wide in a diabasic rock formation. The one carrying the gold values, on which the development-work has been done, is traceable on the surface for over 1,000 feet, averaging in width from 8 to 10 feet, and in values from \$12 to \$15 a ton.

A shaft has been sunk on this vein for 100 feet and two levels driven from it; one is at 50 feet depth, 50 feet to the west and 75 feet to the east; the east drift showing a good shoot of ore. Another level is at 100 feet depth, with drifts of 100 feet west and 250 feet east on the vein, which is small and carries low values; the ground on this level is badly shattered, probably on account of the convergence of the veins. A raise was run from the east drift to tap the ore-body exposed on the 50-foot level above. It would appear that the ore-shoot, cropping on the surface, extends about 65 feet down and averages about 5 feet in width. It is the intention of the company to explore the fissured zone to a further depth either by sinking the shaft or by diamond-drilling. From the extent of the showings I think such work fully justified.

The property has been equipped with a very efficient small plant, consisting of a Chicago Pneumatic Tool Company compressor of 198 cubic feet a minute capacity, of semi-Diesel type, burning about 30 gallons of fuel-oil per eight-hour day. Fuel-oil costs 25 cents a gallon at the property. The hoist, assay office, and machine-shop are all in one building. A good bunk and cook house and manager's residence have been built. One-man Denver "Clipper" machines are used in development. The owners have every confidence in the property and hope to develop a sufficient tonnage to warrant the erection of a concentrating plant.

Producer Group. This group, formerly the *Lucky Seven*, is situated just outside of Jedway harbour and owned by Ike Thompson and Wilson McKinnon. It is now under option to Seattle interests, who have installed a water-driven compressor, and will this winter drive a tunnel from the beach to crosscut the ore showing on the surface. Considerable work has been done previous to the present programme, consisting of open-cuts and stripping and a shaft sunk 50 feet on the vein, from which a drift was run south for 60 feet. This drift shows an average width of 18 inches of good copper ore carrying fair values in gold and silver, averaging about \$30 a ton. The proposed tunnel would be about 300 feet long and give a depth on the vein of about 100 feet. There are good reasons to expect this property to develop into a fair producer.

Ikeda Mines. The Ikeda Mines, Limited, property is comprised of fifty-seven claims, all Crown-granted with the exception of two. The group is situated around Ikeda bay, on Moresby island. The property has been controlled since 1910 by a Vancouver syndicate, during which time there has been done 2,000 feet of diamond-drilling, mainly from No. 3 tunnel; 300 feet of drifting, crosscutting, and raising; 110 feet of sinking from No. 3 tunnel, with 20 feet of drifting on the vein from the bottom of the winze, and 138 feet of a crosscut from the bottom of the winze towards a parallel vein which forks from the main vein. A small stringer of ore was cut at 92 feet in the crosscut, which would correspond to the small vein above. The winze is 270 feet from the mouth of No. 3 tunnel.

The property has been developed by three tunnels, which constitute the main workings, and another tunnel up the hill. The main working-tunnel, No. 3, is at an elevation of 264 feet above sea-level and has been driven on the vein for 600 feet; 360 feet of that distance from the mouth of the tunnel being on No. 1 ore-shoot, which has been stoped through to the surface from two levels above—No. 2 and an intermediate level between No. 2 and No. 3. Farther in the tunnel No. 2 ore-shoot was opened up by crosscuts from the main tunnel and drifting on the shoot. This opened up at the end of the tunnel into the "big chamber," which is about 100 feet long and 40 feet wide, of mixed ore, the average of which will assay, approximately, 2.5 per cent. copper, and contains bands of chalcopyrite from which a considerable tonnage has been mined and hand-sorted to a shipping grade of about 15 per cent. copper, with some gold and silver.

A short distance from the mouth of the No. 3 tunnel a drift was started on and followed a small parallel vein of high-grade chalcopyrite ore, in places 3 feet wide, of clean ore, lying in

a dioritic dyke. This drift is 380 feet in length, joining the main vein again farther in the tunnel. Several thousand tons of ore has been shipped from this small, high-grade vein.

The main vein follows the contact between the diorite dyke on the foot-wall and limestone on the hanging-wall, striking about north and south (mag.) and dipping to the east at from 25 to 45 degrees.

An open-cut on the surface above No. 1 tunnel shows the vein in contact with the limestone to contain 3 or 4 feet of magnetite carrying pyrite and chalcopyrite; then 2 feet of altered and silicified dyke-rock with disseminated chalcopyrite, while lying on the diorite foot-wall is a band of sulphides, mainly chalcopyrite with a little pyrite and pyrrhotite. In No. 3 tunnel the main vein is shown to be an irregular, broken-up mass of basic wall-rock in which are fillings of sulphides.

The winze shows the main vein to be small, but, as only 20 feet has been drifted on it yet, it seems reasonable to expect that further work will disclose ore-shoots similar to those stoped above No. 3 tunnel. All the mining has been on the *Lily* claim.

About half a mile from the beach, on the *Chrysanthemum* claim, is a big showing of magnetite which has been crosscut on the surface, showing a width of 30 feet. The magnetite carries pyrite and pyrrhotite with a little disseminated chalcopyrite, and lies between walls of a basic igneous rock. Vein strikes north-south.

On the *Lotus* claim, at 475 feet elevation, a tunnel has been driven 120 feet, crosscutting a vein of pyrrhotite with some pyrite and scattered chalcopyrite. At 75 feet in the tunnel the vein appears to lie flat and consists of 6 feet of pyrite overlying a belt of from 6 to 10 feet of silicified and pyritized rock, and all showing a little chalcopyrite. This vein also strikes north and south and dips 25 degrees to the east. The surface above the tunnel shows a vein width of 24 feet, but the walls are not defined, the greater portion of the vein being solid pyrite and pyrrhotite with bands of siliceous rock, in which chalcopyrite is sparingly disseminated. Very little copper shows in the massive iron sulphides.

The property has got to the stage where it is hardly profitable to mine the lower-grade ore and hand-sort it to a shipping grade. An initial, small concentrator is required to treat the tonnage of second-class ore on the dumps, amounting to probably 5,000 tons, and the low-grade ore developed in the "big chamber," which could be very cheaply mined now. An estimate of the tonnage available from the "big chamber" and the balance of the mine would be difficult to make, but one can safely figure between 7,000 and 8,000 tons, sufficient to feed a 50-ton mill for a year. A small flotation plant would meet the requirements very nicely.

The main tunnel, No. 3, should be driven ahead to get under the cropping at No. 1 tunnel, and drifts should be run from the bottom of the winze both ways on both veins. It is reasonable to expect that exploration on the showings on other claims will also furnish ore of a milling grade.

I am indebted to Mr. Ikeda, under whose management the property has been operated during the year, for the following statement of output:—

193 tons shipped to Granby; returns received: Copper, 57,404 lb.; gold, 51.5 oz.; silver, 696 oz.

15 tons shipped to Granby; returns estimated: Copper, 4,980 lb.; gold, 4.5 oz.; silver, 58.5 oz.

150 tons shipped to Granby; returns estimated: Copper, 21,000 lb.; gold, 21 oz.; silver, 231.8 oz.

Total, 358 tons: Copper, 83,384 lb.; gold, 77 oz.; silver, 987 oz.

This group of two claims—*Hope* and *Hope Fraction*—owned by Hugh Hope Group. McEachern, is situated about a mile northerly from the head of Houston inlet, on Moresby island. An open-cut at 290 feet elevation has exposed a vein, about 20 feet wide, composed of magnetite and titaniferous iron (ilmenite), with a little pyrite, pyrrhotite, and chalcopyrite. The vein strikes N. 43° E. and dips about 74 degrees to the east. A sample across 10 feet of the face exposed by this open-cut gave assay returns of 2.7 per cent. copper, a trace of gold, and a trace of silver. There are some bands and bunches of good copper ore, but the above values will be about the average. Another open-cut farther south shows about the same vein contents. Just above the upper cut a broad acidic dyke, rhyolitic in appearance, cuts across the vein at N. 15° E., but seemingly does not affect the continuity of the vein. The showing could be opened up by drifting on it from a point about 150 feet lower than the open-cut and is worth investigation as a concentrating-ore.

Another parallel vein has been exposed at an elevation of 200 feet showing 15 feet in width of magnetite, but the copper content is lower than in the other vein.

The property is well located, Houston inlet being deep water, with plenty of timber, and water for everything but power.

This island, situated just outside of Jedway harbour, contains three claims—

Copper Island. *Golden Gate, Skincutite Entrance, and Trust*—owned by A. Heino, who has, each year for several years, sorted and shipped a few tons of chalcopryite ore.

The vein or ore-zone extends the full length of the island, about 1,400 feet, on which a depth of about 200 feet could be obtained at the highest point without sinking. A tunnel has been driven 135 feet at about high-tide level, the face showing 4 feet in width of chalcopryite, disseminated and in bunches, in a silicified limestone which appears to lie on the foot-wall of an extensive hornblende-belt from 20 to 30 feet wide, which extends the length of the island. Wherever this hornblende has been broken into there appears bunches of and scattered chalcopryite. An average sample across the face of the tunnel assayed 3.5 per cent. copper.

I think the hornblende-belt is well worth exploration, for the ore would make an ideal concentrating-feed. Sufficient water could probably be developed in a low, swampy portion of the island for any milling purposes. The island is heavily timbered.

This group, consisting of eight claims, is one of the oldest groups in the district,

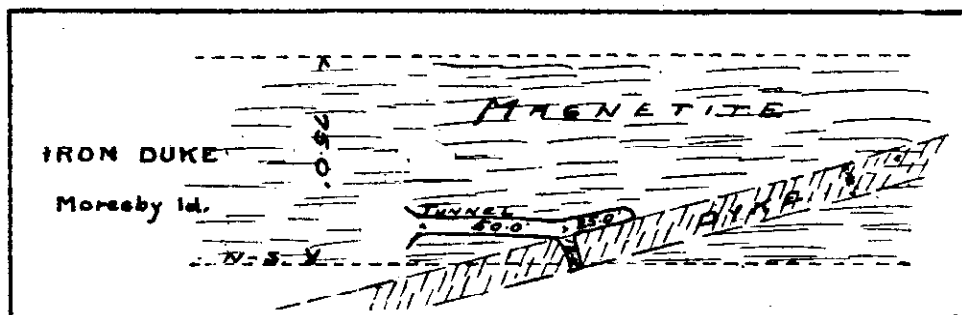
Swede Group. and still owned by the original stakers, Larsen, Pearsen & Rogers. The claims cover the hill just to the left, entering Lockeport harbour. The rock formation is a diabase, throughout which is disseminated chalcopryite and, in places, small veinlets and disseminated bornite. Two tunnels have been driven into the hill, the longest, 170 feet, showing scattered chalcopryite all the way, but sparingly mineralized in places. An average of the whole length of tunnel would probably assay between 1 and 1.5 per cent. copper. About 200 feet north is another tunnel, 80 feet long, showing the same character of rock and mineralization, with the addition of scattered bornite and seams of the same mineral in places.

A diamond-drill hole from the face of the short tunnel for a distance of 80 feet into the hill, and some 2,000 feet of diamond-drilling on the opposite of the hill, was done by the Granby Consolidated Company. No information is available as to results obtained.

There is abundant water-supply for power and wash purposes from two creeks, draining several lakes above, emptying into the head of the inlet on which the property is situated. All conditions are ideal for working on any desired scale.

This group, owned by A. Jones, consists of four claims—*Last Chance, No Doubt,*

Jones Group. *Star, and Tiger*—situated about a mile from the head of Kinnikwoi bay, on Salmon creek. The rock formation and ore occurrence are identical with that of the *Swede* group. A tunnel at an elevation of 225 feet has been driven 25 feet through the diabase, which is here low grade in copper, assaying probably about 1 per cent. Another tunnel 200 feet west of this has been driven 5 feet in the same kind of material. The Granby Company also diamond-drilled this property, with apparently unsatisfactory results.



Iron Duke Group. This group consists of nine claims—*Iron Duke, Iron Duke No. 1, Iron Duke No. 2, Iron Duke No. 3, Simcoe Fraction, I.X.L., Derby, Garfield, and Epsom*—situated on Louise Island. The property is owned by Rogers, Benson & Larsen, the latter only owning a small share. The camp, which is on the claims, is at an elevation of 625 feet and is about an hour's walk from the beach camp on the Cumshewa

Inlet side of the island, where there is a good landing-beach. There is a good foot-trail from the beach to the camp on the property, built and maintained by the owners.

The showing on the claims consists of a big body of magnetite lying along the contact between the igneous formation on the one side and limestone on the other. Numerous light-coloured, later dykes cut across the ore-body, but do not disturb it in any way. The work done consists of a tunnel 75 feet long, with a crosscut from a point 50 feet from the mouth, across a dyke 12 feet. The tunnel is in ore all the way, but it is broken up and oxidized more or less along the dyke, which pinches out at the face in the back of the tunnel. If the tunnel was continued along the dyke it would probably run out of the ore-body, for to all appearances the dyke cuts across the ore. The tunnel is at an elevation of 1,025 feet. There are a number of open-cuts across the ore above the tunnel. The first one, 50 feet above the tunnel, shows a width of solid ore of 50 feet. Another open-cut 50 feet farther up exposes a width of 60 feet of solid magnetite. Farther up the hill another 50 feet an open-cut shows a width of 75 feet of solid ore, while 100 feet farther the vein is again opened up across 75 feet of solid ore. At 1,300 feet, or 300 feet above the tunnel, a small trench run into the ore shows it to be solid magnetite.

A sample was taken across 75 feet of solid ore at an elevation of 200 feet above the tunnel, which gave the following returns: Iron, 57 per cent.; silica, 6.5 per cent.; sulphur, trace; phosphorus, trace.

Below the tunnel, about 100 feet, a small stripping exposes solid ore. The tonnage has not been proven to any extent yet, but it certainly has all the appearance of being an immense body of ore, which could be quarried out and shipped very cheaply.

There is an abundance of timber and plenty of water for all purposes except power.

This group, situated on the north side of Cumshewa Inlet, was reported on by **Homestake** Forbes in the 1913 Minister of Mines' Report, and, as no material change has been made in the property since, I will refer the reader to that report.

Shuttle island, situated nine miles south of Lockport, is about two miles long and about half a mile wide. It was completely staked early in the spring when a cook in the logging camp discovered free gold in the gravel on the beach. Later on, free gold was also found contained in small quartz stringers running through the slaty country-rock. The placer gold found in the gravel is flat, with slightly rounded edges, showing that it has undoubtedly been freed by the disintegration of the quartz stringers, and purely local. Pieces up to \$15 in value were found on the beach. My latest information is that the beach, staked as a placer claim, has been sufficiently tested to warrant its being worked. As there is no great extent of beach, only a small production may be expected.

On the **Aeroplane** claim the quartz stringers were followed for only a few feet in the slate and disappeared. A little gold was obtained by mortaring up the rock and panning it. The rock formation consists of bands of limestone, bedded slates in thin layers, and slates of more massive structure, the latter appearing to contain the quartz stringers in which the gold is deposited, as well as being slightly pyritized. The general formation strikes at about N. 15° E. and dips at 70 degrees to the east. A sample across 6 feet of the pyritized slates or argillites, showing no quartz stringers, gave returns of only a trace each of gold and silver. I understand that a shaft is being sunk about 30 feet back from the beach on the vein or band in which the gold was first discovered.

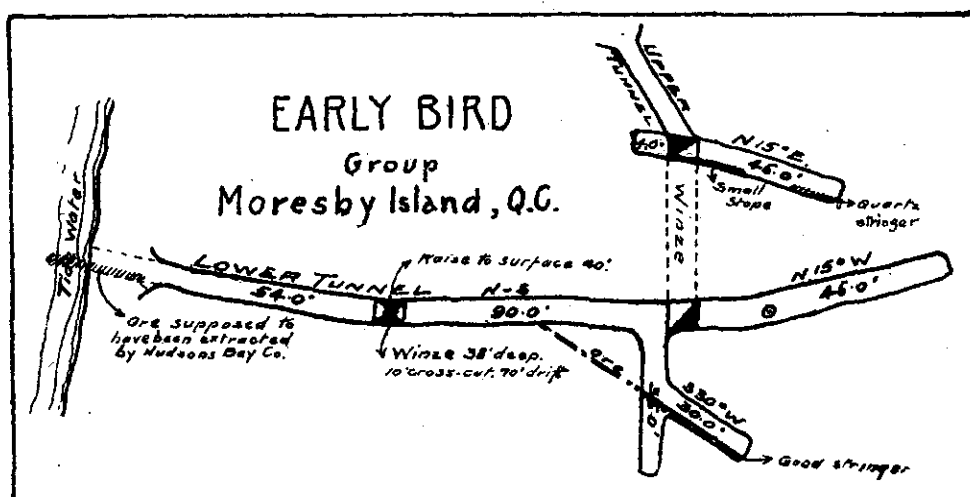
About 80 feet west of the above showing another band of slates appears, carrying more quartz than the other and in which small amounts of free gold were also found. It strikes N. 30° E. and would therefore join the other up the hill. A sample of the most pyritized pieces was taken across 18 feet, but gave no returns in gold or silver. From the exposures of mineral so far the showings are unimportant.

This group of four claims is situated on the west coast of Moresby Island, on **Early Bird** Gold harbour. The claims have been owned and worked by J. McLellan for a number of years. The showing is a small quartz vein, in places lying in a greenstone country-rock, and in other places forming the cementing material in a broken-up siliceous rock lying in the greenstone. Apparently the quartz is a filling of a fissure in the greenstone, in some places impregnating and silicifying the walls for a few inches on each side of it. The quartz carries values in visible free gold; none was seen other than in the quartz.

Two tunnels have been driven; the upper tunnel, at 50 feet elevation, being 25 feet of a crosscut from the surface to the vein and a drift of 44 feet on the vein. A shaft 35 feet deep

was sunk from the surface to this level, and continued in a winze to the lower level. A little ore was stoped from the upper tunnel, from the shaft in toward the face. The lower tunnel, 10 feet above sea-level, has been driven 216 feet on the fissure. At 54 feet from the portal a winze was sunk 38 feet, a crosscut then run 10 feet to the vein, and a drift on the vein of 70 feet. There is said to be good values in this lower drift, but it and the winze were full of water to the lower tunnel-level. At 144 feet from the mouth of the tunnel the winze from the upper tunnel connects with this level.

At 87 feet in, or 33 feet beyond the winze below this level, a quartz stringer breaks off to the right, to tap which a crosscut was run 18 feet from a point farther in, and it was then drifted on for 30 feet. This stringer strikes at S. 30° W. This tunnel is equipped with car and rails. From the mouth of the tunnel to below sea-level it is reported that the Hudson's Bay Company took out several thousand dollars in free gold in early days; in fact, I believe this was the first gold discovery on Queen Charlotte islands.



The 3-stamp mill has a small storage-bin at the head discharging on to a sorting-platform, from which the ore is shovelled into the mortar. Water-power is furnished by an 8-inch wooden pipe to a 3-foot Pelton water-wheel, giving a 100-foot head; but the water-supply is very uncertain, depending on the rainfall. In eight hours the mill treats about 800 lb. of ore sorted to about \$40 a ton. Good camp buildings, mill building, and blacksmith-shop are on the beach.

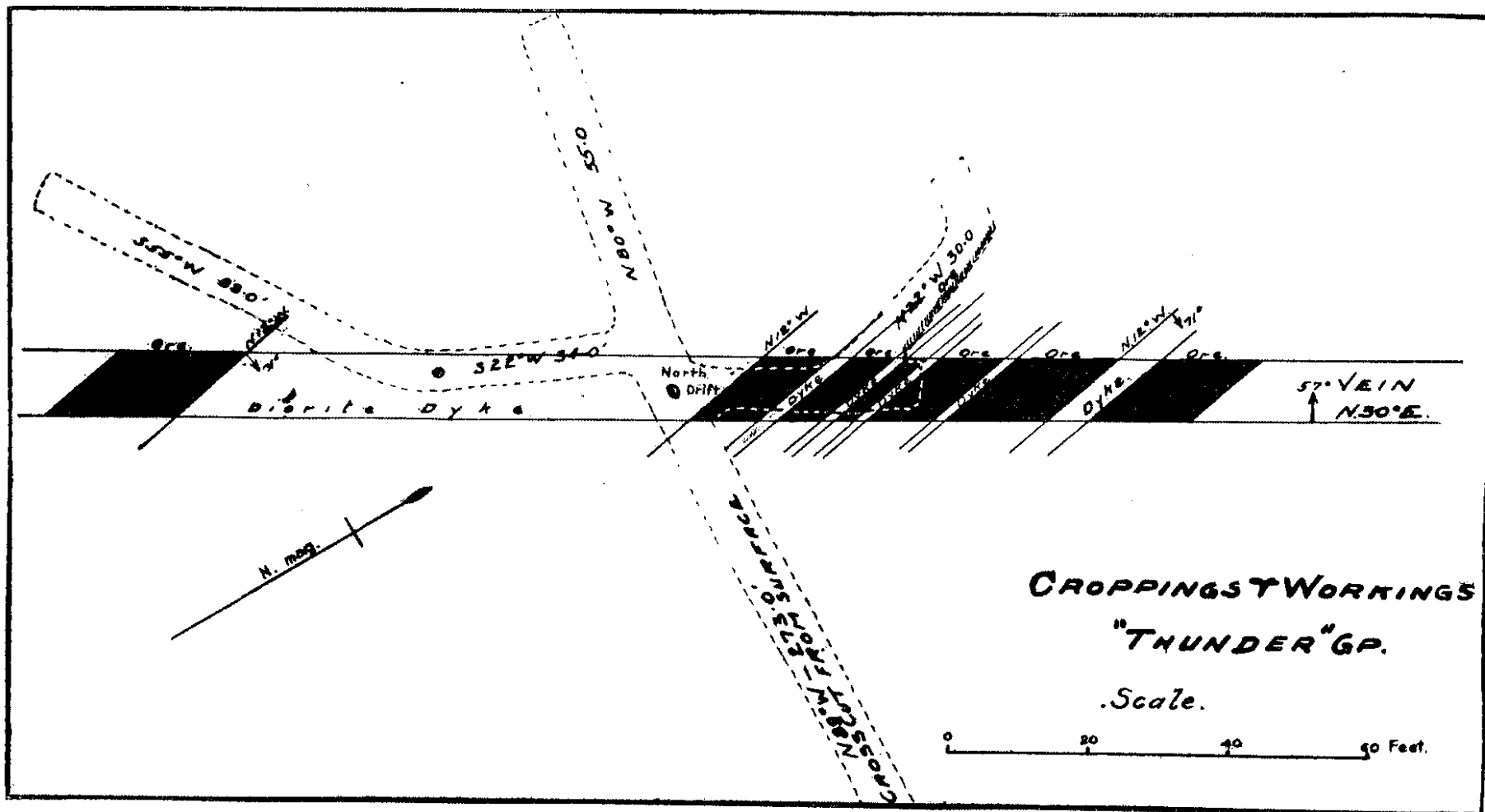
Development-work to date has shown only a small vein of quartz, averaging only a few inches in width, and said to average about \$6 a ton in gold, taking visible gold-bearing quartz with the barren. The incentive for development has been the possibility of striking a pocket similar to that extracted by the Hudson's Bay Company.

This group, across the inlet from the *Early Bird* group, consists of eight claims—*Slide 1*, *Slide 2*, *Thetis 1*, *Thetis 2*, *Thetis 3*, *Thetis 4*, *Thetis 5*, and *Thetis 6*—staked this year by Mason, Higgins & Wiggs, of Queen Charlotte City. Slides have cleaned off the overburden, exposing stringers of quartz in a greenstone formation similar to the *Early Bird*, and on these the owners intend doing some work.

This group consists of four claims—*Caesar 1*, *Caesar 2*, *Caesar 3*, and *Caesar 4*—located two wide, up the hill above the *Early Bird* group, and very likely containing a continuation of that showing. No work has yet been done. The owners are Mason, Wiggs, Hicks & Verheyden.

This group, at Collison bay, on the south-eastern side of Moresby island, consists of three Crown-granted claims—*Thunder*, *Sadie*, and *Spade Flush*.

The group is owned by Ike Thompson, of Jedway, B.C. Development-work to date consists of several open-cuts and strippings to expose and trace the vein. This surface work follows the outcroppings for 500 or 600 feet and shows the vein to be from 6 to 10 feet in width, although the hanging-wall has not been definitely located anywhere. The ledge strikes about N. 30° E. and dips into the hill at 55 degrees to the west. (See sketch.) Numerous dykes



cut diagonally across the vein at about an average strike of N. 12° W. and dip east at 71 degrees. These dykes seem to be the cause of all the difficulty in following the vein underground. There does not appear to be any faulting or slipping of the vein along the dykes. The vein-filling is composed mainly of magnetite in which are some quartz, garnetite, and pyrite, with chalcopyrite fairly well disseminated and in bunches. A cross-section of the vein exposed on the surface is shown in the attached sketch.

Two hundred feet vertically below the croppings, at 650 feet elevation, a crosscut tunnel on a bearing of N. 89° W. has been driven a distance of 330 feet into the hill. This encounters the ledge at 273 feet from the portal of the tunnel. At this point the vein shows in-place on the right-hand side, but only in scattered bunches of ore on the left side. A drift of 34 feet was run north on the ore, but ran out of it, apparently into one of the cross-dykes. At a point in this drift 26 feet from the crosscut a crosscut was driven a distance of 30 feet to the left, following a streak of ore which may be a slight mineralization along the wall of one of these dykes. I think if the drift was continued it would pick up the ore again after going through the dyke.

On the south side of the main crosscut a drift of 34 feet was run without encountering any ore. It is evident from the diagram that this drift is entirely driven in a broad dioritic dyke. This summer the property was bonded to Seattle people, who ran the crosscut mentioned above as following along the wall of a dyke. They also continued the 34-foot drift on the south side a further distance of 83 feet, turning a little more to the west, and consequently in the hanging-wall country-rock all the way. If the property was surveyed and the underground workings tied in with the surface showings, I think there would be no trouble in picking up the ore on the south side of the main crosscut.

A sample taken across the vein for 6 feet 6 inches at a point 30 feet in on the north drift from the main crosscut gave: Copper, 2.6 per cent.; silver, 3 oz.; and gold, 80 cents a ton. Another across the vein for 6 feet on the surface in an open-cut directly above the tunnel gave: Copper, 2 per cent.; silver, 0.7 oz.; and gold, \$1 a ton. In an open-cut 200 feet south of the above sample, across 6 feet, showing magnetite and chalcopyrite, a sample gave returns of: Copper, 1.5 per cent.; silver, 0.8 oz.; and gold, \$1.20 a ton.

The property is very favourably situated for mining and transportation, and I think the showings sufficient to warrant further exploration.

This group consists of three claims—*Meal Ticket*, *Treasure Box*, and *Treasure Vault*—situated south of and adjoining the *Thunder* group. The property is owned by George D. Scott, of Vancouver, B.C. The rock formation is a diorite, the same as the *Thunder* group. The showing consists of a vein of magnetite 8 feet wide, carrying considerable pyrrhotite with some pyrite and chalcopyrite. It is exposed for 200 feet in length on the surface, striking north and south, showing some shipping-grade copper ore.

At an elevation of 275 feet a tunnel was driven 30 feet, crosscutting the vein, which here shows a width of about 8 feet. There is a considerable pile of ore on the dump from this work. The tunnel is about 3,500 feet from the beach, and a further depth of 100 to 150 feet could be obtained on the vein by crosscutting from the creek-bottom, which would give a water-grade to the beach. The ore appears to grade into the diorite going north, but no work has been done on this portion of the showing. There is some fine-looking ore on the surface, and, although not proven, might easily open up into a shoot of shipping ore. There is a good chance to explore the vein by diamond-drilling. Machinery would be necessary for satisfactory development on account of the hardness and toughness of the rock.

This claim, owned by Daykin Bros., is situated on the west side of Collison bay. A crosscut tunnel 51 feet long, of which 15 feet is an open-cut, has been driven from just above tide-water to the vein, showing it to be a limestone-belt about 4 feet wide lying in a diorite country-rock. Throughout the lime is sparingly disseminated chalcopyrite and bornite, evidently a secondary sulphide obtained from the surrounding igneous rocks. The vein strikes N. 25° E. and dips north-west at 53 degrees. The low values do not warrant very much development.

The old Collison Bay Mining Company did a lot of work on a property, since abandoned, about a mile from the beach at Collison bay. Two levels were opened up, connected by an incline. The upper level is a crosscut 100 feet

long from the surface to the vein and a drift of 100 feet on ore. About 50 feet of work was done on the lower level, with no ore showing. The vein is characteristic of the surrounding showings, being magnetite with pyrrhotite, pyrite, and scattered chalcopyrite. The whole dump would probably assay between 1 and 1.5 per cent. copper. A tramway right-of-way was cut out from the tunnel to the beach.

The oilfields* on the west coast of Graham island are again receiving some little attention, though no actual drilling has been commenced. I made a trip around the north and west coasts last spring, landing where weather conditions would permit. The first anchorage on the west coast was inside of Frederick island. This area was examined, both on Frederick and Graham islands. There is an area here, about 2,000 feet wide and about a mile in length along the beach, consisting of banded argillites, sandstones, limestones, and tuffs, designated by MacKenzie as the Maude formation. The general strike is about north and south, with an average dip of probably 30 degrees, although the beds are locally twisted and folded in all directions. The length and dip of this formation would give an approximate thickness of 2,500 feet. Some layers of a soft, tarry substance were noticed along the shaly bedding-seams and the cross-joints. Bands of fossiliferous shales occur, especially in the lower portion of the formation.

It was impossible to land at Tian bay, where the drilling had been done, because of a strong south-wester and a heavy surf. A landing was made at Port Louis, but no indications of oil were seen, the formation consisting of basalt flows and agglomerates of the Masset formation, as at Tian and Otard bays. At the head of Rennell sound, for a width of about two miles, occurs practically the same formation and indications as at Frederick island. The shales strike N. 60° E. and dip at 60 degrees, somewhat more perpendicular than on the north-western side of the island.

I consider that there were no striking indications of oil at any place I landed, and, furthermore, the structure of the formation was never favourable enough at any place to justify one in thinking that it might be the container of an oil-reservoir. I admit that the points at which I was landed were too isolated from each other to form any definite conclusion, and I think that this whole section should be thoroughly investigated by a competent oil geologist, who would then have the necessary data and information to enable him to correlate the areas, which are, as yet, widely separated and in themselves unfavourable for further drilling.

SKENA MINING DIVISION.

This Mining Division has for the past two or three years held first place in mineral production amongst the Mining Divisions of the entire Province. This was due to the output of the Granby Consolidated Mining, Smelting, and Power Company, whose production will now be included in the new Nass River Division, which will therefore have the distinction of having the largest output of the Mining Divisions.

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

COAST SECTION.

The Belmont-Surf Inlet Mines, Limited, property was pretty thoroughly described in the 1917 Minister of Mines' Report; consequently it will be unnecessary to go into details, except to supplement that report with operations and development of this year. The mine and plant have been in continuous operation throughout the year, and it certainly reflects credit on the business management of the company that they have done so without a murmur, under conditions which have called forth protests from the majority of the gold-producing properties on the continent.

They have mined this year approximately 80,000 tons of ore, which has produced 8,209 dry tons of concentrates, shipped to Tacoma, and yielding 41,618 oz. gold, 27,326 oz. silver, and 432,313 lb. copper, a very creditable output for the first year's operations.

The important underground work of the year has been the opening-up of the winze which had been sunk from the 550-foot to the 700-foot level, and drifting several hundred feet, both ways from it, on the ore. This work proved that the values have increased a little and the vein increased in width, with less schists enclosed in the quartz. The winze, which is 5 x 15 feet

* Memoir 88, Geology of Graham Island, B.C., by J. D. MacKenzie.

in the clear, has been timbered in three compartments, one manway and two hoisting compartments. A station has been cut on the 700-foot level, and pockets of 340 tons capacity cut for ore from the 700-foot stopes, which will be hoisted to storage-bins on the 550-foot or working level. The winze will be continued to the 1,000-foot level, for which work a 30-horse-power electric hoist has been installed on the 700-foot level. The ore from sinking the winze will be dumped into the 700-foot pockets.

A new ore-shoot has been opened up on the 430-foot level, showing a width of 15 feet, and 100 feet in length. The ore is a clean quartz of average values. This will be opened up to the 550-foot level by crosscuts now being driven from that level.

The upper level stopes on the 430- and 320-foot levels have been difficult to work because of the heavy bands of schists on the hanging-wall. A new system of stoping will be undertaken which will do away with the handling of this waste.

The *Pugsley* mine has been steadily developed, the tunnel now being in nearly 1,000 feet. The ore is about $2\frac{1}{2}$ feet wide, with high copper content and a little gold and silver values. About another 100 feet will put the tunnel under the surface showings.

A new wash-house and dry has been built near the portal of the 550-foot level of the Surf Inlet mine, steam-heated throughout, with lockers and accommodation for 150 men. A commodious store has been built adjoining the mess-house and several new cottages are under construction. An ice-breaker has been put into commission on the lake to ensure regular shipments throughout the winter. H. J. O'Connell, mine superintendent, is the only change in the personnel of the staff.

The Drum Lummon Copper Mines, Limited, has been operated all summer up to December. The holdings of the company, whose head office is 510 London Building, 626 Pender Street, Vancouver, B.C., consists of fifteen claims, which, I understand, have been surveyed this summer and for which application for certificate of improvements is pending. They are situated on Miskatlah bay, on the north shore of Douglas channel, about twenty-five miles east of Hartley Bay, the nearest port of call for Coast-plying boats, and from which point the property is reached by launch. There is a good floating dock on which supplies are landed by freight-boats.

The year's underground work consists of further driving on the ore, the drift now being over 200 feet long. The new drifting has exposed about the same class of ore in content and extent as was described last year. A couple of hundred tons of ore was broken down on the drift-level for milling purposes before closing down the underground work. There is a seam of fine bornite ore along one wall, but the wider portions, representing more extended replacements of the wall-rock, are low grade, being quartz, and in places pure feldspar, with bunches of bornite included in and bordering the quartz. The average of the total vein contents would be low grade, but it may be considerably increased by using some judgment in breaking down the quartz.

A new compressor with a 25-horse-power gasoline-engine for power was installed early in the spring and proved very satisfactory. A small milling plant has also been erected and had just been started the day before my visit to the property; consequently it needed considerable tuning-up before the best results could be expected. The mine-run of ore is dumped into a small bin, and from there fed into a small jaw-crusher which reduces it to about 1 inch in size, discharging into a storage-bin. Two Gibson mills, each of 18 tons rated capacity per twenty-four hours, are fed from the storage-bin, only one mill being operated while the crusher is running. The Gibson mill consists of a mortar and pestle, the pestle being given a grinding motion by the swinging of the top of it through a circle about 2 feet in diameter, and pressure is provided by a spring on the pestle, together with its own weight. The feed is ground to pass a 40-mesh screen in the mortar and is fed directly to a Wilfley type table, designed by the manufacturers of the Gibson mill. The plant is operated by a 10-horse-power gas-engine, and has demonstrated that it will produce a concentrate of 62.5 per cent. copper, 1.12 oz. gold, and 30 oz. silver from a feed of this ore of 5.9 per cent. copper. Provision will have to be made for retreatment of the middlings and treatment of the slimes, in which the loss in silver is heavy. Nevertheless, it is a very creditable little plant, and will doubtless be improved on and increased in capacity as the further development of the mine demands. With the necessary improvements suggested and a mill of adequate capacity making a good saving on suitable feed, the property should be self-supporting.

The Ecstall River pyrite-showings, mentioned in last year's Report, have been further exploited by diamond-drilling by the Granby Consolidated Company during the year. No information is at hand as to the results obtained, and the work has been closed for the winter, to be resumed in the spring. The importance of the successful development of this property cannot be overestimated. It would certainly have a far-reaching effect in every way and be the making of this portion of the Coast from a mining standpoint.

I was unable to examine any of the prospects on Porcher, Gibson, and other islands during the year. There has, however, been little activity, about the only work being the yearly assessment.

On the north side of the head of Klekane inlet, J. Leedy, of Seattle, did considerable work on a group of claims situated about half a mile from the beach. The rock formation consists of a schistose-belt in which lies a vein of quartz, calcite, and altered wall-rock from 1 to 2 feet in width, carrying bornite scattered in places. The hanging-wall appears to be a band of mica-schist, the vein conforming with the strike and dip of the schists, of N. 75° W. and N. 80°. There does not seem to be much chance for the deposition of an ore-body, as the bornite only occurs in the altered wall-rock. This is the only property on the inlet on which an appreciable amount of work has been done.

There has been a little exploratory work done about half a mile from Swanson Bay on some claims owned by J. C. McNichols, of Swanson Bay, and associates. A few shots have been put in on the bank of a creek in a quartz vein lying in the schists, showing up some galena and zinc blende. Further work is necessary before any conclusions can be formed as to the width, continuity, or values of the vein.

GRAND TRUNK PACIFIC RAILWAY SECTION.

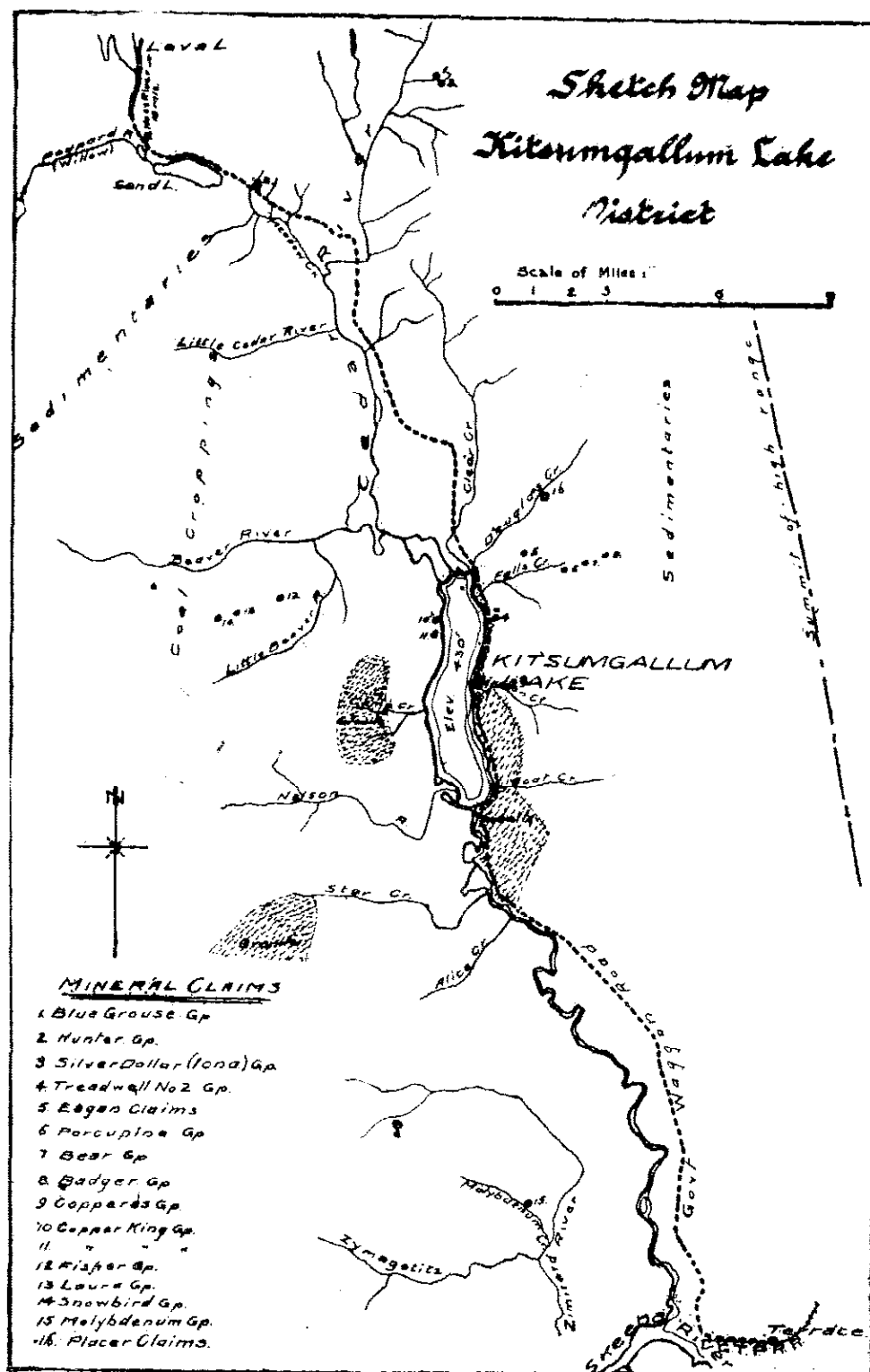
Very little mining development of any importance has taken place along the Grand Trunk Pacific between the Coast and Terrace.

This group, consisting of three claims—*Gem*, *Star*, and *Molybdenum*—owned by T. D. Liard, Geo. W. Kerr, Prince Rupert, and J. N. Erlandsen, is situated one mile up Molybdenum creek, which flows into the Zimacord river six miles and a half up from the station of Zimacord, on the Grand Trunk Pacific Railway. There is a wagon-road built for about a mile from the station and a good trail continues through to Kitsumgallum lake. The trail to the property branches off the main trail just south of Molybdenum creek.

The showings on the claims are along the banks of the creek and very little work has been done by way of opening them up. The croppings consist of a number of small, flat, short quartz veins or lenses lying in a broad diorite dyke intruding the granodiorite. The lenses will not average over 20 feet in length, and are too far apart to be worked together and too small to be worked separately. The quartz is mineralized with pyrite, a little chalcopyrite and a little molybdenite occurring for the most part along the seams. The showing is unimportant.

KITSUMGALLUM VALLEY SECTION.

Kitsumgallum lake is 16½ miles from Terrace, on the Grand Trunk Pacific, and accessible by wagon-road the total distance, the upper two miles of which are not in as good condition as the balance, but can be easily put in repair when the progress of the section warrants it. The trail continues from the end of the wagon-road through to Anyox following the Dominion Government telegraph-line. This valley and the Lakelse valley on the opposite side of the Skeena river are apparently on the eastern line of contact between the Coast Range granites and the Interior sedimentaries. The general rock formation of the Kitsumgallum Lake section is sedimentary, altered in places, with here and there isolated intrusions of granite from the main mass, and should therefore be a very favourable area for prospecting. The contact-belt extends north to the Alice Arm and Stewart sections, at the heads of Observatory inlet and Portland canal respectively. This is a distance of about forty-five miles from the head of Kitsumgallum lake to Alice arm, following the Government telegraph-trail, and about an equal distance farther north to Stewart.



This group is comprised of seven claims—*Copperas, Lucky Tom, Lucky Charles, Copper Group, Lucky Mat, Lucky Scot, Lucky Phil, and Lucky Bill*—and is owned by Phillip Chesley, Mat Allard, and partners. The claims are located about four miles up Maroon creek, which empties into Kitsungallum lake on the east side about its centre.

The rock formation consists of a series of belts of mica and hornblende schists, overlain by a mass of granite about 150 feet thick. The granite intrusion is gneissoid in structure, and has many quartz veins, up to 1 foot in thickness, running through it in all directions and sparingly mineralized with chalcopryrite. Underlying the granite the schists are mineralized for a width of 30 feet with chalcopryrite disseminated throughout it, and in small veinlets lying with the bedding-planes of the schists. A sample across this belt gave a trace in gold, trace in silver, and 0.5 per cent. copper. The schists strike about east and west and dip 40 degrees to the north.

The only work done is a stripping across the showing on the side of a small creek crossing it, where a few shots have been put in, and another stripping a short distance east of this, which does not look as well on the surface. So far as can be seen, the ore is low grade, and it will take considerable work to prove whether there are richer portions which might make the whole ore body of commercial value.

This group consists of six claims—*Treadwell No. 2, Juneau, Alley, Yankton, Contact, and Pinhead Fraction*, owned by J. Belway, McLaren & Nivens, of No. 2 Group. Terrace, B.C. The property is situated about two miles from the head, on the east side, of Kitsungallum lake.

The rock formation is of sedimentary and metamorphosed rocks north from a point just above the mouth of Maroon creek, south of which is an intrusion of granite extending for a distance of five or six miles. In the sedimentaries are beds of strata which have become shattered, allowing small veins and stringers of quartz and epidote to be deposited along the bedding-planes and cross-fractures. These thin seams of silicates carry the values in chalcopryrite, bornite mainly in the epidote, with free gold in places, the larger quartz veins, up to 12 inches in thickness, apparently being barren.

The property was under bond last year to Vancouver people, who ran a tunnel 35 feet long on a bearing of N. 40° W. across the strike of the formation, which is N. 60° E., evidently for the purpose of cutting a band of schists, carrying chalcopryrite, cropping at the edge of the lake. No values were obtained in the tunnel and the option was thrown up.

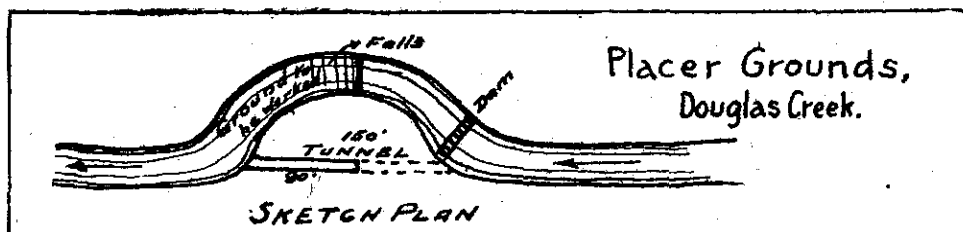
The owners have done a lot of work by way of surface stripping and open-cutting across the formation. About 100 feet south of the tunnel an open-cut shows a width of 15 feet of finely laminated chlorite-schist, and the same formation is exposed in two other cuts farther south. As this work was not extended, I presume the values are too low. About 350 feet south of the tunnel along the trail the face of the hill has been blown off for a width of 35 feet, exposing numerous veinlets and stringers of quartz and epidote with bornite, chalcopryrite, and copper carbonates lying in a slaty, micaceous, schistose formation. A grab sample was taken from the broken material from this cut, which gave only a trace each of gold, silver, and copper. A sample was also taken of the best-looking, roughly sorted ore, which gave returns of: Gold, 0.22 oz.; silver, 0.6 oz.; copper, 0.6 per cent. The rich appearance of the rock, coloured by copper carbonates, is rather deceptive. Farther south, about 1,200 feet along the lake-shore, several cuts have been made on material showing some bornite and chalcopryrite. Also, a tunnel was driven 30 feet on a red, ground-up bed of schists, in which are ribs of quartz carrying pyrite and chalcopryrite. The tunnel shows the "vein" to split near the face. A sample across 30 inches of the oxidized material, 12 feet in from the mouth of the tunnel, gave assays of: Gold, 0.04 oz.; silver, 0.1 oz.; copper, 0.5 per cent.

So far, the results obtained in average values of workable quantities of ore have not been very encouraging. However, some systematic development, such as driving on the best-looking surface showings, might disclose commercial ore.

The placer-ground on Douglas creek consists of five claims, owned by Oscar Olander, Paul Brodin, Carl Forsberg, Carl Johnson, and George Cobb. Douglas creek empties into the head of Kitsungallum lake. The claims give a length along the creek of 1,250 feet and a width of 1,000 feet.

A tunnel was being driven by the owners at the time of my examination across a sharp bend in the creek, in order to drain the water from the creek-bed above the falls, and thus procure about 400 feet in length of dry creek-bed below the falls for working. The tunnel was in about

90 feet, with about 60 feet yet to drive. From recent information from a reliable source I learn that the tunnel was finished and some gold subsequently taken out of the creek-bed, but for some reason the owners quit it.



Blue Grouse Group.

This group, about seven miles north of Cedar River crossing, which is on the Government telegraph-line, or twenty miles north of Kitsumgallum lake, on the east bank of Cedar river, consists of two claims—*Blue Grouse* and *Relief*—owned by O. Wickstrom. There is a fair wagon-road from the lake to Cedar crossing, and from there to the claims only a badly located blazed trail. A good route, however, could be selected, cutting off probably two miles of the distance and eliminating the heavy grades.

The vein is a brecciated, slaty country-rock cemented together with quartz lying in the sedimentary country-rock. The strike of the vein is N. 85° W. and the dip 50 degrees to the north, conforming with the bedding of the sedimentaries. In places in the vein the broken-up country-rock is very coarse, pieces up to 6 inches in diameter being noticed. The cementing quartz carries the mineralization of galena and chalcopryrite, the former being the more plentiful. The "vein" or stratum in the schistose formation is about 3 feet thick, with stringers of quartz penetrating into the wall-rock for 1 foot or more on each wall. There are three open-cuts along the vein, two on the *Blue Grouse* claim and one on the *Relief*. The latter is about 30 feet long, from which about 20 tons of ore has been piled up on the dump. A grab sample from this pile gave: Gold, trace; silver, 0.8 oz.; copper, 0.5 per cent. This ore could be sorted to a fair grade and, with improved transportation facilities, the property would bear investigation and further development. There is a cabin on the claims, just across the creek from the showing, at an elevation of 1,400 feet.

Hunter Group.

This group is comprised of the following claims: *Hunter*, *Hemlock*, *Aurora*, *Bear Hill*, *Hunter No. 1*, and *Hunter No. 2*, which adjoin the *Relief* claim of the *Blue Grouse* group, and extend, two wide, up the hill. The group is owned by O. Olander and partners. The only work done is on the extension of the *Blue Grouse* vein, and, where exposed along the creek, does not show as wide as below, but is otherwise identical with it.

Owing to the Government bridge along the telegraph-line at Cedar crossing being washed out and the water extremely high, I was unable to get across the river. The coal-showings on the farther side would have been interesting.

Silver Coin.

This group, formerly the *Iona* group, and now owned by Belway & McLaren, has had little or no work done on it since reported on in 1914 by Wm. Brewer.

Laura Group.

This group, consisting of the *Laura*, *May*, and *Agnes* mineral claims, is owned by H. Conroy, J. Couture, and O. Gendron, of Terrace, B.C. The claims are situated on the hill between the Little Beaver and Big Beaver rivers, about six miles from the lake. I was unable to examine them on account of the snow, but I understand that a 20-foot shaft has been sunk on a showing of arsenopyrite, running, it is said, \$16 a ton in gold.

There are several claims and groups on the west side of the lake on which a little work has been done; the majority of them, however, are high up and were covered with snow at the time of my trip through this section.

LAKELSE VALLEY (THORNHILL MOUNTAIN) SECTION.

Ptarmigan Group.

This group includes the following mineral claims: *Ptarmigan* and *Sadie*, owned by J. A. Michaud; the *St. Paul*, owned by Albert Michaud; and the *Marie*, owned by Bert Michaud. The claims are located on the summit of and down the east side of Thornhill mountain. The showing, which consists

of a decomposed belt of schists in which are bands and seams of quartz running with the formation, is mineralized with grey-copper (tetrahedrite), chalcopyrite, and galena for a width of 8 feet. This mineralized vein or belt lies in a wider zone of sedimentary rocks, apparently about 50 feet wide. About the only work done is an open-cut, at 4,450 feet elevation, showing a face about 12 feet high of very badly oxidized material. A sample across the 8 feet gave assay returns of: Gold, trace; silver, 4.4 oz.; copper, trace. The vein strikes at N. 70° E. and stands almost perpendicularly. The country-rock is apparently an enclosed, altered band of sedimentaries in the granite. It is a good strong showing and should have sufficient depth obtained on it to get below the surface oxidation. There is a fairly good trail leading to all the claims on Thornhill mountain, branching from the Lakelse wagon-road.

On the *St. Paul* claim of the group is a big vein of quartz averaging about 12 to 14 feet in width. It has been stripped and open-cut in several places, showing a very well-defined and, in places, well-mineralized vein striking N. 80° E. and dipping 35 degrees to the north. The minerals are pyrite, chalcopyrite, galena, and zinc-blende. Samples of the best pyrite have assayed up to \$80 a ton in gold, while samples of the mixed minerals assay up to \$60 a ton in all values. The showings on this vein are at an elevation of 4,530 feet.

The same belt and mineralization extend down the hill on the east side to the *A, B, C, D*, group, owned by George Little and associates, of Terrace, B.C. No work had been done on this group at the time of my examination.

This group, consisting of the *Society Girl*, *Silver Bell*, and *Don* mineral claims, owned by Dan Mason and W. Bell, adjoins the *St. Paul* claim of the *Ptarmigan* group on the west, and contains the continuation of the big quartz vein described on that claim. It has been traced for over 1,000 feet on the *Society Girl* claim and shown to range from 1 to 15 feet in width. Free gold has been panned from it in different places. Several smaller quartz veins have been prospected and opened up at intervals, but have proven rather low grade.

An open-cut was being run in on a soft schistose-belt of oxidized material about 6 feet wide. The only mineral to be seen was specks of hematite. A sample across the face failed to show any values other than a trace each of gold and silver. It strikes N. 30° E. and would therefore intersect the big quartz vein at an angle of 45 degrees.

A shaft has been sunk on a feldspar vein, showing both orthoclase and plagioclase varieties, mineralized with a little hematite, but carrying no values.

The big quartz vein is well worth extensive development on this property, as considerable depth can be obtained to drive in under the *St. Paul* claim.

This group is situated on the south-west slope of Thornhill mountain. There are five claims in the group, as follows: *Lucky Seven*, owned by A. Oleson; *Beaver*, owned by W. Dohl; and the *Diamond*, *Ruby*, and *Pedro*, jointly owned by Oleson & Dohl. These partners have owned these claims for several years, and certainly deserve credit for the exceptional amount of intelligent prospecting and exploration work which they have done.

On the *Diamond* claim they have opened up a small quartz vein lying in a quartz diorite dyke. This vein where crossing a small creek shows a fault-throw of about 25 feet horizontally and about 8 feet vertically. It lies very flat, dipping about 20 degrees west, and has a strike of north-east. The overlying diorite has been stripped off it for about 8 feet square, from which area of vein two or three small pockets of free gold yielded \$300 by mortaring and panning. The gold appears to assemble at points in the vein where small stringers of quartz join it from the country-rock. One patch of gold left in-place showed about 6 inches in diameter of solid gold in the quartz, and lying on the quartz were about 2 inches of iron oxide full of free gold. Associated with the free gold are sulphides of silver, mainly stephanite. I am reliably informed that the owners, in further opening up this vein, took out \$4,000 in free gold in two weeks during the past summer. The elevation of this showing is 3,700 feet.

Farther down the creek, still on the *Diamond* claim, a crosscut tunnel has been driven 15 feet to a small quartz vein showing on the surface and a drift for 20 feet on the vein. The quartz is about 6 inches wide where struck by the crosscut, but pinches in the face to a soft mud-filled fissure. The quartz, decomposed and rusty, carries some galena and a little chalcopyrite and pyrite. A sample from a small pile of the best of it at the mouth of the tunnel gave assays of: Gold, trace; silver, 4 oz.; and copper, trace. The vein strikes N. 30° E. The tunnel is at an elevation of 3,350 feet.

Still lower on the same creek, at an elevation of 3,250 feet, another tunnel has been driven 18 feet on the same vein, showing galena with considerable grey-copper for a width of about 8 inches in the face. Brewer's sample of this gave 107 oz. in silver. Samples from here of the purer grey-copper ran as high as 490 oz. in silver to the ton.

On the same claim, about 250 feet south of the above-mentioned vein, is a parallel one with the same strike and a dip of 53 degrees to the north-west. The quartz carries galena, chalcopryrite, pyrite, and a trace of tetrahedrite (grey-copper), and follows a light-coloured acidic dyke which is traceable on the surface for several hundred feet along the creek. A sample of the best ore assayed: Gold, \$2.40; silver, 60 oz. to the ton; lead, 25 per cent.

On the *Beaver* claim, along the first creek west of the camp, a strong, well-defined quartz vein of from 2 to 4 feet in width is exposed for a length of 500 feet by seven open-cuts. The creek swings away from the upper end of the vein, and consequently it has not been traced beyond that point because of the very heavy overburden. It strikes N. 30° E., but apparently dips in an opposite direction to the other veins on the property, at an angle of 35 degrees to the south. I had not the time to properly sample the vein, but was informed by the owners that their results, from carefully taken average samples from all the cuts, gave an average value of \$10 a ton, of which \$7.50 was gold and the balance in lead, copper, and silver. The gold is free and would therefore be recovered by amalgamation, while the metals could be tabled or floated. There is plenty of timber for all purposes and water for milling and power could be obtained from the creek running over the vein or increased from other creeks a few hundred feet away.

In my judgment, this vein will warrant investigation for a small plant, keeping in view the fact that considerable ore can be obtained for milling from the numerous other veins scattered over the property.

This claim, owned by A. Oleson, Terrace, B.C., is situated about 700 feet up the west slope of Thornhill mountain from the Lakelse wagon-road at an elevation of 1,150 feet. The rock formation consists of a band of sedimentaries enclosed in the granodiorite. In this lies a quartz vein, varying in width from a few inches up to 4 feet, striking N. 20° E. and dipping east at 80 degrees. It has been exposed in three or four open-cuts on the surface for probably 200 feet above the tunnel. These cuts show quartz containing pyrite and chalcopryrite and in places 6 inches of solid pyrite. A sample of the straight pyrite assayed: Gold, 2.36 oz.; silver, 2 oz. a ton. This when roasted will pan native gold freely. A sample of the quartz containing a little chalcopryrite assayed only a trace each of gold and silver.

A tunnel has been driven for 60 feet towards these open-cuts, starting on a small stringer of quartz which has now improved in the face to quartz stringers to the width of 2 feet. It is estimated that a further distance of 20 feet will put the face of the tunnel under the croppings. This is a good, well-situated small showing, and there is reason to expect that it will produce profitable ore.

This group of four claims is owned by a Terrace syndicate. The claims are situated west of and adjoining the *Lucky Seven* group. The showing consists of a small, up to 2 feet in width, flat quartz vein exposed along the face of a granite bluff. The quartz is mineralized, in oxidized seams, with small amounts of chalcopryrite carrying a little gold and silver values. The granite along the vein is in places altered to nearly straight quartz, while in other places it is nearly pure hornblende and epidote, in which are traces of chalcopryrite. The vein appears to strike about N. 60° E. and to dip 20 degrees to the west, corresponding closely with the free-gold vein on the *Diamond* claim of the *Lucky Seven* group.

A crosscut of 73 feet in length was run from the surface to the vein and a drift of 17 feet on the vein, in which no values were obtained; consequently the work was stopped. The tunnel is at an elevation of 3,350 feet, or 350 feet below the showing on the *Diamond* claim. The finding of gold values in such a vein is purely a gamble. It would have been much better work to have started the tunnel on the vein and drifted the total 90 feet instead of doing 73 feet of dead-work.

This group consists of four mineral claims—*Trail*, *Trail Fraction*, *Dardanelles*, and *Independent*—owned by George W. Kerr, J. Crocker, and J. Carmichael, of Prince Rupert, B.C. The claims are situated on the north bank of the Zymoetz (Copper) river, fourteen miles from Copper City and eighteen miles

**Dardanelles
Group.**

from Terrace. The Skeena river is crossed by ferry from Terrace, either at Terrace or above at Copper City, the one at Terrace being the larger and most generally used. From Copper City there is a fine horse-trail all the way up the Zymoetz river, the first four miles being on the south side and the balance on the north side of the river. The upper end has a great deal of downed timber over it, and in places the undergrowth has almost closed it in, but the whole trail could be put in good repair with the expenditure of a few hundred dollars.

There are three quartz veins on the property, all with the same strike of N. 40° E. and dip of 52 degrees to the north, and traceable on the surface for at least two claim-lengths. The surface has all been burnt over, except down along the Zymoetz river and in the creek-gulches, and the overburden is not very heavy; consequently it is not difficult to trace the veins on the surface.

The North or No. 1 vein and No. 2 vein are about 16 feet apart, separated by a dyke of quartz porphyry, while No. 3 vein lies about 180 feet south of No. 2. The general rock formation is a massive granite. The walls along the veins are a greenish-coloured altered granite for a foot or more from the vein.

No. 1 vein has a short tunnel of about 30 feet in length driven on it, showing the vein to average about 18 inches in width and to be well mineralized with pyrite, chalcopryite, and a little galena. It is at an elevation of 600 feet, or about 50 feet above the Zymoetz river. At 800 feet elevation this vein is again exposed by an open-cut and a short tunnel of 10 feet. This work shows a movement of the walls and the pinching of the vein to a seam of ground-up rock. Farther up the hill, at an elevation of 1,100 feet, a shaft has been sunk to a depth of 12 feet on this vein, showing it to be 6 feet wide of banded quartz, about half of which is fairly well mineralized with pyrite and galena, the remaining half being straight quartz. Some free gold is said to have been found in this shaft.

The No. 2 vein has only been opened up at 800 feet elevation. Here an open trench has been dug for 30 feet along the vein and a shaft 8 feet deep sunk at the face, giving a total face of 20 feet, which shows the vein and walls to be well defined. A pile of ore has been sorted on the dump from the open-cut, and the 20-foot face shows about 4 feet of well-mineralized vein. A sample taken across the bottom of the shaft 4 feet in width gave assay returns of: Gold, \$5.60; silver, 1.8 oz.; copper, 1.8 per cent. I should judge that this ore would have a ratio of concentration of 6 or 7 into 1.

The No. 3 vein had only been stripped in one place when I examined the property, showing a width of about 6 feet. A few shots were put in later on, and, I understand, exposed about the same mineralization as in the shaft on No. 2 vein.

There are three creeks on the property which could be developed into a splendid water-power. Timber could be obtained from along the Zymoetz river and the creek-gulches where it was not affected by the fire.

I consider this a very promising property and one which has all the ear-marks of developing a big tonnage of a good grade of milling-ore.

This group situated at the head of the Kitlialkwa river, a branch of the Snowflake Group, Zymoetz river, flowing into it at twenty-eight miles up from the mouth.

There are two claims in the group—*Snowflake* and *Kitlwan*—owned by John Gaberil, of Copper City, B.C. They are reached from 28-Mile by a trail, four miles to his first cabin and eight miles from there to the claims, very poorly blazed and hard to follow.

The country-rock up the Kitlialkwa, where not granite, is a reddish mottled rock, probably an andesitic porphyry. The showing on the property is a small, lenticular body of altered and crushed dyke-rock, along the seams of which have been deposited some hæmatite, possibly small amounts of chalcopite, with an occasional flake of native silver. There is little work done on the showing, but it appeared to be not more than a foot or two wide, although the rock is copper-stained for a greater width. The porphyritic dyke along which the ore lies crosses the creek, but no ore can be seen at that point. I therefore think that the mineralization is a small, local enrichment on the surface. A small sample showing flakes of native silver on the seam-faces was assayed and gave 7.5 per cent. copper and 19 oz. silver to the ton. The showing, with the present condition of transportation, is not important. The surrounding country from a prospecting standpoint justifies the construction of a good, slashed-out trail from the Zymoetz River trail.

N.P. Iron Mines. The North Pacific Iron Mines, Limited, is a company incorporated under the laws of British Columbia, with its registered office at Prince Rupert, B.C. The property of the company comprises some 375 acres of mineral claims, situated thirty-nine miles from Copper City, east of Terrace, which is just across the Skeena river from the Grand Trunk Pacific Railway. A preliminary survey of the Grand Trunk Pacific crosses the property about six miles west of the summit which is at the head of Zymoetz river.

The ore-deposits, classed as limonite, lie on a rugged side-hill and may be expected to have filled all the depressions, as well as being deposited on the flat benches. One open showing extending down the hill has a pitch of about 30 degrees, and is about 100 feet wide by about 600 feet long. An open trench has been dug about the centre of this deposit, giving a depth of 22 feet of ore. The whole area over which the iron is deposited would probably be about 1,000 feet wide at the upper border of it, and about 2,000 feet wide at the base of the hill. Outside of the open showing just mentioned the area is heavily timbered, with a large portion of it swampy ground which one has every reason to suppose will be a heavy deposit of iron. Numerous cuts have been put into the ore from the side-hill, but a great deal of drilling would be required to test the ground in order to make an estimate of the tonnage, which has been variously estimated at from 1,000,000 to 7,000,000 tons. A reasonable estimate now would be about 3,500,000 tons. The area could be sufficiently drilled with an Empire hand-drill or a light churn-drill, to get a fairly accurate idea of the tonnage, for \$3,000 or \$3,500.

The average content of the ore taken from assays of many samples would probably be about as follows: Iron, 53 per cent.; phosphorus, 0.3 per cent.; sulphur, 1.75 per cent.; silica, 1.5 per cent.

The ground is well suited for mining in benches by steam-shovelling, drag-line, or other economical method. The serious handicap is, of course, the transportation, requiring the construction of a railway for a distance of at least forty miles to the Grand Trunk Pacific and a further haul of ninety miles to tide-water at Prince Rupert. Any power required for such purposes could be developed in the Zymoetz river. The development of showings of other minerals in that section might furnish a considerable tonnage for a railway. This class of ore has been proven to make a good smelting mixture with the magnetite ores, so abundant on the Coast and islands, and which has been under investigation during the past year.

NASS RIVER MINING DIVISION.

This Division was created on September 1st, 1918, and has the distinction, due to the production of the Granby Consolidated Mining, Smelting, and Power Company, Limited, of being the largest mineral-producing Division in the Province. For the purposes of this report it will be subdivided as follows: Nass River Division—Observatory Inlet Section; Alice Arm Section; Kitsault River Section; Illiance River Section.

OBSERVATORY INLET SECTION.

The Granby Consolidated Mining, Smelting, and Power Company, Limited, operating its *Hidden Creek* mines and smelting plant at Anyox, has smelted 857,871 tons of ore, exclusive of limestone and quartz used for fluxing purposes, producing 29,692,376 lb. copper, approximately 6,000 oz. of gold, and 382,000 oz. of silver.

An excellent report on the company's holdings, plant, and operations, quoted from articles written by W. A. Williams, superintendent of smelters, was contained in last year's Minister of Mines' Report, and therefore need not be gone into.

The 100-ton "pilot" mill has been operating continuously all year in experimental concentration-work on the company's different *Hidden Creek* ores, as well as ores from their Alaska properties. The tests have been confined to the flotation process, for the reason that the finely disseminated copper content of the ore necessitates fine grinding to liberate it. The mill is equipped with crushing machinery, consisting of a jaw-crusher and ball-mills, and two series of Janney flotation-cells, which have proven fairly successful. Small tests have been made, with very satisfactory results, with a differently designed machine, and radical changes are therefore being made in the mill. The concentration of the siliceous *Hidden Creek* ores has been worked out very successfully, and encouraging results are being obtained from experiments in the selective flotation of the heavy sulphide ores.

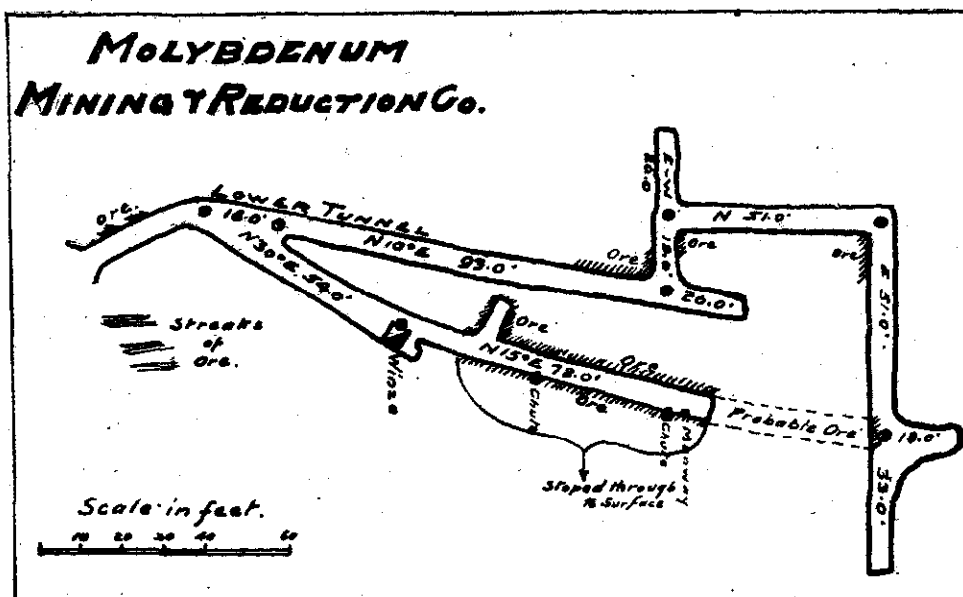
The company has under way an important undertaking in the installation of coke-ovens, with accessories for saving and utilizing the by-products. The coal-supply for this plant will be furnished from the company's own coal-mines on Vancouver island. The coke plant will cost approximately \$2,000,000, and it is expected it will be in operation early in the spring.

The most important prospecting-work on new properties has been the diamond-drilling of the big pyrite-showing on the Ecstall river. I understand that results to date have been sufficiently encouraging to justify the continuation of work next spring.

The company employs about thirty men the year round at Swamp point, on Portland canal, mining limestone used for fluxing purposes at the Anyox smelter; the production is about 250 tons a day. Fluxing quartz is mined on the point just opposite Anyox and also at the Macey quartz camp on Alice arm.

ALICE ARM SECTION.*

The only property on Alice arm that I visited was that of the Molybdenum Mining and Reduction Company. This property was fully described in J. Turnbull's report in the Minister of Mines' Report of 1916, page 66. It has been inactive ever since and I will therefore omit



going into details. I was rather favourably impressed with the ore possibilities, and it is to be regretted that the property should lie idle while the demand for molybdenum was so urgent. (See sketch of workings.)

KITSALT RIVER SECTION.

This portion of the Nass River Mining Division has had a very active summer, due to railway-construction by the Dolly Varden Mines Company, which has built from tide-water to the property, a distance of nineteen miles. The winter had been looked forward to as the starting of the *Dolly Varden* mine as a regular shipper, which would mean that the spring would see renewed activity and life in the mining industry. However, the contracting company building the railway went into liquidation, resulting in the tying-up of everything for the winter. Unless the railway affairs can be adjusted, allowing the resumption of operations in the spring, it will handicap this section for another year.

From a mining standpoint this whole section gives every promise of coming very prominently to the front, for rarely are there seen so many encouraging showings in one section as are being proven in this.

* Turnbull's report, Minister of Mines' Report, 1916.

The large amount of prospecting and development work done by the individual owners on their respective claims is a very noticeable feature of this section, and will result in a very rapid progress when transportation facilities are provided.

A very favourable factor in connection with the ores of this section is that they are particularly well adapted for fluxing purposes for the Granby smelter; consequently, lower-grade ores will be profitable because of only local freight rates instead of a long haul to southern smelters, and probably a more favourable treatment rate.

Starting at the beach, the following properties were examined during the past season. I may add that in the majority of cases I have done little or no sampling, for the reason that to sample these properties in such a way that the samples would be reliable and serve the purpose for which sampling should be done, I could have put in the whole season in this one section. My description, therefore, of a property is to endeavour to give the general reader a good, clear idea of the nature and extent of the showings, and to convey to the mining man sufficient information that he may decide whether the property is worth his investigation or not.

Black Bear Group.

This group of three claims—*I Chance It*, *Aldebaran*, and *Black Bear*—formerly the old *Roundy* property, is now owned by Salinas Bros. *et al.* The owners shipped 13 tons of ore during the year, giving gross returns of \$2,712 in silver.

Independent Group.

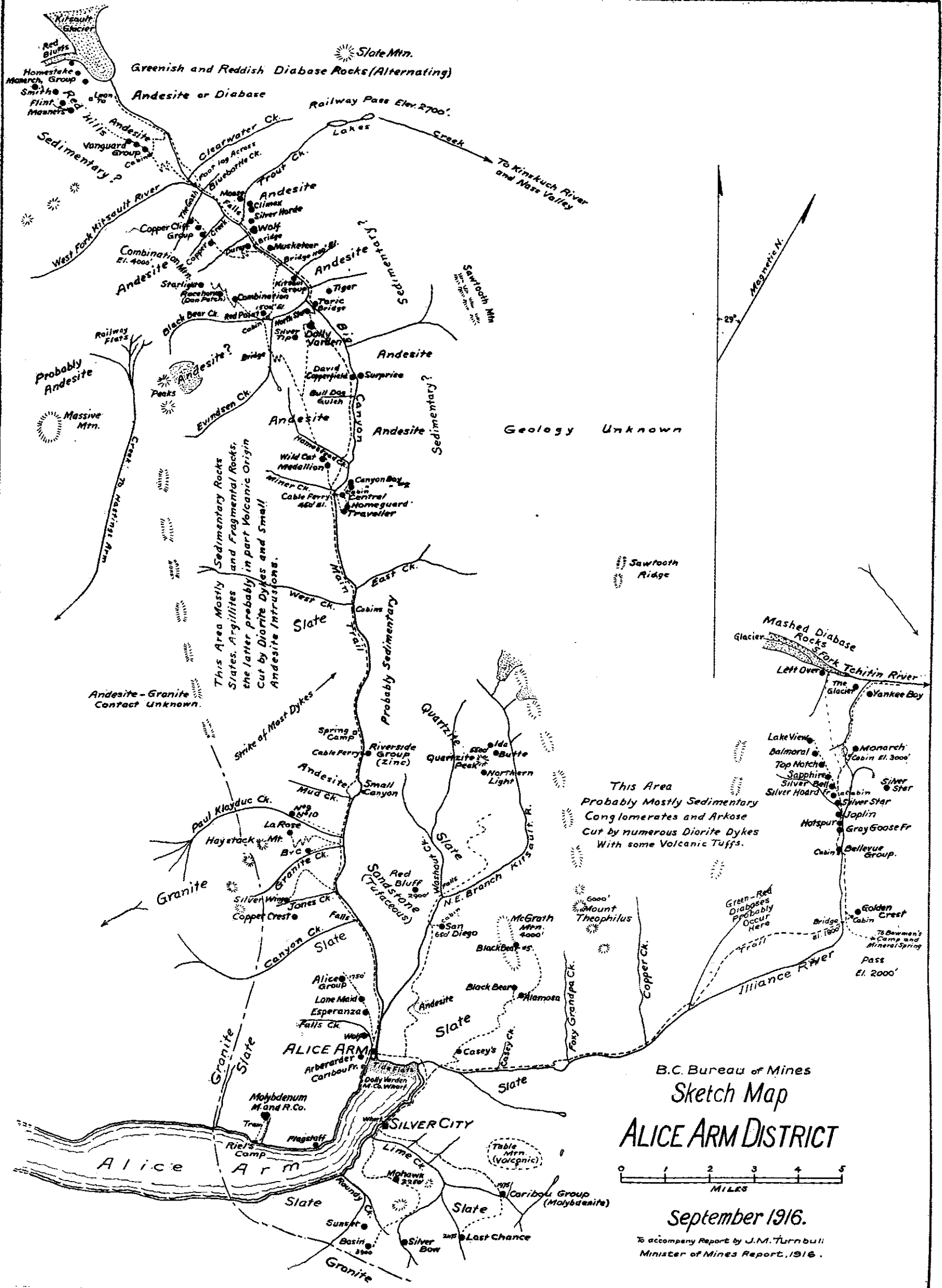
This group consists of three claims—*Independent No. 2*, *Independent No. 3*, and *Independent No. 4*—and is owned by D. A. McPhail, of Alice Arm. The claims are located just above the townsite of Alice Arm, about 1,500 feet from the post-office, and therefore are practically on tide-water. There was a fair trail from the railroad to the cabin, which is at an elevation of 600 feet, which has been improved by the present bondholder who has been working on the property for the past two or three months.

The showing is a quartz-slate vein from 1 to 6 feet in width lying in a slate formation and grading from almost pure quartz in places to a brecciated slate cemented with quartz and a little calcite. It is an exceptionally well-defined vein, with two clean walls, running due north and south and with a dip to the west of 65 degrees. There is a small basic dyke lying on the foot-wall which is in evidence wherever the vein is exposed. The quartz carries pyrite, galena, chalcopyrite, and some blende.

The work done at the time of my examination before the present bonder had started consisted of a tunnel, a shaft, and some surface stripping. The tunnel, at an elevation of 650 feet, had been driven 50 feet on the vein, showing it to have a uniform width of about 1 foot and composed of broken-up wall-rock with quartz-filling, the slate predominating. The quartz is slightly mineralized and the whole is of low values. Above the tunnel, at an elevation of 700 feet and probably 250 feet from the mouth, a shaft has been sunk to a depth of 14 feet on the vein between two fine walls 6 feet apart. The filling between the walls is about half of quartz and slate, with quartz predominating, and the hanging-wall half of slate and quartz, the quartz being in stringers throughout the slate. At the bottom of the shaft the vein is mostly quartz occupying 5 feet of the filling, the other foot being slate. The vein has been stripped about 50 feet beyond the shaft, showing it to be practically the same as the top of the shaft. A sample was taken from a narrow mineralized seam on the foot-wall at this open-cut, giving: Gold, trace; silver, 20.5 oz. a ton; lead, 1 per cent; zinc, 7.2 per cent.

This property is ideally located, and with such a well-defined vein, carrying fair values in places, it is well worth considerable development. A comparatively low-grade ore would be profitable because of its advantageous situation for mining and transportation.

This group (see Reports of 1916 and 1917), consisting of two claims—*La Rose* and *La Rose No. 1*—is owned by Miles Donald *et al.*, of Alice Arm. The property was worked this summer by the owners, who sorted, sacked, and shipped 11 tons of ore, which assayed 153.5 oz. a ton in silver, a total of 1,690 oz. About 12 tons more is ready for shipment, which it is estimated will assay about 500 oz. a ton in silver. The most of this ore was obtained from the north end of the open-cut and from a shaft sunk on the ore in the open-cut. The owners, assisted by the Mines Department, built a first-class trail from the railroad to the property, a distance of two miles. It is on an even grade, climbing 1,850 feet from the railroad, which is 200 feet elevation here, to the tunnel, and puts the property in good shape to maintain small shipments of high-grade ore. It looks as if the vein might be



B.C. Bureau of Mines
Sketch Map
ALICE ARM DISTRICT

0 1 2 3 4 5
MILES

September 1916.

To accompany Report by J.M. Turnbull
Minister of Mines Report, 1916.

picked up farther north from the tunnel, down the hill towards Paul Kladuc creek. Other ore-shoots than the one from which the ore is now being taken may be reasonably expected in the vein.

Three men were employed sorting and sacking and six pack-horses on the trail packing the ore from the tunnel to the railway. Some very fine specimens of native silver, argentite, and grey-copper were found in the ore on the dump.

There are a number of small properties similar to this, situated within easy distance of the railway, which will probably become small shippers when railway transportation is completed.

This group of three claims—*Nome*, *Rambler*, and *Eldorado*—is owned by Sid Cape Nome Miller, of Alice Arm. A tunnel is being driven on a 6-foot banded slate and Group. quartz vein lying in an altered limestone formation. The strike of the vein is north-west, with a dip of 50 degrees to the north. The only mineral showing yet is pyrite, carrying no values. A little zinc has been found on the surface farther up the hill. The tunnel is on an even grade with the railroad, which is only a few hundred feet from it.

The Dolly Varden Mines Company* owns the eight Crown-granted claims comprising the *Dolly Varden* group, and also the *Wolf* group of four claims—*Wolf*, *Wolf No. 2*, *Wolf No. 3*, and *Wolverine*. The *Dolly Varden* is situated on the west bank of the Kitsault river, nineteen miles from Alice Arm, and the *Wolf* group about two miles farther up the river, on its east bank.

There has been comparatively little work done on either properties for the past two years, the company devoting all its attention to the building of the railroad from the beach to the mine.

The *Dolly Varden* has been developed by underground work and diamond-drilling to such an extent that there are thousands of tons of shipping-ore in sight and many thousands of tons of milling-ore available. It is therefore only a matter of transportation when this property will take its place with the producing mines, and will continue to expand, with the installation of mining, milling, and power plants, into one of the important mines of the Province.

The *Wolf* group was staked by Don Cameron in 1916 and held only a couple of months before selling to the Dolly Varden Company for \$50,000. A great deal of prospecting-work has been done, principally by diamond-drilling, of which there is about 5,000 feet, proving the existence of a big body of milling-grade ore. At an elevation of 1,325 feet, or 200 feet above the river, a tunnel was started on and driven in the ore-body for 35 feet, a cross-cut then run 10 feet toward the foot-wall, and another 50 feet toward the hanging-wall, or a total of 60 feet across the vein, without encountering either wall. The vein, striking N. 70° E. and dipping 72 degrees to the north-west, is a pyritized quartz containing argentite and ruby-silver, lying in the andesite "silver-belt."

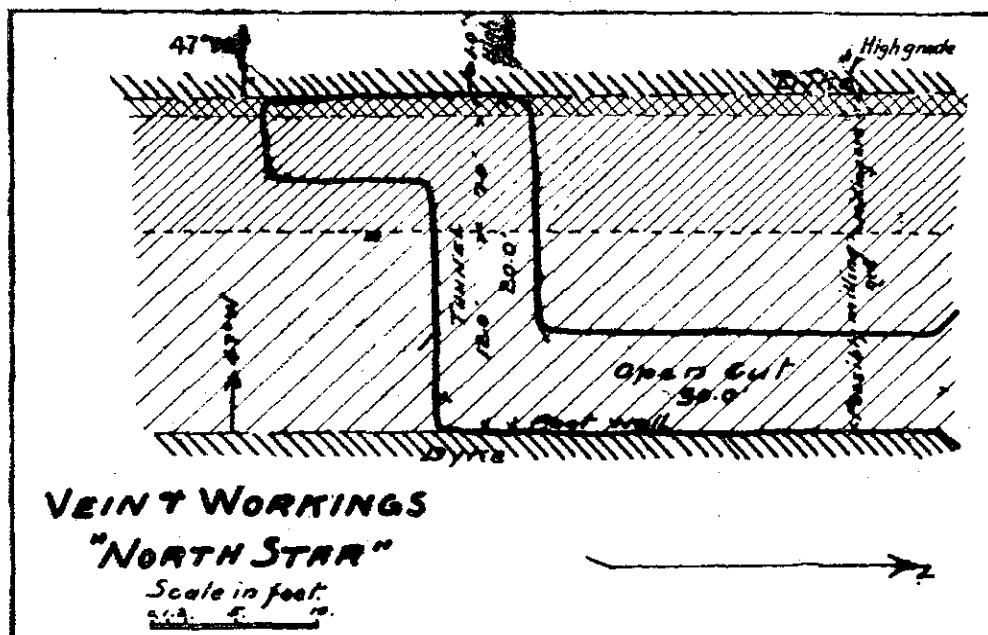
The company plans extending the railway through to the *Wolf* property and erecting a concentrator convenient to both mines. Flotation tests have been made on these ores with very satisfactory results.

This claim is owned by Gus Pearson, Ole Evindsen, and E. Carlson, of Alice North Star. Arm, B.C. It is situated north-west of and adjoining the *Dolly Varden* claims.

At an elevation of 1,600 feet, or about 700 feet above the railroad, the showing has been opened up by an open-cut 80 feet long, following along a basic dyke on the foot-wall, then a crosscut of 20 feet to the hanging-wall and a drift of 20 feet on the hanging-wall portion of the vein. (See sketch.) This work exposes the vein for its full width of 20 feet between the dykes which apparently form the walls, although ore has been found in breaking through the foot-wall dyke. The enclosing country-rock is andesite, locally termed the "silver-belt," since all the silver-showings in the section occur in it. The vein-filling is a-pyritized siliceous rock, probably the altered and silicified country-rock. About 8 feet in width on the hanging-wall of the vein is almost pure quartz and carries the principal values, though there are small bunches of ore occurring in the remaining 12 feet or less siliceous portion of the vein-filling. The quartz is mineralized with pyrite and carries the values in silver, occurring as argentite, ruby-silver, and a little galena, and will average from 20 to 25 oz. a ton. There is about a foot of high-grade ore on the hanging-wall which will assay over 100 oz. a ton, with bunches of very high grade in it. A sample taken from the last round out of the face gave: Lead, trace; silver,

* See Minister of Mines' Reports for 1916 and 1917.

20 oz. a ton. About 100 tons has been more or less sorted and piled on the dump, which the owners claim will average better than 40 oz. in silver to the ton. There are several cuts below the tunnel, proving the continuity of the vein to the lower boundary-line of the claim. The present tunnel-level will gain a depth of about 100 feet on the vein when it is continued through to the *Dolly Varden* line. A further depth of probably 150 feet can be obtained to the lower



end line of the claim, beyond which either tunnelling from the claim below, owned by others, or sinking will have to be resorted to. A length of 600 feet of vein is contained in the claim, which, with the possible depths just mentioned, shows the tonnage possibilities. Further exploration may prove a tonnage of medium-grade shipping-ore sortable to a high grade, or it may prove the whole to be of milling grade; the chances are good for either.

The property, having the advantage of cheap shipping facilities, has a very favourable outlook.

This group is comprised of four claims—*Toric*, *Anglo*, *Moose*, and *Lamb*. The **Toric Group.** claims are owned by Strombeck Bros. and are situated on the east side of the Kitsault river, about opposite the *North Star* claim. They extend from the river's edge up the hill, and as the railroad-grade runs across the *Toric* claim the property is well located for transportation. There is a good cabin on the *Toric* claim just above the railroad-grade which has been cut along here, crossing to this side of the river about half a mile above the *Dolly Varden* sawmill. With a reasonable freight and treatment rate, a \$10 a ton ore would about break even; consequently any property within a short distance of the railway will be able to handle a comparatively low-grade ore without even hand-sorting or concentration.

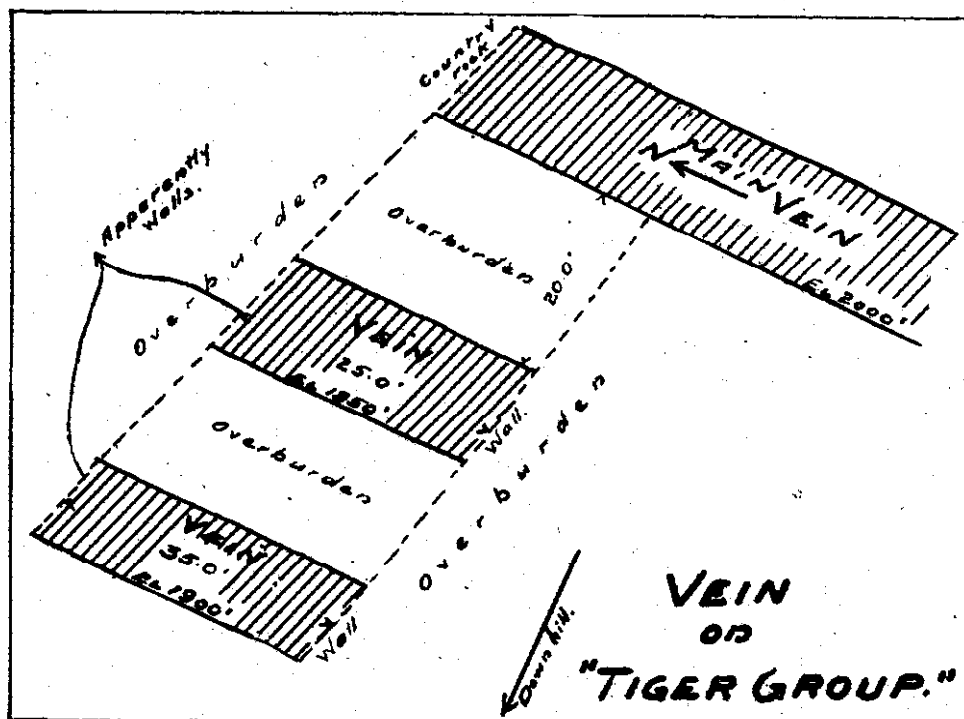
There are two veins on the claims; one, exposed by a 20-foot open-cut and a 10-foot tunnel, shows a 24-inch vein of quartz and country-rock, carrying iron pyrite and a little galena. It strikes east and west and dips 60 degrees to the north. This vein carries small values in silver.

The main vein, discovered this summer, has been opened up at a point 150 feet above the railroad by an open crosscut, showing a 3½-foot vein of barite banded with a reddish rock that looks like jasper, and quartz, in the andesite formation. The whole vein matrix is mineralized with streaks of galena and some pyrite. It strikes N. 80° E. and dips 65 degrees to the north, the same as the *Dolly Varden* vein, and at right angles to the *North Star* vein. A grab sample taken from material thrown back from the face of the open-cut gave assay returns of 0.3 per cent. lead and 17.1 oz. silver a ton, which is sufficiently encouraging to drift on. The vein has

been uncovered in a couple of places farther up the hill. With a sufficient tonnage of this grade of ore, this property, equipped with a small concentrating plant, would be a profitable proposition.

This group of two claims—*Tiger* and *Lion*—situated north of and adjoining *Tiger Group*. the *Toric* group, is owned by Ed. Pickett, of Alice Arm, B.C. The owner has done very creditable work on these claims and has succeeded in tracing the vein and exposing it for several hundred feet by means of open-cuts and stripping. The vein strikes about north and south, the same as the *North Star*, and dips 68 degrees to the east, and might easily be the extension of the *North Star* vein. It lies in the "silver-belt" formation of andesite.

The cabin on the claims is at an elevation of 1,700 feet, to which there is a fair foot-trail, breaking from the main trail just above the crossing at the foot of the *Dolly Varden* hill. The first showing is just above the cabin at an elevation of 1,800 feet, about 600 feet above the railroad-grade at the foot of the hill on the same side of the river. Here the vein is about 7 feet wide, consisting of 14 inches on the foot-wall, then about a foot of dyke or enclosed country-rock, and the balance of somewhat broken-up vein-matter. The vein is better defined at the next showing above, at 1,900 feet elevation, where it is exposed by an open-cut showing it to be 8 feet wide of hard, vitreous quartz well mineralized with iron pyrite. It is evidently of low grade, for no silver-bearing minerals could be seen at this point. The pyrite occurs



scattered throughout the quartz and in small veinlets and bunches. The vein is again exposed, with a face 10 feet high, by an open-cut about 50 feet farther north and 25 feet vertically up the hill. The width and contents are the same as in the last cut, with the appearance of a little galena, which will no doubt increase the silver values. Another open-cut some 30 feet farther along on the strike of the vein failed to pick it up, being probably a little too high up the hill or the vein overlaid by the country-rock. However, it is again cut about 30 feet farther north, showing an increase in width to 10 feet and an improvement in mineralization, in that there is more galena and some zinc, with traces of silver sulphide. Again, 30 feet farther along, at an elevation of 2,000 feet, another open-cut exposes a width of 12 feet of vein which has been stripped for a length of about 30-feet, where it appears to end abruptly against a face of country-rock. This exposure shows the characteristic pyritized, hard quartz, but in addition it shows patches of ruby-silver, with an occasional flake of native silver.

The mineralization or vein was again picked up about 50 feet vertically down the hill directly under the last showing. (See sketch.) Here an open-cut along the side-hill shows ore for a length of 25 feet, extending about 12 feet beyond the end limit of the vein above. The cut is about 12 feet into the hill, and there is a distance of about 20 feet from the top of the cut to the vein above covered with overburden; consequently there is no way of judging as to the continuation of the lower to the upper showing. Both ends of this cut appear to be walls confining the ore.

Still farther down the hill another cut exposes ore along the side-hill for a length of 35 feet, the ends of which also appear to be walls. Both of these cuts show good ore, carrying noticeable amounts of ruby-silver.

I have since been informed that there is a smaller cut below these, which I did not know of, which has the best ore-exposure of all, averaging 46 oz. silver to the ton. At the present stage of development-work it is difficult to form any conclusions as to what has happened to the vein. It would appear that there has been a cross or fault fissure running down the hill which has become filled and part of the vein. The main portion of the vein, that is, on the strike of north and south, may continue from any point on the cross-fissure, or what looks like a cross-fissure may extend indefinitely and be a cross-vein running into the main vein at this point. There is a similar occurrence on the *Musketeer* group, except that the main north-and-south fissure continues beyond the point of juncture with an east-and-west vein. Further work on this may show similar conditions.

This vein is exceptionally well mineralized throughout, and showing, as it does, values in silver in portions of it, may develop shoots of higher-grade silver ore anywhere in it. It is also exceptionally strong, well defined, and regular, and may be expected to maintain this regularity and size at depth. I cannot see where there is any chance for surface or secondary enrichment, as the vein, wherever opened, shows no signs of oxidation or alteration from the primary sulphides.

This is a property meriting extensive exploration.

Musketeer Group. This group is composed of five claims—*Athos, Porthos, D'Artagnan, Armes,* and *D'Artagnan No. 1*—situated north of the *Tiger* group and south of the *Wolf* property of the Dolly Varden Company. The claims are owned by Miles Donald and Al. Miner, of Alice Arm, B.C. An open-cut 30 feet long and about 8 feet deep, just above the railroad-grade, has been put across the showing; the cut was partially filled in, so that the width of the vein is obscured; however, it shows the characteristic filling, in the andesite fissures, of pyritized quartz and bands of red, jasper-looking rock similar to that in the *Toric* cut, with a little galena. About 100 feet south of this a face of ore has been picked down along a little bluff on the side of a small creek, showing 18 feet in width of silicified rock heavily impregnated with iron pyrite. No attempt has, as yet, been made to trace this showing, but lining it in with the first showing mentioned would give it a strike of east and west, the same as the *Toric* vein. About 200 feet farther south a short tunnel has been driven 14 feet on nothing and shows nothing in the face.

Considerable work has been done by way of open-cutting across a bluff at an elevation of 2,000 feet, the work showing a vein of quartz and barite 12 feet wide, carrying bands and bunches of iron pyrite evidently low grade, striking N. 80° W., and possibly the continuation of the vein mentioned as exposed at the foot of the hill. The course of this vein corresponds to that of the *Toric* and the *Dolly Varden*.

Some 50 feet south of the above exposure another open-cut across the face of a prominent bluff has shown up another vein 18 feet wide, consisting of a hard vitreous quartz with a little barite, heavily mineralized with iron pyrite, and apparently also low grade, as no silver sulphides were seen. This vein strikes north and south and dips 68 degrees to the east, and is therefore parallel with the *Tiger* vein, the adjoining group to the south, and resembling it in every way, except that no silver sulphides have yet been found. The continuation of this vein down the hill would just about hit the "bug-hole," a local name applied to the showing on the *Bonanza Fraction*, situated just across the river. It may be noted that the east-and-west vein joins the north-and-south vein just above these open-cuts, and both terminate at the junction, so far as can be seen. It is rather a peculiar coincidence that the *Tiger* vein or veins appear to do the same thing at about the same elevation of 2,000 feet.

There are on these claims two veins very strong in every way, and although the work done has not shown any commercial ore, yet the portions of the veins opened up are so small compared with the whole that they have little bearing on the possibilities of the balance of the veins.

This group, adjoining the *Musketeer* group on the north, has been mentioned under the Dolly Varden Mines Company. It may be interesting to note that there are also two veins on this property—the main one, on which the work has been done, striking about east and west, and another striking N. 25° W., or about at right angles, as on the *Tiger* and *Musketeer*, joining each other, but at the bottom of the hill on this property.

This group, consisting of three claims and a fraction—*Silver Horde No. 1*, *Silver Horde No. 2*, *Silver Horde No. 3*, and *Silver Horde Fraction*—is owned by A. Davidson and Al. Miner. The claims adjoin the *Wolf* group on the north and have been surveyed. Two open-cuts, the lower one at 1,600 feet

elevation, have exposed a vein in the andesite formation very similar to those described on all the other properties in the same formation. This is between 15 and 20 feet in width, possibly not quite so siliceous as the others, but carrying the same mineralization. The lower cut averages 7 oz. in silver and the upper one 4 oz. in silver a ton. It is either a parallel vein to or the extension of the No. 2 vein on the *Wolf*.

The Granby Consolidated Company diamond-drilled this vein, the results from which are not available, but were evidently unsatisfactory, as their option on the property was not exercised.

This group is composed of two claims—the *Climax* and *Climax No. 2*—and owned by Magnus Oleson. They are situated on the north side of Trout creek, adjoining the *Moose* and *Silver Horde* groups. The vein, lying in andesite, has been opened up by two open-cuts, showing it to be rather different from the other veins, in that it is composed of a greenish, brecciated country-rock; through which small quartz veinlets are interlaced. On the hanging-wall there is about a foot of a more siliceous filling, sparingly mineralized with galena. The vein is about 4 feet wide and has a bearing of east and west, with a dip of 32 degrees to the north. About 30 feet from this the other open-cut shows the same vein-filling. A sample was taken of the best-looking galena-bearing quartz, from which assays gave 14.1 per cent. lead and 14.5 oz. silver a ton.

This is a well-defined vein showing fair values, and, as such, deserves opening up.

This group of four claims—*Moose No. 1*, *Moose No. 2*, *Moose No. 3*, and *Moose No. 4*—is situated adjoining the *Climax* and *Silver Horde* properties. It was staked by Don Cameron after disposing of the *Wolf* to the Dolly Varden Company, and is still owned by him. The claims are about half a mile from the *Wolf* property, to which the railroad will eventually be constructed; therefore transportation will offer no difficulties. All the properties at or near Trout creek have abundant water for power.

On the *Moose No. 1*, at an elevation of 2,450 feet, a short way below the cabin, the face of a straight precipitous bluff has been shot off for a width of 20 feet, exposing a mineralization for practically the whole width, but of which about 6 feet could be considered a vein. It is impossible to tell here positively the strike of the vein. The country-rock is andesite.

Another cut a short distance below this, elevation 2,400 feet, discloses a well-defined vein 14 feet wide, of which about 12 feet on the west side is a mixed quartz and greenstone, while 2 feet on the east wall is very much oxidized and evidently very rich ore. I take this to be the continuation of the vein exposed above in the bluff, although they are not exactly the same strike, and the heavy timber and overburden between prevents tracing them through. This is a fine showing and will produce shipping-ore right away. About 50 feet vertically below this the same vein has been again exposed for a width of 5 feet by an open-cut and tunnel which is about 6 feet underground. It has a strike of N. 45° E. and stands about perpendicularly. This showing is in line with both cuts above and evidently the same vein.

Farther down the hill, about 200 feet, an open-cut 14 feet along the face of a perpendicular bluff exposes a vein 7 feet wide, with a face 12 feet high, running N. 15° W. and dipping 70 degrees to the east. The vein-filling is a broken-up country-rock with veinlets of quartz in all directions, and bands of quartz generally parallel to the dip of the vein. The mineralization is chiefly pyrite and evidently low grade. Its strike shows it to be another vein diverging from the other at about 60 degrees, and would therefore connect with it down the hill.

This is a good-looking property for quick action in shipping, for there is high-grade ore from the surface. I am informed that it is the owner's intention to open up the property himself and put it on a shipping basis.

This group is owned by Archie McPhail, George Kolbeck, and Pat Morley, of Alice Arm, B.C. There are four claims in the group—*Last Chance No. 1, Last Chance No. 2, Last Chance No. 3, and Last Chance No. 4*—situated about three-quarters of a mile from the railroad, up Trout creek on the north side, and adjoining the *Moose* group on the east. There is a foot-trail to the property from Trout Creek camp, on the Kitsault, over the *Climax* and *Moose* properties. There should be a good pack-trail put up Trout creek as soon as one is built up the Kitsault valley from the railway to the head of the river. This upper Kitsault area certainly requires and deserves a first-class trail built on a suitable grade for future conversion into a road. Ore brought from this and adjoining properties to the river by tramway would be about half a mile from the railroad when it is completed through to the *Wolf*, or about three miles from its present terminus at the *Dolly Varden*. Immediate shipping would therefore be impracticable from any property above the *Dolly Varden* until such time as the railroad is completed through to the *Wolf*, or a good wagon-road constructed from the present terminus up the valley. There is a good cabin on the claims at an elevation of 2,600 feet.

The showing consists of a side-hill exposure some 300 feet in length, which has had one open-cut put into it and numerous shots here and there along the surface. It has a peculiar appearance on the surface, in that it consists of all sizes of rounded pebbles and boulders of greenstone in a matrix of barite, quartz, and calcite, carrying pyrite, galena, a little chalcopyrite and blende, and some argentite. The principal values are in silver. A sample taken across 20 feet on the surface assayed 9 oz. silver a ton. Another sample, taken from all the fresh exposures where the shots had been put in, gave 61 oz. silver a ton. The open-cut on the surface has cut into the vein a few feet for a length of 20 feet and shows considerable high-grade galena and argentite.

A crosscut tunnel has been faced up at the foot of the hill, about 30 feet below the open-cut, which will be driven through the showing by the owners as early as work can be undertaken in the spring.

About 100 feet above the open-cut the ground breaks to a broad flat bench. Several holes and strippings have disclosed ore for 20 feet back from the edge of the bluff, but no conclusions can be drawn as to the width of the vein until it is crosscut below.

It is a fine big surface showing, apparently carrying good average values in silver, and consequently merits extensive exploration. The results of the driving of the crosscut tunnel will be of interest, for a proven tonnage of this grade of ore would make a fine flotation proposition, with Trout creek so handy for water and power. It is one of the meritorious prospects of the section.

The *Camalachie Fraction* is one of a group owned by D. A. McPhail, situated north of and adjoining the *Moose* and *Last Chance* groups. The showing on the fraction consists of a quartz vein, with enclosures of country-rock, lying along a diorite dyke on the hanging-wall. Several shots have been put in, tracing the vein for 300 or 400 feet, and showing it to vary from a few inches up to 6 feet in width. Samples taken by the owner gave assays of 12 oz. silver a ton.

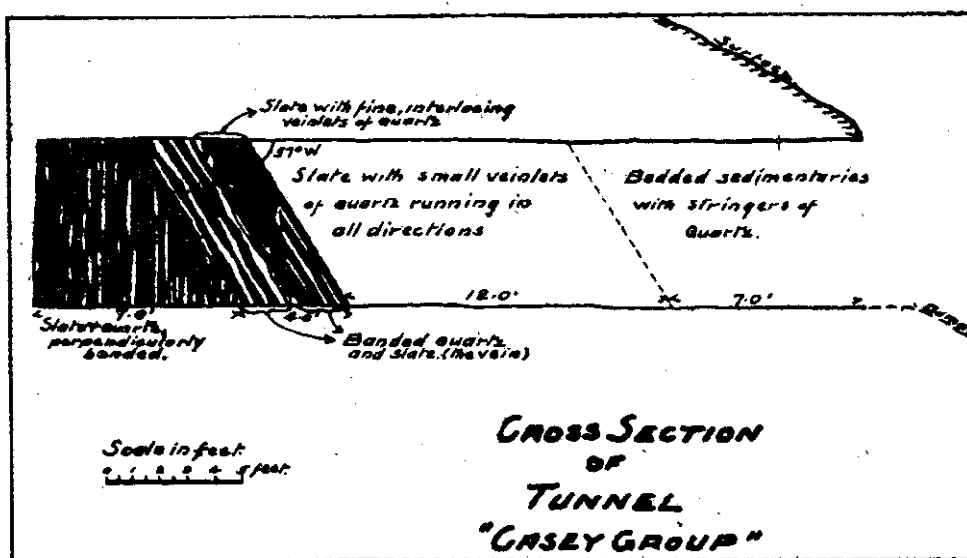
There is a big quartz vein known as the "Blue Bird vein" running through this group and traceable for several thousand feet. I did not get over that part of the claims, but am told that the vein has been exposed in several places by open-cuts, and shows small silver values wherever tested.

This group is made up of three claims—*Columbia, Wanderhoft, and Daisy*. They are owned by Pete Anderson and are situated on the north bank of Clearwater creek, about two miles and a half from the Kitsault river, from which there is an old foot-trail. The vein strikes N. 45° W., dips 70 degrees to the north-west, and lies in a sedimentary country-rock. The first open-cut is at an elevation of 2,650 feet, showing the vein to be about 6 feet wide and to consist of brecciated argillite cemented with quartz. As the vein is followed up the creek it varies from almost straight argillite, interlaced with quartz stringers, to almost pure quartz up to 15 feet in width. The slate bedding-planes lie at about N. 35° E. and dip at an angle of 31 degrees to the west, the vein therefore cutting

the formation at about right angles. There are numerous diorite dykes lying with the slates and through which the vein also cuts.

The quartz is sparingly mineralized with pyrite, with occasionally a little chalcopyrite showing. About 40 feet north of the first cut, at an elevation of 2,775 feet, where the creek bends away from the vein, an open-cut has been driven 20 feet, giving a 12-foot face on the vein, following a slip in the vein which shows it to be almost perpendicular. So far no values of any importance have been developed, and its only favourable feature is the size and persistence of the vein.

The *Second Thought (Casey)* group is situated twenty-two miles up the Kitsault river, on the east side, and two miles and a half above the proposed terminus of the Dolly Varden Railway at the Wolf property. There are four claims in the group, owned as follows: *Second Thought*, *Second Thought No. 1*, *Second Thought Frac.*, *Big Ben* (half-interest), and *Little Ben* (half-interest), by Geo. B. Casey, of Prince Rupert, B.C., and Jack Graham, of Alice Arm, B.C.; *Big Ben* (half-interest), by R. McGinnis; and *Little Ben* (half-interest), by W. Waldon.



Development-work consists of a crosscut tunnel (*see sketch*) and open-cuts on the surface above the tunnel about 50 feet. One open-cut has been run on the vein along the side-hill for a length of 30 feet, cutting into the vein for 5 or 6 feet. About 20 feet above this, where the vein crops through, is a narrow seam of a few inches thick on the foot-wall, carrying high-silver values in argentite, ruby-silver, and some native silver. The strike of the foot-wall is N. 30° E. and the dip of the vein about 62 degrees to the west. The vein-filling is shown on the surface to be mainly quartz, with slate pieces enclosed, and in places banded quartz and quartz and slate.

The tunnel has been driven a distance of 30 feet across the formation, starting from the level of the trail, which gives very little dump-room, but necessary to obtain all the depth possible under the croppings. A cross-section of the tunnel shows from the mouth 7 feet of banded sedimentaries, with small stringers of quartz through it; then 12 feet of a blocky slate or argillite, with small veinlets of quartz running in all directions through it; then a section of 4 feet, the vein, consisting of banded quartz and slate, pitching 57 degrees to the west, and mineralized with pyrite, argentite, and small flakes of native silver, as well as an occasional colour of free gold; the next 7 feet to the face is principally slate perpendicularly banded with quartz, slightly pyritized, and with traces of native gold and silver. The tunnel should be continued through to the slates, which appear to form the foot-wall of the vein, and I would also drift on the 4-foot vein of ore. A grab sample was taken from the dump of the quartz from the tunnel and gave assays of: Gold, trace; silver, 8 oz. a ton. A sample of the last 11 feet of the tunnel would probably average better than this, which, I consider, very encouraging, as the ratio of concentration would reduce the mineral content to a high-grade concentrate.

About 100 feet south of the tunnel, just off the trail, another vein crops showing a width of 6 feet of quartz, with fragments of slate embedded in it, giving it a mottled appearance. Specks of argentite can be seen in the quartz, and it is stated that native silver has also been found. This showing averages 9.5 oz. silver across the 6 feet. Another open-cut some 500 feet farther up the hill shows the extension of the vein to be about 2 feet wide and containing traces of silver sulphides. It strikes N. 10° W. and dips at 35 degrees to the west; the two veins are therefore converging with depth. No work has been done on this vein, but it is surely worth some exploration.

Taking everything into consideration, this property has a very promising appearance, and with the railroad completed through to the *Wolf* will be well situated for transportation. A great deal of depth is not obtainable on the main vein without sinking, but the other can be drifted on from the surface.

This group, consisting of eight claims—*Black Diamond No. 1, Black Diamond No. 2, Black Diamond No. 3, Black Diamond No. 4, Silver Bell No. 1, Silver Bell No. 2, Silver Bell No. 3, and Silver Bell No. 4*—is owned by John Hauber *et al.* The claims are located on the extension of the quartz vein on the *Columbia* group. I had not time to go over these, but am informed by the owners that there are two or three open-cuts on the vein and that native silver has been found.

This group is comprised of four claims—*Homestake No. 1, Homestake No. 2, Homestake No. 3, and Homestake No. 4*—and is owned by A. Davidson, Gus Pearson, and A. Smith. They are located along the west side of the glacier, twenty-six miles up the Kitsault river from Alice Arm, the four claims being staked along the vein. The main trail up the valley extends through to the property, although the upper two miles, after it crosses to the west side of the river, is not much of a trail. A great deal of credit is due the owners of this property for the amount of prospecting and work done on their claims, under very difficult and discouraging conditions. The completion of the railroad to the *Wolf* will put this portion of the country within five or six miles of transportation, and through a part not at all difficult to build a wagon or sleigh road.

The showing on the *Homestake* consists of a vein or mineralized zone extending the length of the claims, on a strike of east and west, paralleling the river, and dipping at 62 degrees to the north. The lower end of the vein is at an elevation of 3,400 feet, which is probably 500 feet above the glacier-flat or the old bed of the glacier. The ledge could be crosscut from this flat with from 200 to 300 feet of tunnel, thus providing a camp-site down in the timber, where a trail could be easily built to it, and obtain a depth of about 500 feet on the vein. The mineral zone has been crosscut in numerous places, disclosing a width up to 35 or 40 feet in places of altered and silicified greenstone mineralized with pyrite, galena, and, especially on the upper end of the zone, chalcopyrite. The rock formation is a greenstone or a greenish andesite containing many of these siliceous belts.

About 600 feet from the lower or east end of the zone it has been exposed by an open-cut, about 4 feet deep, for a width of 35 feet from the hanging-wall without reaching the foot-wall. Probably 150 feet farther west another cut shows the zone to be more siliceous and heavily mineralized with a very fine-grained iron pyrite, the foot-wall portion showing considerable galena.

Another cut, farther west about 75 feet, crosses the vein, following a small gully, the sides of which were also broken into. Traces of grey-copper were noted in this cut. Both walls are of greenstone.

The vein is again cut 50 feet farther west, showing a width of 35 feet, heavily pyritized, very little galena, but an appreciable amount of chalcopyrite. This is the best-looking showing so far, and for the depth obtained, not more than 4 feet, looks very promising.

Fifty feet farther west shows the walls of the zone to be very little altered from the country-rock, with the centre more siliceous and very well mineralized.

About 60 feet farther along on the vein there is more greenstone and less silicification than in any of the cuts, but shows a little chalcopyrite and galena.

A cut has been put in, about 20 feet west, at a point where a cross-vein meets the main one. The smaller cross-vein carries chalcopyrite, and at the juncture the mineralization in the main zone is heavier in copper sulphide than elsewhere. The small vein has a strike of N. 70° E.,

and has been opened up below, towards the glacier-flat, by two or three open-cuts. The first one, 75 feet from the main vein, shows a width of 6 feet of good quartz-copper ore, while 100 feet lower there is a very good showing of solid chalcopyrite, pyrite, and a little galena. Farther below it again crops in a small creek, where there is about a foot of good galena in a big oxidized capping which is certainly worth getting under. This small vein would make an excellent tunnel-site to get under the western portion of the main zone from the glacier-flat, and would serve the double purpose of prospecting the vein itself as well as tapping the main one.

On the extreme west end of the main vein, where it crops on the end of the hill about 100 feet above the glacier, an open-cut with a face 12 feet high in the vein exposes a width of 18 feet of vein-matter, of which about 4 feet on the foot-wall is good chalcopyrite, the balance being a mixed-up, oxidized material composed of broken-up greenstone, with galena and chalcopyrite deposited in the oxidized seams. No attempt was made to sample the showing, for it would require moiling to obtain an average across the cuts, and would take more time than I had at my disposal.

Taking into consideration the width and continuity of the vein, the persistence of the mineral content, the improvement in appearance in what little depth has been gained in the open-cuts, the grade of ore exposed in some of the cuts, and its favourable situation for mining, there are good reasons to believe that this property might easily develop an immense tonnage of concentrating-ore. As pointed out, deep development can be economically obtained by a crosscut tunnel to the vein on the lower end, or a drift on the cross-vein to the upper end of the main vein, or by drifting in on the ore from the upper end above the glacier and tramming the ore around the hill.

Matilda. This claim, owned by Arthur Smith, is situated on the side of the mountain, above the *Homestake* group, at an elevation of 4,100 feet at the tunnel. This has been driven 30 feet on a silicified greenstone vein, in which are finely disseminated iron pyrites. The tunnel has a bearing of S. 30° W. Ore on the dump shows galena and chalcopyrite, which comes from a small open-cut above the tunnel, showing about 4 feet wide of very good-looking ore. It apparently is only a bunch, as the tunnel, driven just below it, failed to show it. There is a wide belt of this altered greenstone here, about 30 feet, lying in a greenstone or andesite country-rock, with a strike of about S. 70° W.; the tunnel therefore cuts diagonally across the mineral. A sample of the best-looking galena gave 16.3 per cent. lead and 2.4 oz. silver, with a trace of gold.

The claim is worth keeping up the assessment on until improved transportation lessens the difficulties and cost of development-work.

Tip Top. This claim is situated at the same elevation as the *Matilda* claim and a little farther south along the hill. It is owned by H. Mann. The showings are identical with the *Matilda*, being an altered greenstone heavily mineralized with pyrite and also a little chalcopyrite. There are four open-cuts on this claim, on as many veins; in fact, the whole side of the mountain seems to be a series of these altered zones in the greenstone. The copper content, so far as exposed, is too low to be of commercial value until such time as cheap railway transportation is available.

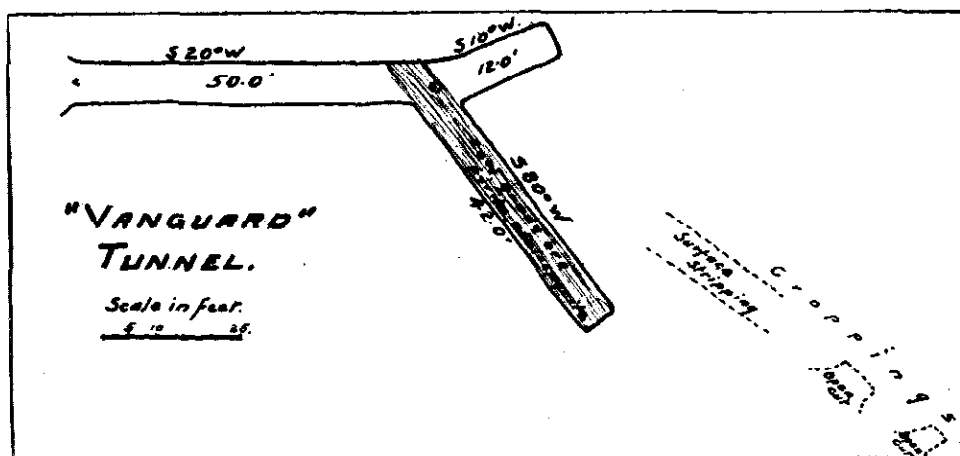
Fox. This claim and a fraction the name of which I did not get, owned by O. Flint, are situated south of the *Tip Top* claim, along the mountain-side, above the *Homestake* group. Again there is the same character of vein as on the *Matilda* and *Tip Top* claims, a greenish, siliceous filling carrying pyrite and a little chalcopyrite. The vein stands perpendicularly and strikes S. 70° W. up the hill. A tunnel has been started at an elevation of 4,000 feet and driven 6 feet on the vein, here showing about a foot of almost solid pyrite, with considerable chalcopyrite in bunches and small seams. This is a fair showing and justifies the extension of the tunnel.

This group of four claims—*Vanguard*, *Nimrod*, *Nero*, and *Mother Lode*—is **Vanguard Group**, situated on the west side of the Kitsault river, about twenty-four miles from

Alice Arm. The claims are owned by Morris Peterson and the Strombeck Bros., who have certainly shown their confidence in the property in the large amount of prospecting and development work done. There is a fair foot-trail branching from the main trail along the river to the cabin, at an elevation of 2,850 feet, about 1,000 feet above the valley. From the cabin the trail has been extended to the tunnel and other workings on the upper end of the claims.

At an elevation of 3,000 feet, a fine showing of chalcopryite has been exposed by means of two open-cuts about 15 feet apart on the vein, which has a strike here of S. 70° W. and a dip of 62 degrees to the north, with the slope of the hill. The first or east open-cut shows the vein to consist of a dark, coarse, somewhat altered greenstone, siliceous in places, and almost entirely replaced by solid chalcopryite for a width of about 8 feet. The other cut, 15 feet farther along on the vein, shows it to be rather broken up and oxidized, but containing solid bunches of chalcopryite. This showing and the continuation of the vein up the hill must lie very close to the contact between the greenstone and sedimentary formations, as the latter was noted in crossing High Grade creek a short distance up the hill.

From a point about 20 feet south of the first cut the vein has been stripped for 40 feet down the hill, exposing a width of from 4 to 8 feet of chalcopryite, in which are included small bunches of country-rock. This exposure, with the two cuts above, is an exceptionally fine showing of chalcopryite which could be easily hand-sorted to a high-grade shipping-ore.



About 40 feet below the lower end of the above stripping a tunnel has been driven at an elevation of 2,900 feet on a bearing of S. 20° W., intersecting the vein at a point 50 feet from the portal and extended 12 feet farther into the wall. A drift was run for 42 feet on the vein which strikes S. 80° W., showing its content to be light grey-coloured, rather siliceous rock, fairly well pyritized and carrying a slight amount of chalcopryite in the face. It is a disappointing showing when compared with that on the surface above, but the tunnel should be continued, as the ore-shoot in the vein may rake into the hill, in which case the drift is not in far enough to reach it.

Some 300 feet south of the tunnel along the side-hill a showing of solid chalcopryite 4 feet wide was first disclosed by an open-cut, under which a tunnel was run later, but which failed to find the continuation of the surface showing going down. This tunnel is now being continued into the hill on the assumption that the isolated showing on the surface has broken off the vein farther up the hill. This vein has been stripped farther west along the trail, exposing a width of 5 feet, containing bunches of chalcopryite through it. It has the same strike as the main vein.

This is another property in this section that could ship a small tonnage of hand-sorted ore of a high grade if the transportation facilities were available. It has as fine a surface showing of ore as one could expect; is well located for mining purposes; has plenty of timber for all needs; can obtain water for power purposes from any of the local creeks; and, with a tramway, can deliver ore to within three miles of the railroad when completed through to the Wolf property.

This group is made up of four claims—Copper Cliff, Copper Cliff No. 1, Copper Cliff No. 2, and Copper Cliff No. 3—situated on the west side of the Kitsault river, just opposite Trout creek. The owners are J. Wells, A. Davidson, and

J. E. Juggins, of Alice Arm, B.C. The showing on the property is a belt several hundred feet wide of oxidized, yellowish-red stained rock on the surface and light grey when broken into, rather soft and disseminated with pyrite, in which can be seen a little chalcopryite. The zone lies along the contact of the andesite and sedimentary formations, and in

the andesite, which has been somewhat altered and slightly silicified and pyritized. On the east side of Gash creek, which cuts across the belt, a low-grade copper-bearing vein crops, running N. 30° E., whose width at this point could not be determined. The vein is a somewhat siliceous, darker-coloured rock, full of iron pyrites which carries a small percentage of chalcopyrite. Above the cropping an open-cut has been dug along the hillside for a length of 30 feet, of which about 6 feet in width is fairly good copper ore. The formation throughout is the lighter grey, slightly pyritized rock. At an elevation of 2,550 feet a crosscut tunnel has been driven 45 feet toward the above-mentioned cropping and open-cut. Judging by eye, it will require a further 50 feet of driving to get under it.

North-west of the tunnel about 100 feet and across the creek the Granby Consolidated Company ran a diamond-drill hole from the argillites into the red-stained formation for a length of 170 feet, and, I believe, found nothing of sufficient value to warrant any further work on that side. Some drilling was also done farther north-east along the contact into this zone, with, I suppose, unsatisfactory results, as nothing more was done.

Some good float of chalcopyrite has been found below the zone, and it seems reasonable to think that, somewhere in such an immense mineralized belt, commercial ore will be found. The property is only about a half mile from the Kitsault river in a straight line, so that transportation is not a handicap.

The Carpenter-Egan claims, *Ouray* and *Bertha Fraction*, are situated on the west side of the Kitsault river, opposite the *Wolf* camp and adjoining one of the *Wolf* claims lying on the west side of the river. The claims are owned by Albert E. Egan and B. J. Carpenter, of Alice Arm, B.C. At an elevation of 1,500 feet, about 300 feet above the river, several open-cuts have been put in, tracing the vein along a ridge, running south and north into the hill. The vein has not been completely crosscut in any place, so that the width is indefinite. It is shown to be composed of quartz, with considerable calcite mineralized with pyrite, chalcopyrite, and a little galena, and lies in andesite formation. The vein lies very close, about 40 feet on the north end, to the *Wolf* line, and with its dip will no doubt extend into *Wolf* ground. Work on that end of the vein, however, proves it to pinch out, better part of the ore extending south and gradually getting away from the side line. There is some very good-looking copper ore showing in the cuts, but sufficient work has not been done in any one place to be of much use in showing up the vein.

A sample obtained by taking a few pieces from each cut in an effort to get an average of the ore gave only a couple of ounces of silver, with a trace each of copper and lead. The general appearance of the ore would suggest higher values than this. There is supposed to be an opening on the south end of the vein showing some fine ore, but in the absence of the owner I was unable to locate it. The vein can be opened at the foot of the ridge on the south end by drifting on it. I was very favourably impressed with the showing and its location.

The *Trouble Fraction*, owned by A. Davidson, is on the west side of the Kitsault just at the bridge crossing to Davidson's cabin. The owner had just put a couple of shots into the showing at the edge of the water, which had exposed a considerable width of greenstone, shot full of small veinlets of quartz and calcite, carrying a little pyrite and galena. A little east of the present exposure there appears to be more quartz, but it had not been broken into. The showing as yet does not look important.

The *Bonanza Fraction*, owned by Miles Donald, Charles Swanson, and Al. Miner, lies on the west bank of the Kitsault just above the *Big Canyon*. An open-cut across the face of a precipitous bluff overhanging the river shows a vein in andesite 18 feet wide, consisting of quartz mineralized with considerable pyrite and a little galena. It is directly in line with the north-south vein of the *Musketeeer* group and is similar in every way. A crosscut tunnel is being driven from the side of the bluff toward the vein as a more convenient point of attacking it than in the face of the bluff. It has been driven 18 feet and will require 10 feet more. The work on this fraction was done by the operators of the *Kitsault* group for that property, but when the group was surveyed the fraction contained all the work. It is a strong showing, but the ore disclosed so far is low grade.

This group of four claims—*Wild Cat*, *Montana*, *Slocan*, and *Medallion*—is owned by Davidson & Macey. The claims are situated on the west side of the Kitsault above Homestake Creek bridge. At an elevation of 1,750 feet a couple of shots have been put in on a surface showing, exposing about 4 feet of a vein of copper-

bearing quartz, in which is considerable greenstone. The walls of the vein are the typical light greenish-grey, somewhat silicified rock, disseminated with iron pyrite near the copper-bearing vein. This vein, being more siliceous, looks more promising, for as a rule the copper sulphide occurs in a greenish hornblendic rock in small patches along the oxidized seam and in decomposed spots, giving the impression that the mineral has been deposited from surface waters and therefore will not be found at any depth. The above-mentioned vein is fairly well defined, striking at N. 70° W., dipping 45 degrees to the north-east, and merits further work.

East of this vein about 100 feet and running toward it are two basic dykes cutting across another vein which has been open-cut below at an elevation of 1,600 feet, exposing a width of 2 feet of dark-green rock heavily mineralized with chalcopyrite. This vein runs N. 40° W. and stands about perpendicularly, and will therefore intersect the upper vein to the west of it. A sample across 16 inches of this copper ore gave assay returns of 7 per cent. copper and 3 oz. silver a ton. The rock next to the ore is quartz-stringered and shows a low copper content. No drifting has been done on this to open it up, but it looks as if some good shipping-ore could be sorted out of it. A tunnel at 1,450 feet elevation has been driven 125 feet toward getting under this showing, following the east dyke of the two mentioned above it. The vein runs to this dyke and there should be no difficulty finding it if it continues in depth.

There is a good mining equipment at the tunnel and work will be pushed ahead as soon as possible by the owners. This property has a good chance to develop into a producer and is ideally situated in every way. The tunnel is about 650 feet above the railroad, which solves the transportation problem.

ILLIANCE RIVER SECTION.*

Silver Bell.

This claim, owned by Al. Clary, Alice Arm, is situated on the south slope of McGrath mountain, to which there is a fair road from the beach. The showing at 600 feet elevation consists of a dioritic dyke or vein 15 feet wide, throughout which are stringers, bands, and bunches of quartz, carrying pyrite, arsenical iron, and some zinc-blende and galena. It has been opened up by an open-cut for 6 feet and continued in a tunnel across the vein for 12 feet farther. The vein strikes N. 15° E. and dips 55 to 60 degrees to the east. A sample was taken from a pile of ore on the dump which gave returns of: Silver, 0.6 oz.; lead, trace; zinc, 2.8 per cent. This is a big vein and further work would have to be done to draw any conclusions as to its possibility. The claim lies on comparatively flat bench; consequently any depth on the vein would have to be procured by sinking.

This group, consisting of five claims—*Lone Star No. 2*, *Clipper*, *Silver Standard No. 1*, and *Silver Standard No. 2*—is situated on the south side of McGrath mountain, adjoining the *Silver Bell* mineral claim and about three miles from the beach. The claims are owned by G. W. Morley *et al.*, of Alice Arm, B.C. At an elevation of 700 feet a tunnel has been driven across a 25-foot vein of grey quartz, in which are bands of pure white quartz running in all directions. The whole is considerably pyritized and also contains some arsenopyrite which apparently carries gold values in this particular section, the owners claiming as high as \$27 a ton in this ore. The vein has about the same strike as the *Silver Bell* vein below, but is a different vein. A grab sample from the dump gave only low values in gold and silver.

Just across a small creek from the tunnel is a formation of schistose argillites and slates carrying disseminated pyrite, and throughout it interlaced quartz stringers are mineralized with galena and zinc. No work has been done on it and the ore does not look to be of commercial grade on the surface, but from its general appearance some work is warranted. The schists are bedded on a strike of N. 30° E. and dip 75 degrees to the north-west.

Silver Band Group.

This group is situated on the north-east slope of McGrath mountain, about four hours' walk from the beach at Silver City townsite. There are four claims in the group, owned as follows: *Sunrise*, by A. Clary; *Silver Bands*, by G. W. Morley; *Lucky Strike*, by Hillier; and *Tip Top*, by J. Hutchison. On the *Sunrise* claim, at an elevation of 3,600 feet, several open-cuts have been made on as many veins of banded quartz and slate, the siliceous portion carrying mainly sphalerite or zinc-blende, with a trace of galena. The country-rock is slate, very hard and siliceous in places near the

* See Turnbull's report, 'Minister of Mines' Report, 1916.

vein, and so badly distorted and broken up that it is impossible to decide as to the continuity of the ore-shoot. At this elevation there are at least three croppings, varying in width from 2 to 10 feet, all badly oxidized on the surface; the enclosed slates seemingly altered to a soft, brownish, easily pulverized rock.

Farther south about 200 feet, on the *Silver Band* claim, a big showing of slate and quartz 30 feet in width has been exposed. The vein-filling here shows a banded or lenticular structure of oxidized material and quartz up to a foot thick, carrying zinc-blende and traces of galena, and long, narrow bands and kidneys of pure zinc-blende. I should judge the slate content would aggregate about half of the total width of 30 feet. This is a big showing, but cannot be traced on the surface any distance; the amount of work done is very small toward opening up or proving such an extensive showing. It would take a crosscut tunnel 500 or 600 feet long from the valley to get under the cropping, but which would give probably 300 feet in depth, with a good chance of cutting other veins; otherwise the showings would have to be sunk on.

Some 1,500 to 1,800 feet north of this showing, on the *Lucky Strike* claim, what is probably this same vein is cut by a deep gulch. An equal depth could be obtained at this end of the vein by a shorter tunnel, but it would be a much more difficult place to work. The elevation here is 3,750 feet, and the strike of the vein N. 50° W., about the same as the first showing described. A sample from this end of the vein gave 7.5 per cent. zinc, with only a trace each of silver and lead.

The property would have to be developed as a zinc proposition only, judging from the scarcity of galena and silver in the surface showings. The price of zinc since the war is over will very likely go down to pre-war prices; consequently the outlook for such a property is not very encouraging.

This group of four claims—*Standard*, *Standard No. 1*, *Standard No. 2*, and *Standard Group*, *Standard No. 3*—situated on the south side of McGrath mountain, is owned by Billy McLean, Olsen, and Donnelly. It is a short distance off the main trail going from the beach to the *Silver Band* group, which is the highest of the showings on McGrath mountain. On these claims, at an elevation of 2,800 feet, there is an open-cut along the side of the hill 60 feet in length, exposing a vein of quartz the full length of the cut. In the total distance I doubt if a 10-lb. piece of quartz could be broken from the ledge not showing zinc-blende. It is impossible to decide positively the strike of the vein, but to all appearances the open-cut is across or possibly a little diagonally across it. The quartz carries disseminated zinc-blende, bunches of zinc-blende, and bands of solid zinc-blende up to 2 feet thick. It is the biggest showing of zinc ore I have seen, and since there is no other mineral in the quartz but zinc sulphide, it is an ideal concentrating-ore. The ratio of concentration, I should judge, would be about 6 into 1. A sample from this cut of good-looking zinc ore taken for the purpose of getting the silver values gave returns of 48 per cent. zinc and 0.6 oz. silver a ton; it is therefore a straight zinc ore.

Lower down the hill, along a small creek, two or three open-cuts have been put in on a quartz ledge which may be the continuation of the other showing if the vein runs up and down the hill, but a parallel vein if the big one cuts diagonally into the hill. These lower showings look well for the amount of work done and show traces of galena. Conditions are perfect for opening up this vein—plenty of timber, splendid tunnel-sites, and transportation by tramway to the beach.

This claim is owned by W. Bradley and is situated on the trail to the *Standard* group. An open-cut along a small creek discloses a showing of quartz and calcite about 12 feet wide, of which 6 feet contains considerable slate, the whole filling carrying zinc-blende. The vein strikes north and south and dips very flatly at from 20 to 25 degrees to the east. Directly across the creek exactly the same mineralization lies higher up the hill, suggesting the faulting of the vein. The showing is not important, with zinc at a normal price.

This claim, owned by J. B. Adams, lies just across the creek from the *Kent* claim and contains what may be the extension of that vein. A tunnel has been driven 10 feet, showing a foot of quartz on the hanging-wall; then a mixture of quartz and slate to the black slate foot-wall. The ground is badly distorted. Some gold values are said to have been obtained in the quartz, and for such it might be worth more prospecting.

Ingraham's claims are situated about eleven miles up the Illiance river from tide-water, on the east side of the river and about 100 yards from the main trail. I did not get the names of the claims. A vein about 12 feet wide, of what appears to be an altered lime with quartz stringers through it has been exposed by an open-cut at an elevation of 2,100 feet. The country-rock is probably sedimentary. On the hanging-wall the quartz is more predominant and the mineralization, of stringers and bands of iron pyrite, heavier. The hanging-wall is not well defined, but appears to be on the schistose country-rock, with a small, separating stringer of decomposed quartz. The face of the open-cut is about 10 feet wide and 8 feet high. The surface is stripped for 30 feet back from the face, showing massive pyrites for a width of 4 feet. A sample of this gave only 0.02 oz. gold and 0.2 oz. silver a ton, and no copper. No sample was taken of the pyritized quartz, which may possibly be of better grade than the straight pyrite.

The United Metals Mining Company holds three claims—*Joplin*, *Silver Star*, and *Silver Horde*—situated fourteen miles up the Illiance river on the west bank. There is a good cabin on the property and three men were employed at the time of my examination. D. J. Hancock is in charge of operations. The main trail from the beach to the head of the Illiance river runs across the claims; the upper two miles is in poor condition.

Considerable work has been done on the property during this year; in fact, there had been comparatively little development done for the three or four years previous in which the property was worked. All exploration so far has been practically on the surface, as there is little chance to obtain much depth by tunnelling, as the rise up the bottom of the valley is gradual, and the gulch formed by the Illiance river is shallow along here so close to the head of the river. The showings are small quartz veins lying in the sedimentary country-rock, and for the most part conform with the general stratification in strike, N. 45° W., and dip. The ore-shoots appear to be long, narrow, lenticular-shaped deposits whose continuity in length and depth is very irregular. The general mineralization consists of galena and zinc-blende, carrying high values in silver. There are so many of these small veins that it should be profitable to work them, as several would be producing ore while others were being explored.

Just above the cabin a showing has been exposed by an open-cut and stripping for a length of 60 feet, showing from 6 to 18 inches of high-grade ore. A depth of about 40 feet can be secured under this showing by means of a drift-tunnel from the cabin flat, and should the ore extend to that depth will produce a considerable tonnage.

Farther north another kidney of ore has been disclosed and partially mined for a length of 80 feet, and probably 10 tons of ore sorted and sacked ready for shipment. Just west of this, along a small creek, another vein has been cut showing some ore, but is not being worked at present. North of the cabin about 100 yards another vein has been stripped in several places, showing ore which will be opened up later.

Along the west bank of the Illiance river, here a small creek, a 6-foot open-cut has exposed a nice showing of high-grade ore with a face 12 feet high. The greater part of this has been left in place and about 4 tons piled at the mouth of the cut. This pile was sampled, giving 11.5 per cent. lead and 160.6 oz. silver a ton. Just opposite this, on the east side of the creek, a flatter vein has been uncovered about 20 feet long by 8 feet in width, showing it to be small and frozen to the foot-wall. About 200 feet farther south on the river a cross-vein has been open-cut on each side of the river, showing about 8 inches wide of high-grade ore; a sample from small piles thrown out to be sorted gave 7 per cent. lead and 53.4 oz. silver a ton. This is the only cross-vein (strike north and south) seen so far and may be only a local swing or fold in the schistose formation.

A pile of about 20 tons of ore had been packed to the cabin from the different showings, from which a grab sample gave assays of: Silver, 123 oz.; lead, 15.5 per cent; zinc, 24 per cent.

Ore produced from this property or section will have to be packed to the beach on horses. The trail for the first eight or ten miles from the beach is in fair condition, except for grades (seemingly no regular grade was attempted), while the upper four to six miles will require considerable work in spots to put it in good condition for packing. I am informed that a contract has been let for packing out a guaranteed tonnage, and for this purpose a train of twenty pack-horses will be taken in in the spring. Another active season's work such as this should put this

property in good shape to maintain small, regular shipments of high-grade ore. The maintenance of a first class pack-trail is thoroughly warranted by the showings on the upper Illiance river.

This group consists of five claims, as follows: *Silver Bell* and *Sapphire*, owned by Joe Hayes, W. W. Moore, and Mrs. McGrath; *Top Notch*, owned by Mrs. McGrath and Joe Hayes; *Balmoral*, owned by W. J. Bradley; and *Lake View*, owned by Major Christie. Joe Hayes, of Alice Arm, B.C., has charge of the property. All five claims are included in bounding the property, but only the *Top Notch* and *Balmoral* were grouped for assessment purposes for the year.

There is a good cabin on the claims at an elevation of 3,200 feet. A lot of open-cutting and stripping has been done for assessments. On the *Silver Bell* claim there is an open-cut for 120 feet in length, following a small vein for the whole distance, which crops in bunches of high-grade ore. The strike of the vein is N. 45° W., following the general bedding strike of the schistose country-rock. On this property, as on that of the United Metals Company, very little depth has been obtained on any of the showings; consequently no conclusions can be drawn as to what the possibilities are at depth. It would be possible to procure a depth of about 100 feet by driving a crosscut tunnel from the main valley, on the east, into the hill. On the same claim, about 150 feet north of No. 1 open-cut, another cut has been run along another vein for 50 feet, with a strike of N. 60° W., showing the same character of vein as in No. 1 cut. The croppings of all these veins are a reddish-brown decomposed schist, the appearance probably caused by the oxidation of the pyrite disseminated in the schist adjoining the veins, the general schist formation carrying no pyrite. An open-cut has been run across this vein, about 30 feet from the end of No. 2 stripping, from a small gulch, giving a face 20 feet high on the vein and showing about 8 inches of ore. A further stripping, No. 3, then extends along the vein for 45 feet from the open-cut just mentioned to a cross-dyke of greenish dioritic rock about 20 feet in width. There is a fair cropping of ore along this stripping, of from 4 to 12 inches in width, of quartz carrying galena and pyrite. A sample knocked off along this ridge of ore gave returns as follows: Silver, 12.4 oz.; lead, 1.5 per cent.; zinc, 5.4 per cent.; showing that a concentrate of lead would make a very high-grade ore if the silver were all contained in the galena. Very little grey-copper was noticed in the ore along here.

Two hundred feet north of the north end of No. 3 stripping, and evidently the continuation of the same vein, an open-cut and stripping, No. 4, has been made for a length of 60 feet. This work has disclosed a vein 4 feet wide, consisting of small veins of quartz mineralized with galena, chalcopyrite, grey-copper, and possibly a little argentite, on either side of a finely laminated, more or less oxidized schist. This showing is an improvement over No. 3, in that the width of the showing admits of more possibilities. The strike of this portion of the vein is N. 30° W. and the dip vertical. In places there are small quartz veins within the enclosed schists in the vein, making the showing well worth obtaining depth on. It would be necessary to run a long open-cut or a tunnel to obtain any depth here, as the surface water, since the showing is in the bed of a gulch, would make sinking impossible for prospector's work. An open-cut from No. 3 stripping would give approximately 40 feet in depth. A sample was taken by knocking off pieces of quartz here and there all along the showing, and represents probably an average width of 18 inches of ore. The sample assayed: Silver, 49.5 oz. a ton; lead, 8 per cent.; copper, 5.6 per cent. An excellent grade of shipping-ore could be hand-sorted from this, and a small mill would produce a very high-grade concentrate.

On the *Sapphire* claim an open-cut and stripping, No. 5, elevation 3,575 feet, about 80 feet long, exposes a capping of yellow oxidized schists, tufaceous in appearance, with a few croppings of ore here and there. The work is not sufficient to show anything of importance. The vein strikes at N. 45° W. Extending for 200 feet or more north of No. 5 cut are a number of cuts put in to trace the vein through, but the formation is badly distorted and the general strike of the formation is more to the west.

West of the open-cuts just mentioned, about 75 feet, is a strong outcropping, striking N. 30° W., which has only been exposed in a couple of small open-cuts about 50 feet apart, and which joins another outcropping, exposed in a big knob, about 30 feet farther north at an elevation of 3,625 feet. At this point, No. 6 stripping, it has been crosscut for 12 feet, showing a good rib of ore about 2 feet wide in the centre and several smaller veins protruding through the oxidized schists for a width of 30 feet. This showing suggests that the two veins, more or less traceable all the way up the valley, have come together here in a broken-up, twisted area. An

open-cut about 100 feet north of the junction of the vein exposes the extension of the vein at an elevation of 3,650 feet, the last work on the *Sapphire* claim. A sample taken from a small pile of ore gave assays of: Silver, 17.5 oz. a ton; copper, 3 per cent.; lead, 4.5 per cent.

Continuing north on to the *Top Notch* claim, extensive open-cutting and stripping has been done for a length of 100 feet, the cuts in places being 12 feet in depth and 12 feet wide. This work traces a vein along a greenish-coloured dyke about 20 feet wide running with the formation at N. 50° W. The dyke is very persistent and can be seen 1,000 feet away. There are a few separated croppings of ore showing in this cut, but nothing important. A sample of ore taken from the cuts gave: Silver, 6.6 oz. a ton; lead, 6.5 per cent. About 100 feet more stripping has been done farther north on the *Top Notch* claim, but there is nothing important showing.

Just south of and about 150 feet west of No. 6 showing an open-cut has been put in on a brown, oxidized-looking rock for a width of 30 feet, in which are found small bunches of chalcopryrite. The same cropping can be traced down the hill, but this is the only place it has been broken into. A sample of the rock gave: Copper, trace; silver, 0.8 oz. a ton; and a test for manganese, which its appearance suggested, gave 3.5 per cent.

Judging from the number of ore-showings, their size, and the grade of the ore, there are reasons to believe that a sufficient number of these showings could be opened up and enough ore extracted to furnish a small concentrator, or be hand-sorted to a shipping-grade and the property made profitable.

Glacier. This claim, belonging to Mrs. Bromley, is situated about a mile over the divide on the Nass River side, on the west side of a small creek running from the summit into the Tchitina river, which flows into the Nass river. There is a tunnel about 12 feet long driven on the vein and two open-cuts just above the tunnel. The vein is quartz and slate, slightly pyritized, with from 4 to 12 inches of ore on the foot-wall, of the characteristic high-grade ore of this section. The formation here is a chloritic schist, probably overlain by igneous rocks, judging from the amount of such in the creek-bed. Lack of transportation makes the showing unimportant.

Yankee Boy. This claim, owned by R. Y. Ingraham, lies just opposite the *Glacier* claim across the creek, and doubtless contains the same vein. I did not know of the claim or showing when there; consequently did not see it.

Monarch Group. This group, consisting of the *Monarch* and *Monarch No. 2* mineral claims, staked by J. E. Stark and J. E. Juggins, is situated about 200 feet above Summit lake on its east side. Work done on the claims consists of surface cuts and a tunnel driven to get under these showings. The open-cuts, at an elevation of 3,850 feet, disclose a rather fine show of ore. About 30 feet south of and above the tunnel an open-cut 6 feet deep in places and about 100 feet in length uncovers the vein for that distance, running east and west; then turns at right angles and follows the vein north for over 200 feet. The vein lies in a schistose, volcanic tuff, and consists of silicified country-rock and quartz with a little calcite, heavily mineralized in places with pyrite, chalcopryrite, chalcocite, with a little galena and zinc-blende. The tunnel, at an elevation of 3,750 feet, or 100 feet under the croppings, has been driven a distance of 162 feet on a bearing of east and west, then turns to the left for 24 feet, making a total of 186 feet, which should have cut the ore-body if it went down on the strike and dip indicated on the surface. There is no sign of ore in the tunnel. It is rather surprising for one to go into the tunnel from such a strong, well-mineralized surface showing and find no trace of it, although comparatively only a few feet beneath it. I would certainly continue the tunnel east and west far enough to convince myself that a flattening of the dip of the vein was not the cause of missing it. A grab sample was taken from the broken ore on the surface, giving returns of: Gold, trace; silver, 8 oz. a ton; copper, 8 per cent.; zinc, 6.7 per cent.; lead, trace.

This is an excellent surface showing, and if it could be picked up as good on the tunnel-level would make a very promising property.

Group. This group, staked by Juggins & Jones, consists of two claims—the *Silver Star* and *Silver Star Extension*. The claims are situated on the east side of the Illiance river, opposite the property of the United Metals Company, and about a mile from the United Metals cabin, from which there is a good trail.

Silver Star A crosscut tunnel 42 feet long has been run to the vein from a deep gulch. The vein where encountered by the tunnel shows about an inch of galena. It was then drifted on for 14 feet, giving a greatest width of ore of 8 inches, and pinching out entirely in the face, where the walls

are badly distorted and show considerable movement. The rock formation is a clayey schist. The ore may be expected to appear again in the drift when the crushed zone is passed, and therefore the tunnel should be extended. About 40 feet south of the tunnel-mouth the vein crops in the wall of the gulch, on which about 12 feet of an open-cut has been run, showing from 2 to 6 inches of solid galena and grey-copper. The vein strikes at N. 50° W. and dips at about 45 degrees to the west.

I fail to see why the tunnel was not started on the vein and run as a drift for 42 feet instead of that amount of dead-work done in crosscutting. A sample taken from the ore in the open-cut assayed: Silver, 170 oz. a ton; lead, 25.2 per cent. This would be the shipping grade of ore, as the sample was taken of the best.

The showing is small for a company to operate, but would make a good leasing proposition for three or four men who would mine and ship the ore themselves.

This group has four claims in it—*Silver Cliff No. 1*, *Silver Cliff No. 2*, *Silver Cliff No. 3*, and *Beaver*—owned by Hauber & Hallett, of Alice Arm. They are situated on the east side of the Illiance river, opposite the United Metals

Company holdings, at an elevation of 3,800 feet. The showing is a small quartz vein about 8 inches wide, lying a decomposed, schistose tuff, and slightly mineralized with chalcopryite and trace of argentite. Very little work has been done. A sample of the quartz gave: Gold, trace; silver, 6 oz. a ton; copper, 0.6 per cent. The vein is frozen tight on both walls and does not give much promise of improvement.

On the *Silver Cliff No. 1* there is a cropping, 6 feet wide, of barite carrying a small amount of chalcopryite, and which has been opened up by an open-cut 15 feet wide, exposing a face 6 feet high. This vein has been exposed in several places above.

On *Silver Cliff No. 2* claim there is an immense outcrop, about 60 feet wide, of white, barren-looking quartz. It has been broken into in only one place, showing no mineralization and carrying no values.

PORTLAND CANAL MINING DIVISION.*

The general condition of the mining industry in this Division has been marked by a steady improvement throughout the year. Predictions of a year ago have been and are being fulfilled and new ones made for the future.

Development-work has placed one property on the shipping-list, which, I think, will become probably a large silver-gold producer within a year or two. Exploratory work during the year has been highly satisfactory on at least three properties, which give every reason for expecting them to develop into producing mines. Prospecting-work on claims held for some time, done by the owners, and which is the most important development-work of all and the best indication of mining conditions in any district, has disclosed some very fine showings of ore in all parts of the Division. Prospecting has resulted in several new "finds." There is considerable open ground yet for the prospector, and a lot more that would be open if the "claim-fiend" staked only what he could explore.

The outlook for mining for the coming year is exceptionally good, because the properties that are under development are showing up so satisfactorily that mining operators are being attracted to this district and are taking over prospects to develop. The greatest benefit this Division could receive, right now, is a good dock, located at Stewart, B.C., to meet the requirements of both the Salmon and Bear River valleys.

For convenience the Division will be subdivided into three sections, as follows: Portland Canal Mining Division—Portland Canal Section; Bear River Section; Salmon River Section.

PORTLAND CANAL SECTION.

This group consists of eight claims—*Elsie*, *Tunnel Fraction*, *Copper King*, *Outsider Group*, *Regina*, *Hope*, *Brown*, *Summit*, and *Constance Fraction*—situated at Maple bay, which is about thirty-five miles from Stewart. This is the old Brown-Alaska property which was equipped in 1916 with an aerial tramway from the mine to the beach, where commodious ore-bunkers and a good freight-dock were built. It was operated for a couple of years, shipping several thousand tons of copper ore, averaging about 2.8 per cent. copper, to the Hadley smelter.

* Memoir 32, Dominion Geological Survey, by R. G. McConnell.

The present owners, Martin Woldson and associates, of Spokane, Wash., with Andrew Sostad in charge of operations at the property, have been operating now for over a year. During this time they have driven a working-tunnel, at an elevation of 912 feet above sea-level, a distance of about 750 feet, gaining a depth of 173 feet below the old working-tunnel from which the ore shipped was extracted. This year's work consists of 351 feet of driving on the foot-wall, with five crosscuts from it across the vein aggregating 114 feet, which work has developed an ore-shoot over 200 feet long and averaging about 16 feet in width. At the time of my examination of the property two crosscuts had been driven; the first showed the vein to be 14 feet wide of quartz mineralized with pyrrhotite and chalcopyrite, with 2 feet of it on the hanging-wall of about 5-per-cent. copper ore; the whole, judging by eye, would average approximately 2 per cent. copper. The second crosscut, 50 feet farther in the tunnel, proved the vein to be 19 feet wide of the same grade of ore. The vein strikes at N. 10° E., and dipping at from 55 to 60 degrees to the east, will give backs of approximately 200 feet to the level above, which will produce a big tonnage of milling-ore from this ore-shoot alone between these two levels.

The "West tunnel," at an elevation of 1,190 feet, 105 feet above the old tunnel and 278 feet above the present working-tunnel, crosscuts to the vein from the surface. Drifts have been run both ways on the vein, showing an ore-shoot 250 feet long, averaging between 5 and 6 feet in width. This is another ore-shoot north of the old one from which the ore was mined in early days, and now being opened up by the level below.

The old "main tunnel" was driven under this north ore-shoot on the 1,085-foot level, but apparently the ore does not extend down that distance; however, a raise will be put up from that level to tap it, for it will no doubt also produce a big tonnage of milling-ore.

At an elevation of 2,100 feet, about 900 feet above the "West tunnel," there is a very strong outcropping of the same class of ore. It has been broken into in several places and stripped along the surface for 300 feet or more, showing a width up to 30 feet and averaging between 8 and 10 feet. This is evidently another vein east of the one on which the workings are, lower down. The ore is a decomposed, honeycombed quartz on the surface, but when broken into shows the same content of pyrrhotite and chalcopyrite as the other vein.

These veins appear to be contained in a belt of sedimentary rocks, more or less altered, enclosed in the main Coast granites. The higher showing just mentioned could easily be opened up and the ore trammed down to the upper terminal of the aerial tram from the main tunnel to the bunkers on the beach. No sampling was done for the reason that a grab sample here and there would be of no use, and I had no time for a thorough systematic sampling necessary on such a property.

A very efficient small plant was installed early in the spring, consisting of a compressor building and two 9 x 8-inch straight-line Ingersoll-Rand compressors, set on separate heavy-timber foundations, and each driven by a 24-inch Pelton-Doble water-wheel. About 1,300 feet of 5-inch water-line was laid, giving a 300-foot head at the water-wheel. The compressors, discharging into a common air receiver, maintain a pressure of 107 lb. at the machine, from which two Leyner hammer-drills are operated. It has been a very satisfactory little plant for the work for which it is intended.

It is evident that, unless very favourable smelter rates can be procured for this low-grade siliceous ore, concentration will be necessary. The ore, being a straight quartz and sulphide mixture, should make an ideal flotation-feed, and I should judge the ratio of concentration would be about 10 or 12 into 1. The old equipment is in bad condition, but practically all the ironwork, tram-cables, etc., could be salvaged and used again.

There is a supply of timber for all purposes and plenty of water for milling and possibly power. The property is very advantageously situated on tide-water.

This group consists of the following claims: *Scottish Chief, Portland, Blue Bell, Maple Leaf, Copper Queen, Lizzie, Scotland-for-Ever Fraction, Anaconda, Princess Alexandria, Thistle, Comstock, Princess May, Maple Bay Fraction, Comstock Fraction, Princess Royal Fraction, Princess Victoria, Princess Alice, Princess Maud, Eagle, May Queen, Star, and Rose.* They are situated at Maple bay, on Portland canal, about thirty-five miles from Stewart, adjoining the *Outsider* group on the south. The Granby Consolidated Company, which had a bond on this group, put in a power plant on the beach and a tramway from the beach to the tunnel, which it drove on the *Star* claim. This

work (exact amount not available) is done on the extension of the *Outsider* group vein, but, failing to develop a satisfactory ore-shoot, the option was thrown up and the plant dismantled.

Owing to the lateness of the season when I examined this section, I was unable to get over the higher showings on this property. However, from reliable maps and private reports I have gained some information which may be of interest. On the *Eagle* and *May Queen* claims a vein has been traced the full length of the claims, showing a width up to 45 feet. At an elevation of 2,300 feet a tunnel was driven 25 feet across the ore-body and a drift of 60 feet run on a strip of country-rock enclosed in the vein. Six samples from the 25-foot crosscut assayed from 1 to 3.5 per cent. copper. At the end line of the *May Queen* and *Eagle* there is 6½ feet of massive sulphides; 3 feet 3 inches from the foot-wall assaying 7.28 per cent. copper, and 3 feet 3 inches on the hanging-wall assaying 4.6 per cent. copper. About 300 feet farther along, at an elevation of 3,200 feet, the outcrop is 12 feet wide, averaging 2.7 per cent. copper. Five hundred feet farther along is an exposure 6 feet in width of solid sulphides.

At the intersection of the *Princess Alexandria* and the *Princess May* claims, at an elevation of 2,400 feet, there is an outcropping traced for 2,000 feet by open-cuts, and can be followed on the surface another 1,500 feet. A cross-vein from the *Anaconda* claim connects with this at an elevation of about 3,000 feet. The *Princess* vein will average lower grade than the *Eagle* vein. On the *Anaconda* there are two veins, the one mentioned as joining the *Princess* vein and a small, irregular, parallel one. The former averages about 2.4 per cent. copper for a width of 8½ feet.

On the *Thistle* claim another vein can be traced for 1,000 feet. A cut across the south end exposes it for a width of 17 feet; an average assay of three samples across it gave 3.4 per cent. copper. In the middle of this vein there is 5 feet 8 inches of ore assaying 8.2 per cent. copper.

On the *Blue Bell* claim two veins are exposed, striking N. 10° E. and dipping 45 degrees to the East. These extend along the face of a steep cliff and are from 1 to 3 feet wide, showing some good-grade copper ore. A tunnel was driven under them for a length of 360 feet, but failed to pick up the ore at depth.

Taking these showings altogether, their persistence, and average values in copper—there are no gold or silver values—there are good reasons to believe that further exploration will develop not only a tonnage of milling-grade ore, but probably shoots of shipping-ore. The property is most conveniently situated on tide-water. I expect to make an examination of these showings as early in the spring as conditions will permit.

At Swamp point the Granby Consolidated Company has several claims from which they obtain the limestone for fluxing purposes. The property is well equipped and employs about thirty men the year round, under the superintendence of Roy Price. The production is about 250 tons of lime rock a day, which is hauled to the smelter in company scows.

This group, consisting of eight claims—*John D.*, *Guggenheim*, *J. P. Morgan*, *Danny*, *Lookout*, *Summit*, *Charlotte*, and *Hillside*—is owned by the Georgia River Mining Company, whose registered office is in Duncan, B.C. and under the management of C. H. Dickie. Referring to the Minister of Mines' Reports

for 1914, 1916, and 1917, there is no need of going into details of the property, and note will be made of only the work done and results obtained during the year.

The winze, which was down 35 feet, was continued to a depth of 42 feet. In the sinking of this winze the ore was left on the west side of it at about 22 feet from the top, following a small stringer from the east side to the bottom at 35 feet. This year the ore was again broken into and followed for 7 feet down. It was found to be 2 feet in width, about half quartz, and the balance the typical pyrrhotite of the property, a sample of it assaying 2.28 oz. gold and 3.74 oz. silver a ton. The *Bulletin* tunnel was extended 20 feet and a crosscut driven from the end of it 35 feet west toward the "Big Showing." There is no ore showing in the face of the tunnel nor in the crosscut.

The Department of Mines assisted in extending the trail up the Georgia river towards the property. The repairs and improvements on the old portion of the trail were heavier than anticipated; consequently the amount provided for new trail was not sufficient to complete it through to the mine, although the most difficult portion is over. There are about three miles yet to build.

More settled conditions will no doubt permit of the equipment and further development of this property for production.

The Marmot river has had very little mining activity of any kind and was not examined this year. I am informed that there are a couple of properties that might get out a small tonnage for shipment if trail conditions were improved.

BEAR RIVER SECTION.*

This group of four claims—*Somme Fraction*, *Molly Fraction*, *Gulch Fraction*, and *Molly B.*—is situated on the east side of Bear river about half a mile from tide-water, just across the river from the town of Stewart. The claims are owned by J. W. Stewart, of Victoria, B.C., and associates. Part of the claims are on Indian reserve, but I believe arrangements have been made whereby the Indian owners are to be paid a 10-per-cent. royalty on the net proceeds of ore mined from the reserve.

The rock formation appears to be an altered greenstone, and in places a brownish, schistose-appearing rock resembling tuff. It is very close to the main granite range, and the mountain-side along here is full of isolated tongues of granite intruding through the general greenstone formation.

The showing consists of a vein, running N. 60° E. and dipping 60 degrees to the north, of about 10 feet in width, of quartz with which are associated garnetiferous silicates, epidote, and enclosures of a dark-green rock, probably hornblende, the whole suggesting a vein of contact metamorphic origin. It has been exposed by an open-cut at the edge of the river and a stripping of about 20 feet above to another small cut. The prominent mineralization is pyrite, with scattered chalcopyrite and molybdenite, the latter mainly contained in the greenish hornblende rock, although it is more or less disseminated throughout the whole vein. It is a strong well-defined-looking ledge and should prove continuous, though it has not been traced any distance owing to the heavy overburden on the hill above, nor has sufficient work been done to form any opinion regarding it.

Without sampling, I would size the vein up to average about 2 per cent. molybdenite. There is about 5 tons piled on the dump, a sample of which was sent to Seattle dealers, who gave returns of 9 per cent. MoS₂, and for which a flat rate was offered of \$117 a ton f.o.b. Stewart dock. On the whole, it is a good showing, well located for transportation, and having all the natural advantages of timber, water, and of being easily developed by tunnels. It is worth investigating for molybdenum, and, I understand, can be bought on reasonable terms.

This group consists of nine claims—*Prince John No. 1* to *No. 9*, inclusive—owned by James Nesbitt and Andy Archie, of Stewart, B.C. The claims are situated on the west bank of Bear river about five miles above Stewart, on the opposite side of the river from the Portland Canal Short Line Railway. The work on the property consists of surface cuts, a crosscut tunnel, and some diamond-drilling done by the Granby Company, which had the property under option last winter. The tunnel, at an elevation of 2,350 feet, shows a cross-section as follows: From the mouth of the tunnel there is 30 feet of greenstone-schists to the ore-body; then 45 feet of schistose, slates, and argillites mineralized with chalcopyrite, disseminated throughout the slates and in narrow bands, veinlets, and small lenticular bunches lying in the bedding-planes and cross-fractures; beyond the mineralized zone is an acidic dyke 45 feet wide; then a width of 65 feet of slate and argillites to the face of the tunnel, slightly mineralized with chalcopyrite, but not of sufficient value for milling purposes, although further work by way of drifting should be done in this portion to further prove the grade of the ore. In the 45 feet of "vein" there are portions of a few feet in several places showing good copper ore, while the balance is more sparingly mineralized. Reliable samples across the ore-zone have given an average of 2 per cent. copper and \$1 in gold and silver a ton.

The diamond-drilling by the Granby Company, I am told, was so unsatisfactory owing to the soft slips and fractures in the formation that it was abandoned, and the tunnel driven through the dyke and the portion beyond. The open-cuts on the surface expose the same conditions as shown in the tunnel. On account of the snow I was unable to get over the surface to any extent. Some free gold has been found farther south on the claims in small quartz veins.

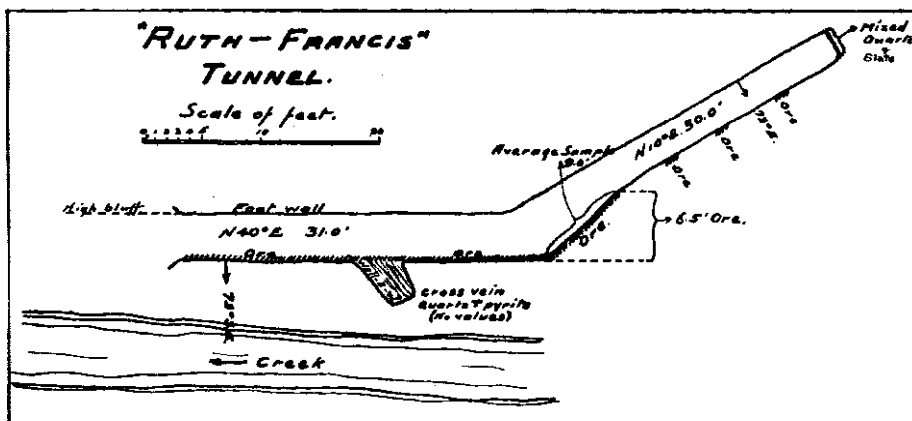
The property is very advantageously situated from a mining and transportation standpoint, and, judging from the general appearance of all the showings, I think that insufficient explora-

* Memoir 32, Dominion Geological Survey, by R. G. McConnell.

tion has been done to be conclusive as to the merits of the property. While it might not meet the requirements of the Granby Company, the ore is so well adapted to flotation that it might become a profitable concentrating enterprise.

This group, consisting of four claims—*Mayflower*, *Trade Dollar*, *Kitty*, and *Mayflower Group*. *Blaine*—owned by H. P. Gibson, of Stewart, is situated about 1,000 feet above the Bear river on the east side, between Glacier and Bitter creeks. Along a small creek three or four veins of quartz and argillite, carrying pyrite, a little chalcopyrite, blende, and galena, are exposed in an argillite country-rock, termed the "Bitter Creek formation" by McConnell. A little work has been done by way of stripping and open-cutting, and a crosscut tunnel of 20 feet, with a further drift of 6 feet on one of the veins exposed on the surface. The drift will have to be advanced about 40 feet to get under the surface showing, which consists of a vein, about 4 feet wide, of quartz and argillite. This is a fair showing and deserving of the continuation of the drift to get under it, further work depending on the results obtained. A few tons of ore, running about \$60 a ton in gold values, was taken from a small vein lower down the hill, showing that there are good values in the vein. There is a good foot-trail from the railroad to the property and there would be no difficulty in getting ore down.

This group is owned by Nesbitt & Archie, who also own the *Prince John* group. *Ruth and Francis Group*. *Johnny*—situated on the North fork of Glacier creek, four miles from the railway. There is a fair pack-trail to the property from the Bear River valley, with the exception of a few bad places that could be repaired in the event of steady packing. There is a small cabin on the property at an elevation of 3,440 feet and an abundance of timber and water for all purposes.



On the *Ruth* claim a tunnel (see sketch) has been driven 61 feet, following the hanging-wall, which strikes N. 40° E. for 31 feet; then turns to the left on a bearing of N. 10° E. for 30 feet to the face, following the foot-wall. This portion of the vein is a mixture of pyritized quartz and slate, carrying no values. At a point 16 feet in the tunnel a cross-vein of quartz and slate breaks from the main vein on a strike of due east and west, and on which a short drift has been run, showing no values. At 31 feet in the tunnel, where it turns to the left, there is a face of solid antimonial lead on the right-hand side, across which for a width of 6½ feet (or 9 feet diagonally) a chipped sample was taken, assaying: Gold, 40 cents; silver, 31.6 oz. a ton; lead, 15 per cent.; zinc, 18 per cent.; antimony, 8.3 per cent. Shots were put into this ore-body at intervals to the face of the tunnel, breaking into the antimonial lead in each case. The ore has been broken into for only a foot or two in the face where it was first encountered, and it would be interesting to know whether the hanging-wall goes ahead at the same strike as shown so far with the ore following it, or whether there is a swing in the hanging-wall conforming with the turn in the foot-wall to N. 10° E. There is a small seam of ore from the mouth of the tunnel on the hanging-wall all the way. At no place on the surface, so far as can be seen, is there more than 6 inches of solid ore.

About 200 feet farther south and 60 feet vertically lower another tunnel has been driven 25 feet on the same vein, here showing a width of 6 feet of mixed quartz and slate, in which there is a little pyrite and galena.

About 25 feet south of the mouth of the main tunnel another cross-vein runs N. 60° W., lying on the south side of the 2-foot basic dyke. A small open-cut has been put in on this, showing the typical quartz and slate filling of 4 feet in width, in which are small values.

About 15 feet east of the main vein at the mouth of the upper tunnel another vein crops in the bed of the creek, showing a width of 6 feet of quartz and slate running parallel with the opened-up vein. No work has been done on it and the values are not known. The country-rock is, for the greater part, blocky argillites and slates, though there are areas showing a fine slaty cleavage.

There is a vein of copper ore on the *Copper King* claim, consisting of quartz and calcite carrying chalcopyrite, from which some very good samples of ore were shown. It has been prospected by an open-cut which I was unable to see on account of the snow. A tunnel has been driven 40 feet toward it and will require a further 30 feet to get under the cropping. The property gives a very favourable impression, and, I think, merits pretty thorough exploration.

This group consists of four claims—*Copper King*, *Copper King Fraction*, *Copper King* Group. *Copper King No. 2*, and *Copper King No. 3*—and is owned by G. M. Brown. It lies east of and adjoining the *Ruth and Francis* group. I am informed

that the showing is much the same as that on the *Copper King*, of the *Ruth and Francis* group. The work done consists of open-cutting, which I was unable to examine. The vein is said to be about 10 feet wide, heavily pyritized in places, and to carry up to \$10 a ton in gold.

This group, consisting of two claims—*Sunshine* and *Sunshine No. 1*—belongs *Sunshine Group.* to Fred. Young and Godfrey Anderson, and is situated beyond the *Copper King* group, on the main trail. The owners mined from the surface and sorted out about 3 tons of ore during the summer, a sample of which was sent to the smelter, and assayed: Silver, 349.4 oz. a ton; lead, 17.1 per cent.; zinc, 27.1 per cent. It was not shipped because, for some reason, the smelters refused to accept that grade of silver ore containing such a high percentage of zinc.

This group of four claims—*Lakeview No. 1*, *Lakeview No. 2*, *Lakeview No. 3*, *Lakeview Group.* and *Silver Bell Fraction*—is situated on the North fork of Glacier creek, on the *Ruth-Francis* trail, about two miles and a half from the railway. The claims are owned by James McKay and Charles Bibeau, who have done a large amount of exploration work on them. There is a good cabin near the workings at an elevation of 2,100 feet. A few tons of high-grade silver ore has been shipped each year by the owners for several years.

The vein, which strikes about east and west and dips 50 degrees to the south, can be traced for several hundred feet on the surface. At one of the croppings an open crosscut was run for 80 feet, obtaining a depth of about 12 feet on the vein. A drift was run 28 feet on the vein from the end of the crosscut, exposing a small rib of the high-grade silver ore sorted and shipped. The vein where cut by the open-cut shows a width of 9 feet, of which 4 feet on the foot-wall is principally quartz with some pyrite; the balance, 5 feet, is a very heavily pyritized quartz and slate. On the hanging-wall is a diabasic dyke about 2 feet wide, outside of which is a quartz-stringered slate for a foot or two, carrying pyrite. The heavily pyritized portion of the vein would concentrate about 3 into 1 and the quartz portion probably 10 or 12 into 1.

As stated in last year's Report, the property was then under bond to a local syndicate, who were driving a crosscut tunnel 100 feet vertically lower to undercut the surface exposure in the open-cut. The tunnel was driven 250 feet, which should have cut the vein, but, failing to do so, the option was thrown up.

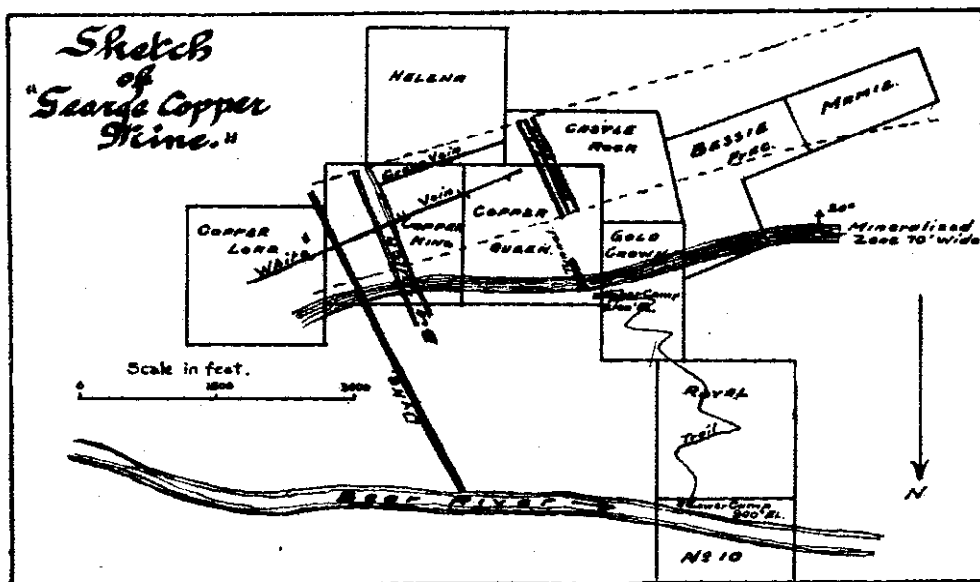
The property is therefore now in fine shape for further exploratory work, such as sinking on the vein to learn its dip and continuity at depth. When the irregularity is located, for there must be some reason for the non-extension of the vein downward, work in the lower tunnel can then be regulated accordingly. High gold values are found in the quartz and pyrite and also in the more solid pyrites. It is a property that I would have no hesitation in recommending for further prospecting, believing that by concentrating the ore it can be made profitable.

(See Minister of Mines' Report for 1917.) This property, situated on the south side of Bear river, six miles up from the terminus of the Portland Canal Short Line Railway at the *Red Cliff* mine, is owned by W. B. George, of Stewart, and R. George, of Vancouver. The group is comprised of ten claims—*Mamie*, *Bessie*, *Gold Crown*, *Copper King*, *Copper Queen*, *Copper Lord*, *Castle Rock*, *Helena*, *Royal*, and *Water Fall*. (See sketch of claims.)

At the foot of the mountain on which the claims are located Bear River valley has an elevation of 900 feet at the cabin. The upper camp on the claims is 2,100 feet elevation, to which there is a steep foot-trail. An appropriation was recommended by me and granted by the Mines Department to aid in the construction of a pack-trail from the cabin to the upper camp. Conditions this summer, however, were such that the owners could not put in the trail, but I am assured they will be in a position to do so the coming summer.

This year the tunnel was extended 10 feet, making a total length of 115 feet, into the big mineralized zone, showing a little improvement in its mineral contents.

On the "Blue vein" no work was done this year. It is comprised of three veins contained in a 50-foot mineralized belt, traceable for 1,000 feet or more, the veins aggregating 10 feet of ore, averaging: Gold, \$4; silver, 30 cents a ton; copper, 3 per cent.



The "White vein," traceable for 2,000 feet on the surface, was opened up this year in two more places by open-cuts, making five cuts or exposures on this vein. Just west of the "big gulch" is a showing of quartz and chalcopryite on the hanging-wall 18 inches wide, assaying: Gold, trace; silver, 0.4 oz. a ton; copper, 8.8 per cent.; the remaining 36 inches in the foot-wall assaying: Gold, \$1.20; silver, 0.4 oz. a ton; copper, 14 per cent. About 30 feet west of this it was exposed for a width of 9 feet 6 inches this year, of which 4 feet is magnetite carrying chalcopryite (no assays), 3 feet of fairly solid chalcopryite, and 2 feet 6 inches of quartz and chalcopryite; the last 5 feet 6 inches is estimated by W. B. George to average from 8 to 10 per cent. in copper. Another sample, about 350 feet west of the last, of 40 inches on the hanging-wall gave: Gold, trace; silver, 0.4 oz. a ton; copper, 1.6 per cent. About 10 feet farther west a sample across 36 inches on the foot-wall assayed: Gold, trace; silver, 0.4 oz. a ton; copper, 16 per cent. On this same vein, 200 feet east of the "Blue vein," a crosscut this year showed it to be 15 feet wide, of mixed ore, stringers of ore in country-rock, and it is thought that the full width has not yet been exposed.

No work was done on the "Green vein," which is about 50 feet south of and parallel to the "White vein." A sample last year across 5 feet gave assays of \$2 in gold and silver and 5 per cent. in copper.

The property appears to improve steadily with exploration, and with improved conditions should receive the more extensive investigation it is entitled to.

SALMON RIVER SECTION.*

This section continues to improve with exploration, and with one property shipping high-grade ore this winter and several others well on the way towards making producing mines, it may be considered as fairly well established and the steady growth of mining activities a certainty.

There is urgent need at the present time for adequate shipping facilities in the way of a dock, and the mining condition of this and the Bear River section should be sufficient guarantee for the future to justify the Dominion Government in building one. Then, with a good road from the upper Salmon river to tide-water at Hyder and a good road from there to the dock, this section would have good facilities for developing and mining on any scale. The upper Salmon river—that is, that portion in British Columbia above the Alaska-British Columbia boundary-line—is now reached from Stewart, at the head of Portland canal, by a trail along the beach from the old dock to Hyder, at the mouth of Salmon river, and from there up the valley by the Government trail.

There are at present hotel accommodations at Hyder, and I understand that the hotel at Stewart will be open for the coming year. Stewart is now reached by launch every week from Prince Rupert, but it is altogether likely that one of the larger boats will take the run in the spring.

A road was built last summer from Hyder to the *Bush* mine, sixteen miles up the valley. At 11-Mile there is a road-house run by "Dad" Davis, where a first-class bed can be had and A1 meals, for "Dad" is a good gardener and "some" cook. From this central point a big area of this section can be gone over. From 11-Mile the road is followed for about three miles, from which point a good horse-trail continues to the head of Salmon river and Cascade creek.

The most widely distributed rock formation in this section is greenstone, termed by McConnell the "Bear River formation," which borders on the north-eastern side of the Coast granites, practically all of which lie on the Alaska side until the Salmon River glacier is reached. The greenstones are badly sheared to a greenish schist in which are altered and silicified zones containing the majority of the known ore-bodies of this section.

The following properties were examined this year:—

International Group.	This group, consisting of eight claims— <i>Cabin, Group, Lucky, Daly, Grub Stake, Grub, Boundary, and International</i> —is owned by Pat Daly and associates. The claims are situated about two miles north-east of 11-Mile and just on the British Columbia side of the boundary-line. There is a good trail to the property branching off the old trail a few hundred feet above the boundary-line.
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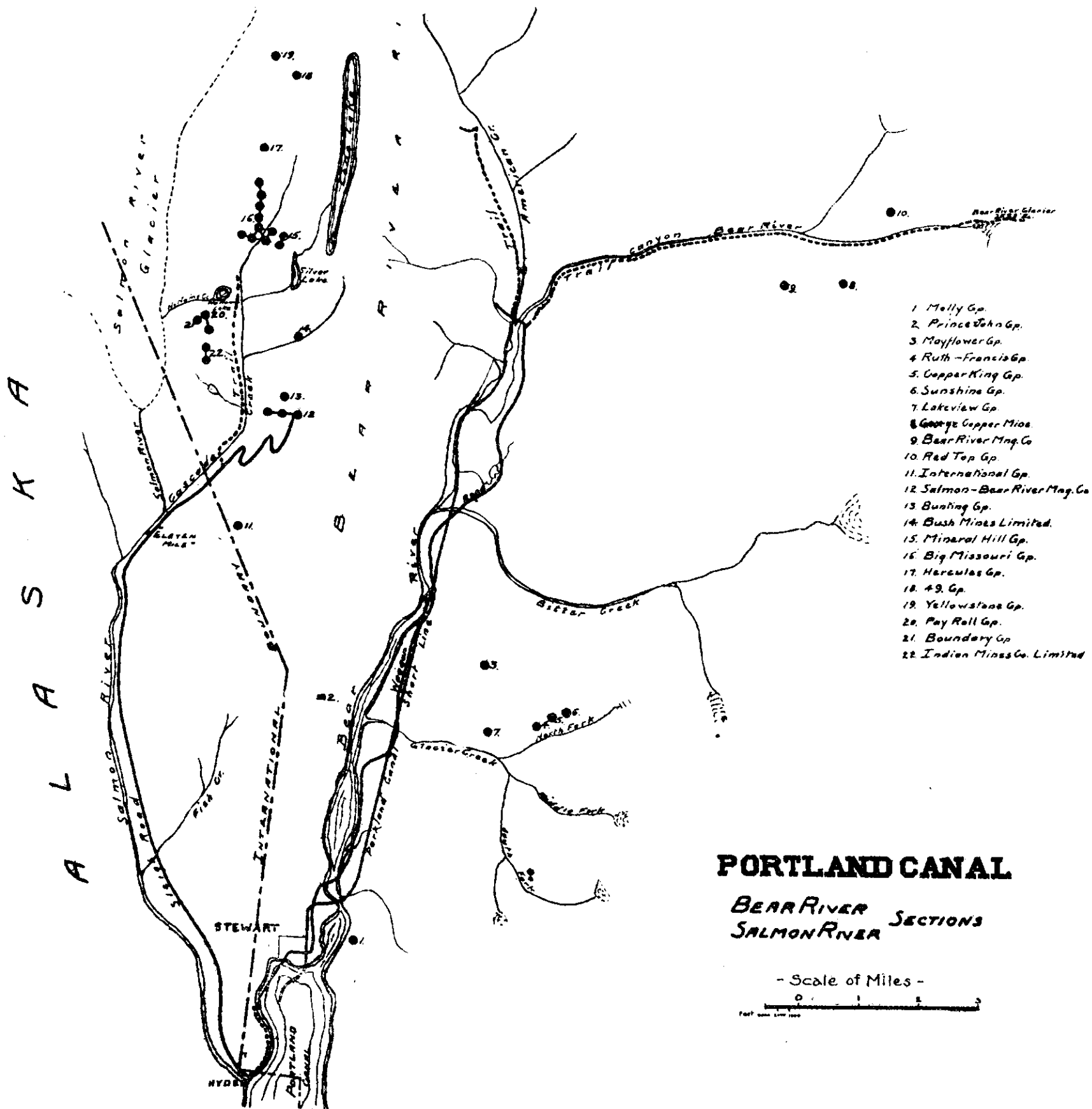
The showing consists of a band or vein of silicified greenstone, between 8 and 10 feet wide, lying in a dark-green schist. The vein dips 63 degrees to the west and has a strike of N. 20° E. Throughout the vein are small veins of pure quartz running in all directions, the whole filling mineralized with iron pyrites. As a general rule, in these veins the best values are carried in the purer quartz portions. This vein is cut by a small creek showing a face about 12 feet high on each side, and on the north side open-cuts traced the vein for some distance up the hill. Where exposed the vein will carry about \$3 or \$4 a ton unless silver sulphides are showing. The vein-filling is exactly the same as the *Bush* vein, and there is, of course, the possibility that shoots of high-grade ore will occur in this as in the *Bush* vein.

The showing is strong and well defined and there is no reason why it should not persist in length and depth. The property is well located and well supplied with necessary timber and water. Only exploration can prove whether or not there are deposits of commercial ore.

This company's holdings consist of eight mineral claims, as follows: *Essington, Rupert, Simpson, Pictou, Cascade Falls No. 4, Cascade Falls No. 8, Daly, River Mining Co. and Pat Fraction*, probably better known as the *Bush* property. The claims are located on the east side of Cascade creek, about sixteen miles from tide-water. They are all Crown-granted. During the year a winter road was built from the beach to the property and is being utilized this winter for hauling out ore. The management estimates that 1,000 tons or more of \$200 a ton ore can be shipped this winter. The road cost approxi-

* Memoir 32, by R. G. McConnell, Dominion Geological Survey.

† See 1917 Report.



mately \$45,000, of which a portion was appropriated by the Mines Department under the "Mineral Survey and Development Act." It is estimated that to convert it into a serviceable wagon-road will cost about an equal amount. In conjunction with the road a half-way house and barns were erected at 9-Mile for the accommodation of drivers and teams. Fourteen horses, with all necessary equipment, were taken in this fall, it being the intention to work three 4-horse teams on the level haul from 11-Mile to the beach, and several single teams on the hill from the mine to 11-Mile. Latest information is that several hundred tons has just been shipped by the steamer "Prince John" to Tacoma, Wash.

Three distinct veins were cut along the road-grade, the most southerly being the one on which all the development has been done. The other two, so far as known, do not show the high-grade ore of the other zone. There has been comparatively little work done underground this year because of lack of labour and the concentration on the sleigh-road construction. Since the last report the upper tunnel has been extended to a total length of 460 feet, about 130 feet for the year. At 330 feet from the portal a barren strip was encountered and cut through in 45 feet; from there to the face, a distance of 85 feet, the average values for the full width of the drift are phenomenal. The present face shows 2 feet of bonanza ore, and the balance, 3½ feet, is very high grade. The face is about 200 feet below the surface, and should this shoot continue through to the surface, persisting in length, width, and values, an estimation of its gross value is somewhat staggering. The main crosscut (No. 3) in this tunnel has been extended to 90 feet in length without encountering the wall. The average value of from \$50 to \$60 a ton has held all the way.

The appreciation of the importance of this property by mining men is beginning to be shown in the renewed interest in other properties in this section. With the reorganization of the company, no doubt progressive plans will be carried out which will place it as one of the leading producers of the Province.

This group, consisting of eight claims, lies west of the Salmon-Bear River
Bunting Group. Mining Company's ground, and probably contains the extension of the veins. No examination of the property was made by me. It is said that this group was under option to R. K. Neill and associates.

The Bush Mines, Limited, holdings consist of six claims—*Leslie, Leslie M., Leslie No. 2, Leslie No. 5, Leslie No. 6, and Mahood*—situated about half a mile above the forks of Cascade and Cooper creeks and about a mile north of the Salmon-Bear River property. Unfortunately, I was unable to find the property when in this section last fall without any one who knew its location.

A company has been organized by the owner, O. Bush, with a capitalization of \$1,000,000. Stock is being offered to the public at 20 cents a share under the statement that "the vein appears to be a continuation of the same vein now being worked by R. K. Neill on the Salmon-Bear River property." In this case "appearances" are decidedly deceptive, as the Salmon-Bear River vein has a strike of N. 80° E., and therefore could not, without undergoing probably fatal contortions, get near the showing of the Bush Mines, Limited.

This group consists of four claims—the *Joker, Mystery Fraction, Mineral Hill,*
Mineral Hill and *Midas*—situated east of and adjoining the *Laura* and *E Pluribus* claims
Group. of the *Big Missouri* group and about twenty miles from tide-water. The claims were owned by Bob Martin and Dr. Carter and are now under option to Welsh, Fetter, Carlton, and associates, of Seattle. They have carried on active exploratory work since early in the spring and will continue all winter.

The property, under the able superintendence of Al. Harris, has had a large amount of work done on it; comfortable camp buildings have been erected at an elevation of 2,650 feet, the lumber being packed in on horses from the beach; numerous open-cuts have been put in on the cappings and a tunnel is being driven. Some very high-grade ore has been exposed on the surface, and the tunnel is for the purpose of obtaining depth under these. At the time I was on the property, about the middle of October, 219 feet of tunnel had been driven through an altered, pyritized greenstone, crossing several small quartz veins carrying values up to \$12 a ton. A crosscut was started north from the face of this tunnel and has encountered, it is said, some fair ore. Also the tunnel has since been extended with very satisfactory results. From all indications there is every reason to believe that this property will develop into an important producer of high-grade silver ore.

This group is comprised of sixteen full claims and four fractions, owned by **Big Missouri Group.** Dan and Andrew Lindeborg and the Stevenson and Proudfoot estates. The claims are situated twenty miles from tide-water, east of the Salmon River glacier, and are reached by a good horse-trail from the Salmon-Bear River road. The property has been described in several of the Minister of Mines' Reports (1917), and as nothing new has developed on the ore-bodies reported on I will not refer to them here. The new work done this year on an entirely new ore-body has given the property a different standing altogether, for while the old workings exposed an immense body of low-grade complex ore, the new work referred to has disclosed extensive bodies of high-grade silver ore.

The work consists of fifteen or more open-cuts on the *E Pluribus* claim adjoining the *Mystery Fraction* and the *Mineral Hill* claim of the *Mineral Hill* group, which have demonstrated the continuation of the high-grade ore-shoots on the *E Pluribus* ground. These cuts are from 6 to 40 feet in length, and I am reliably informed that the ore exposed contains in places silver and gold values of over \$100 a ton for a width of 20 feet. I did not attempt to sample these cuts, but I know from the appearance of the ore that the majority of them show a milling-grade ore at least, and several of them high-grade ore. A sample taken across 10 feet of good-looking ore in one cut gave assays of 115.6 oz. silver a ton.

The property is under option to D. D. Mann, who plans to commence operations on a comprehensive scale as soon in the spring as conditions will permit. I am reliably informed that diamond-drilling will be used for exploratory work.

Should this portion of the property develop satisfactorily, the immense low-grade ore-bodies will doubtless be exhaustively examined and experimented with until a successful process of concentration is devised. The success of this property will mean the immediate success of this whole upper Salmon River valley.

This group of three claims—*Yellowstone*, *Butte*, and *Old Timer*—owned by **Yellowstone Group.** Bill Murphy and the Stevenson estate, is situated north of the Hercules Mining Company's holdings, which adjoin the *Big Missouri* ground on the north. The required assessment-work was done for the year, showing up some of the best grade of ore yet found.

The Hercules Mining Company claims are north of and adjoining the **Hercules.** *Missouri* and are crown-granted. No work has been done for several years.

This group has two claims—the *Oriental* and *49*—situated east of the **49 Group.** *Yellowstone* group. The claims are owned by the Lindeborg Bros., who did considerable work on them this year. The old showings are on the extension of the *Yellowstone* vein. Several open-cuts were put in higher up the hill from the old cut, exposing two new veins. One, south of the main vein, was shown to be 2 feet wide, assaying 0.04 oz. gold and 72.6 oz. silver a ton; the other, a 10-foot vein, giving values of \$1.20 in gold and 6 oz. in silver a ton. Another cut south-west of the old one exposed a vein 20 feet wide of broken-up quartz, from which a sample of the best-looking ore gave \$6.40 gold and 29.8 oz. silver a ton.

The old cut, which had been exposed for a width of 20 feet, of which 8 feet is good ore and the whole averaging \$3.20 in gold and 19.0 oz. silver a ton, was extended south for 6½ feet on the south side of a 25-foot dyke which apparently lies in the vein. The average assay of the 6½ feet gave 80 cents gold and 65.6 oz. silver a ton. The values in the veins on this group are uniformly good wherever opened up, and, everything considered, it is a very promising property.

The extension of the road from the Salmon-Bear River road to the *Big Missouri* is of vital importance to all these properties north of the *Big Missouri* group.

This group of two claims—*Pay Roll No. 3* and *Pay Roll No. 4*—owned by **Pay Roll Group.** W. Murphy, of Stewart, B.C., lies south of the *Big Missouri* group on the Missouri ridge, which extends north from the junction of the Salmon river and Cascade creek. The showing is a quartz vein, carrying pyrite and galena, opened up by several cuts and a crosscut tunnel on the north end of the vein, at the edge of the gulch formed by No Name creek. The vein is traced on the surface for 1,000 feet or more. A sample across 2 feet in an open-cut just south of the tunnel gave 18 per cent. lead and 4.7 oz. silver a ton. The vein strikes N. 55° W. and dips 53 degrees to the east. The tunnel has been driven 25 feet,

crosscutting the vein, which is of mixed ore about 12 feet wide, with 2 feet on the hanging-wall of good-looking ore. The foot-wall is a broken-up slaty rock and the hanging-wall has the appearance of an acidic dyke. It is a strong vein and gives promise of developing a tonnage of concentrating-ore. A few hundred feet south of the tunnel a cross-vein shows considerable chalcopryite.

This group of four claims—*Boundary No. 1, Boundary No. 2, Boundary No. 4, Boundary Group, and Missing Link Fraction*—belonging to D. L. McIntomney, of Anyox, B.C., lies west of the *Pay Roll* group. The claims are Crown-granted and have had no work for several years.

The Indian Mines Company, Limited, owns four Crown-granted claims—*Portland Indian Mines, land No. 1, Portland No. 2, Big Dick, and Fritz*—situated on the Cascade slope of the Missouri ridge. The Government trail to the *Big Missouri* runs about 1,000 feet below the cabin, and a branch trail has been built by the company to the camp, which is at an elevation of 2,000 feet. The property was extensively explored a few years ago, although it has not been under operation for the past three years.

The country-rock is the prevailing greenstone formation of the section. The vein is quartz, varying in width from 10 to 20 feet, and apparently following a wide dioritic dyke intruding the greenstone-schists. It is one of the most persistent veins of the section, being traced for 2,000 feet on the property and an equal distance on the claims above. The quartz is mineralized with pyrite, galena, and blende, carrying gold and silver values. The vein has been opened up by three cuts above the upper tunnel and two tunnels driven in on it. The first two cuts going up the hill from the tunnel show little galena, the values being about \$10 a ton in gold across a width of 12 feet of pyritized quartz. The third cut on the top of the ridge, about 150 feet vertically above the tunnel, is the main showing. Here the vein is exposed by a deep open-cut, showing a width of 20 feet, of which from 5 to 8 feet is solid galena bordered on both sides by pyritized quartz and silicified greenstone to the walls. An open-cut was driven from the side-hill a distance of about 20 feet, giving a face of 8 feet under the cut and showing 6 feet in width of solid ore of a mixture of blende and galena. This is a big surface showing and the vein should have been cut completely across here.

The main tunnel was driven over 400 feet on the vein to tap these surface showings. The first two shoots were drifted through, the first showing 2 or 3 feet of solid, fine-grained galena, which only came part way up in the drift; the balance of the vein is pyritized quartz. This shoot is about 35 feet long. The second shoot is shown to be pyritized quartz without galena, and will average about \$10 a ton in gold. The main shoot has been encountered and driven on for about 25 feet to the face of the tunnel. Two crosscuts at the face show the mineralization to be 14 feet wide, with neither wall reached. There is about 2 feet of good-looking galena on the foot-wall side that should be drifted on. A sectional sample across the face gave \$2.40 in gold, 3.5 oz. in silver, 10 per cent. lead, and 16 per cent. zinc. This is a very promising face of ore, and it is to be regretted that it was not drifted on farther.

The lower tunnel, at about 150 feet vertically lower, has been driven 60 feet on the vein, exposing from 1 to 3 feet of ore in the foot-wall. There is very little galena showing here, the values being mainly in gold.

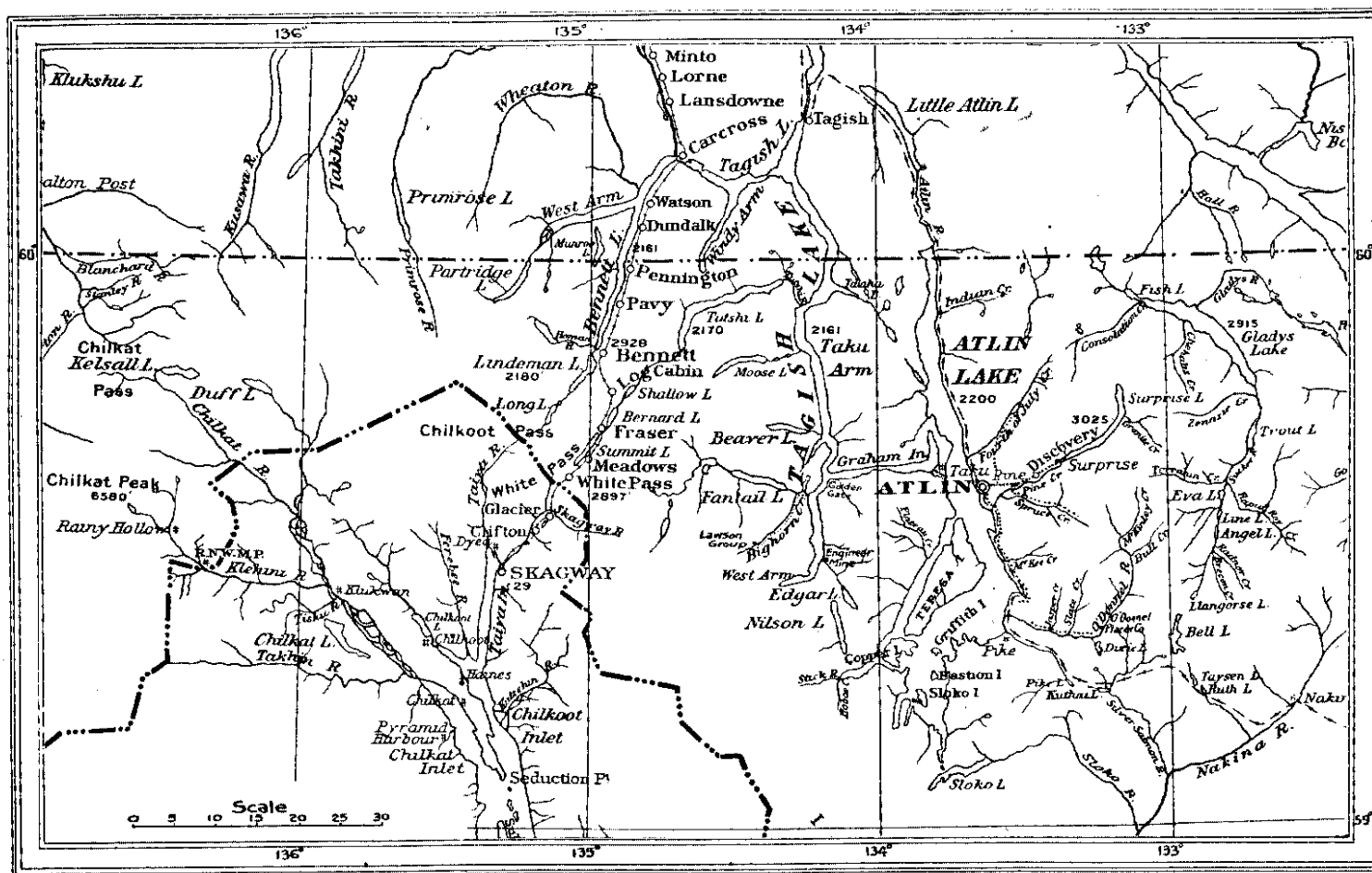
Work on this property was discontinued when a little more development might have proven very satisfactory. It is well located for tunnel-mining and has plenty of timber and water for all purposes. There is a good camp, and a good equipment of tools, etc., and a car and rails in the upper tunnel.

STIKINE MINING DIVISION.

I am informed by H. W. Dodd, Gold Commissioner at Telegraph Creek, that mining has been practically at a standstill this year. Also that there has been very little placer-gold production, due, no doubt, to better labour conditions outside.

The total yield in placer gold will be about \$1,000, the greater portion coming from Dease lake, with about \$200 from the rest of the district. The Thibert Creek Mining Company did not operate this year. The Princess Hydraulic Company, of McDame creek, had only a few men working for a short time on dead-work.

In mineral, assessment only was kept up on seven claims. Acreage-tax was fully paid on eleven claims on Unuk river and on nine claims on the Iskut river. Four Crown grants were



issued to F. E. Bronson and associates on the *Red Bluff*, *Red Bird*, *Homestake*, and *Mermaid*, also on the Iskut river.

ATLIN MINING DIVISION.*

This Division has been comparatively quiet for the past two years because of the increasing scarcity of labour and the extreme high cost of everything pertaining to mining. There has been little or no prospecting for mineral, and, with the exception of two properties, no development-work. In the placer areas very little new ground has been prospected and work on pay-dirt is seriously handicapped by lack of labour. The placer-gold production for the year will approximate \$220,000, as compared with \$305,000 for last year.

My observations with reference to the remaining working-life of the creeks were that, while a few of the smaller creeks are practically exhausted, the large creeks, such as Pine and Spruce, with a number of their tributaries, have miles of unworked ground above the present workings, which has every possibility of being as rich as, if not richer than, that now being worked.

The possibilities of lode-mining are unlimited, for while there have been many locations made, I was surprised at the comparatively small amount of exploratory work done. In fact, the *Engineer* mine and the *Laverdiere* group were the only two properties being actively exploited. Considerable work has been done on the properties adjoining the *Engineer*, but relatively unimportant when contrasted with the possibilities as demonstrated by the development of the *Engineer* mine.

There is an immense area of country, practically unprospected except along the lake-shores, from the Yukon boundary south to Taku inlet and river, lying along the eastern contact of the Coast granites, and probably as favourable a section for exploration as any in British Columbia. Any ore within transportation distance of the lakes can be shipped by way of Carcross at reasonable rates. The joint freight tariff of the Pacific and Arctic Railway and Navigation Company and participating carriers quotes a rate on ore in sacks in car-lots from Atlin to Tacoma or Vancouver of \$8.25 a ton in car-lots and \$9.25 a ton in less than car-lots, and from Atlin to Anyox a rate of \$8.50 a ton C.L. or \$9.50 a ton L.C.L. From the *Engineer* mine, which would mean anywhere on Tagish lake, to Tacoma or Vancouver, a rate of \$6.25 a ton C.L. or \$8.25 a ton L.C.L., or to Anyox of \$6.50 a ton C.L. or \$8.50 a ton L.C.L. Ore-sacks are delivered to Atlin from Seattle or Vancouver for \$21 a ton in car-lots or \$30 a ton in less than car-lots. Miscellaneous commodities going into Atlin range from \$50 to \$60 a ton. The above rates on ore show that the transportation companies are giving every assistance toward developing and advancing the mining industry in this section.

South of Atlin lake to Taku inlet is an area that has had practically no prospecting. A reconnaissance trip was made by Mr. Carruthers, the District Public Works Engineer, last summer through this portion of the Atlin section, convincing him that transportation in the form of a wagon-road could be provided if the production of that area and the Atlin country warranted it. A good trail should be provided in the meantime for the benefit of the prospectors.

For the purposes of this report the Division will be subdivided as follows: Atlin Mining Division--Rainy Hollow Section; Atlin Section.

RAINY HOLLOW SECTION.†

This section of the Atlin Mining Division is accessible by way of Haines, Alaska, a port of call for the American boats, but not for Canadian coastwise steamers, which call at Juneau and Skagway. To get to Haines, unless on an American boat, it would be necessary to catch one at Juneau going north, or return from Skagway to Haines by launch.

From Haines up the Chilkat river to Wells camp at the mouth of the Klehini river, a distance of twenty-four miles, there is automobile service, the trip taking about two hours. The road is in fair condition and with some improvements would be serviceable for truck-haulage. The elevation at Wells camp is 110 feet. From Wells camp the walking was fine for the balance of the distance, thirty-four miles, to the *Maid of Erin* camp, a total distance of fifty-eight miles from Haines. Leaving Wells camp, the Chilkat river was crossed on the Government bridge, and the road, poor along the river-bottom for two miles, followed up the south side of the Klehini river to the next stopping-place at Porcupine, where accommodations

* Memoir 37, by D. D. Cairnes, Dominion Geological Survey Branch.

† Dominion Geological Survey, Summary Report, 1913, page 29.

could be had, a distance of fourteen miles. Autos could make the run to this point if the two miles across the river from Wells camp were repaired. The road-grade is generally good, there being one hill of 16 per cent. grade at eight miles from Wells. From Porcupine to the boundary-line at Pleasant camp is seven miles. The road on the south side of the Klehini was washed out; consequently the river was forded about three miles from Porcupine and the old Dalton road followed from there to Pleasant camp. Elevation at the boundary is 900 feet. Good accommodation at Pleasant camp. From here to the end of the wagon-road at Rainy Hollow is ten miles and a further three miles and a half of new road to the *Maid of Erin* camp. The elevation at Rainy Hollow, the foot of the hill, is 1,700 feet; at the *Maid of Erin* camp, 3,280 feet. This last ten miles of the road in British Columbia has a couple of bad hills and several soft stretches, but on the whole is in fair condition.

This is a big section with good possibilities, judging from my brief observations. I regret that my time was so limited, but I hope to make a more thorough investigation of this section next season.

**Maid of Erin
Group.**

This group is composed of thirteen claims, situated on Mineral mountain, fifty-eight miles from Haines, on Lynn canal, and about fifteen miles south of Skagway. The property is owned by Conway, Kennedy & Burnham, of Skagway, Alaska, Mr. Kennedy being in charge of operations at the property. It has been held by the present owners for a number of years, who have encountered many difficulties in connection with obtaining transportation facilities. The property being in British Columbia, with about forty-five miles of the road through Alaska, has complicated the situation. However, the road for the greater part is now in fair condition, permitting of ore being hauled out, though at heavy cost. Some years ago 30 tons was shipped, which gave smelter returns of 32 per cent. copper and 56 oz. in silver a ton.

Ore-hauling at present costs $1\frac{1}{4}$ cents a pound from Rainy Hollow to Porcupine and 1 cent a pound is paid for return freight; 1,300 lb. is hauled down with a 2-horse team and 800 lb. freight taken on the up trip. I have no estimation of haulage from Porcupine to Haines, as it was expected to have the road in such repair to permit of motor-hauling. It was costing the owners \$75 a ton to break, sort, sack, and deliver the ore to Haines. The freight and treatment from Haines to Tacoma smelter will amount to \$11 a ton, \$6 treatment, and \$5 freight. This makes a total cost of \$86 a ton for production; consequently it will take a high-grade ore to be profitable. This year 25 tons was shipped, assaying 35.05 oz. silver and 22.32 per cent. copper.

Mineral mountain, on which the claims are situated, consists of broad belts of limestone, slates, and sandstone, in places metamorphosed to quartzite, the whole apparently underlain by the granodiorite, which forms the western border of these sedimentaries lower down the hill. Directly in contact with the granite is a broad belt of crystalline limestone from 300 to 400 feet wide, through which intrude spurs of granite from the main mass to the west. In this belt of limestones, about 250 feet from the granite and paralleling the general strike of the contact, is a vein or, more properly, a zone of altered limestone, mainly calcite, about 12 feet wide on the north end, impregnated with specks, bunches, kidneys, and small veins, up to 4 feet in width, of bornite. Southerly along the zone the bornite crops in isolated bunches and small veins, probably caused by the intrusions of granite. The strike of the zone is north and south and the dip about 20 degrees to the east, following the general strike and bedding of the sedimentary. Along the immediate contact of the granite and limestone is also a mineralization of bornite, but it has not been opened up at all.

The work on the claims consists of a crosscut tunnel 100 feet vertically lower than the croppings, driven about 40 feet in the limestone toward the showing, to which it is probably 200 feet farther, as the vein dips into the hill. Another tunnel has been driven 40 feet across the showing and about 20 feet under it, exposing about 12 feet of a mineralization of small parallel veins and bunches of bornite, which is also disseminated throughout the calcite. Some small replacements of bornite occur in the underlying limestone foot-wall, but are not sufficient to make commercial ore. This is a fine showing of concentrating-ore. Directly over this tunnel the ore now being sorted for shipment is taken from the surface, where the bornite occurs in irregular veins, up to 2 feet thick, of solid ore through the calcite. Just south of this an open-cut or a small excavation in the vein has been made, from which the ore shipped some years ago was taken. A short distance south-east of these showings, on the top of a bench, a shaft has been sunk through the limestone to the ore.

Present operations employ five men, breaking, sorting, sacking, and hauling the ore down to the end of the Rainy Hollow road, three miles and a half from the workings. This hauling is done with a small Cleveland caterpillar tractor weighing 3,000 lb., having a 54-inch tread and a 5-foot belt. This machine takes 1 ton to a load on a trailer down the hill over grades of 20 per cent. with the load, and returns with 300 to 400 lb. of supplies. The owners this spring built this road for the tractor at a cost of \$1,500, and certainly are deserving of a great deal of credit for their aggressiveness under most difficult conditions.

The ore, being a straight bornite in calcite gangue, would be ideal for flotation. Operations on a large scale could be carried on by opening up the ore-body from the south end on the point of the hill, or from the side of the hill, by a crosscut tunnel to the ore, and then drifting both ways from it on the ore.

The mountain is bare of timber, which would therefore have to be obtained from the valley below along the wagon-road. Wood for the camp is hauled up from the end of the road by the tractor. The ore could be trammed from the mine to the creek below, where ample water for milling purposes is available.

This is a fine, big, promising showing and gives good reasons for believing that extensive development will open up sufficient tonnage of milling-ore to justify the installation of a concentrating plant and improved transportation.

This group consists of five claims—*Glacier, Idaho, Texas, Boundary, May-Hibernian Group, flower, and Parrot*—situated east of the *Maid of Erin* group on Mineral mountain. The claims are owned by Dan Sullivan. The showing is a wide belt lying along the limestone, mineralized in places for a width of 40 feet, in which are stringers of chalcopyrite which, when bunched, make fair ore, but the greater portion of the belt is low grade. The ore is magnetite carrying chalcopyrite, very characteristic in the western contact of the Coast granites with the sedimentaries.

A shaft has been sunk to a depth of 10 feet next to the lime, showing about 2 feet of fair ore, the balance being low grade. About 10 feet east in an open-cut the vein shows a width of 10 feet, in which are a few inches of fair ore, while the balance is low grade. A grab sample was taken of the best-looking ore on the dump, giving 2.5 per cent. copper and 0.5 oz. silver a ton.

This showing of ore, if on tide-wafer, would merit a lot of work, but, situated as it is with the possibilities of rail transportation rather remote, its values are not very encouraging.

This claim is owned by Conway, Burnham & Kennedy. It lies on the trail from the end of the wagon-road to the *Maid of Erin* property. An open-cut about 4 feet deep exposes a vein, apparently about 12 feet wide, lying in limestone and mineralized with pyrite, galena, and blende. It strikes north and south, which is the general strike of all the veins in this section. A grab sample of the broken ore in the cut, and which should be a fair average of the whole, gave 21.4 per cent. lead, 21.4 per cent. zinc, and 4 oz. silver a ton. This is another showing that would be well worth opening up if it were handy for shipping.

With a good motor-road from Haines to Porcupine, ensuring cheap supplies and haulage, and a good wagon-road the remainder of the distance, this section would have some chance for development.

ATLIN SECTION.

This section has been a big producer of placer gold for a number of years, and in all probability will continue to do so for years to come. The section has also produced one quartz property in the *Engineer* mine, which has all the ear-marks of becoming the greatest gold-producer in the Province. This will naturally stimulate the exploration of the same class of deposits in other parts of the section and will turn attention to lode-mining in general, which, so far, has been neglected.

I am including in this report a short description of the *Venus* and *Venus Extension* properties, which, though on the Yukon side of the boundary, are representative of possible showings farther south on the British Columbia side of the boundary.

This group* is part of the mineral holdings of McKenzie & Mann, at which the town of Conrad flourished a few years ago. The property is situated on the west side of Windy arm, about sixteen miles from the town of Carcross.

* Dominion Geological Survey, Summary Report, 1916, page 39.

Being right on the water's edge, it is ideally located for mining, milling, and transportation. It was operated up to about the middle of the summer. The main workings consist of a crosscut tunnel from the side-hill to the vein, a distance of about 500 feet through andesite country-rock. Drifts have been run both north and south on the vein for approximately 500 feet each way from the tunnel. At the south end of the south drift a winze has been sunk on the vein to a depth of about 60 feet (no measurements made), in good-looking ore all the way. At about 30 feet down from the drift-level the vein splits and has been followed on the hanging-wall for the remaining 30 feet to the bottom. Evidently the foot-wall split was followed for some distance, but abandoned in favour of the hanging-wall showing.

Throughout the whole 1,000 feet of drifting the work has been in ore, supposedly of better grade in spots, from the fact that portions have been or were being stoped. I was reliably informed that the whole vein will average between \$10 and \$12 a ton in gold, silver, and lead values, and maintain an average width of $2\frac{1}{2}$ feet. The vein is apparently a filled fissure in the andesite country-rock, having a strike of N. 30° W. and dipping south-west at from 30 to 35 degrees. The main filling is quartz mineralized with arsenopyrites and galena, the latter carrying the silver and possibly a small percentage of the gold values, a concentrate of the iron assaying about \$20 a ton in gold. There is considerable oxidation of iron in the vein, and resulting chlorides of silver which have been lost in milling operations.

The damp oxides have caused some little trouble in stoping on account of them hanging on the flat foot-wall. To assist this crosscuts have been run into the foot-wall and chute raises put up to the stopes. The most of the stoping has been done on the north drift, and without examining or measuring the stopes I would roughly estimate that there is a sufficient tonnage of ore about the drift-level to the surface to feed a mill of 100 tons capacity in twenty-four hours for a year or more. The average feed to the mill during the last operation was 2 per cent. lead, \$3 in gold, and 10 oz. in silver a ton; the ratio of concentration was from 10 to 12 into 1, and a product of 14 per cent. lead, 100 oz. in silver, and 1 oz. in gold was made. The concentrates consist of both the iron and lead sulphide, accounting for a low percentage of lead. The recovery has only been between 60 and 65 per cent., due largely to mechanical losses in the mill, which was treating about 60 tons a day.

There has probably been a slight enrichment in gold values in this upper oxidized zone, due to the oxidation and removal of the iron; but I judge this would be offset by the silver losses, due to leaching, and I would therefore look for about the same values at depth below the oxidation when the primary sulphides are reached. It seems reasonably certain that, with economical mining and efficient concentrating, with an average of \$10 to \$12 ore, this can be made a profitable undertaking.

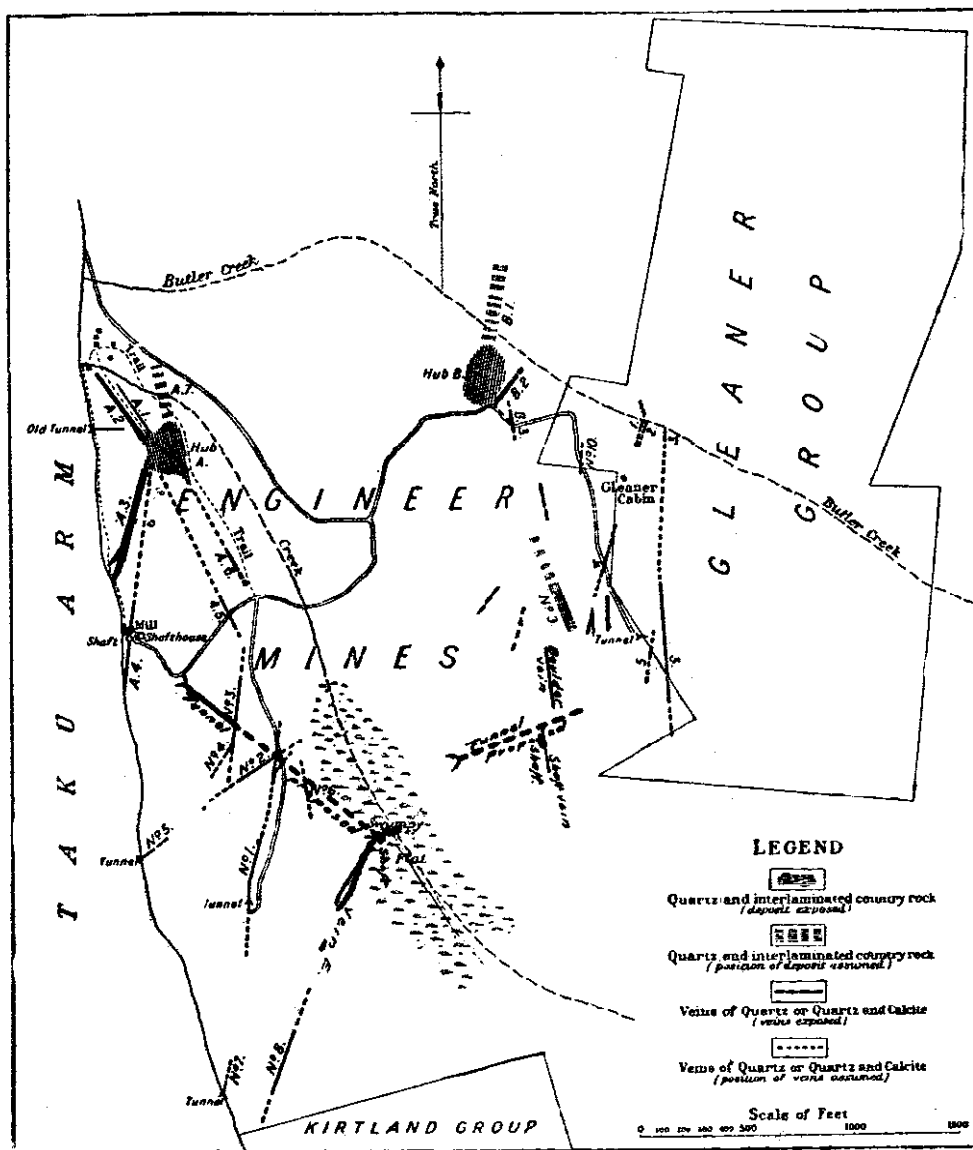
The equipment on the property consists of a 2-bucket aerial tramway from the mine to the mill located on the beach, and a compressor plant consisting of a steam-driven, 6-drill Rand-Ingersoll straight-line compressor, with a 2-inch air-line from the receiver to the mill. Fuel is obtained from the head of the arm, about three miles from the mine, costing from \$9 to \$10 a cord laid down at the boilers. This steam plant also supplies power for the concentrator, pump, generator, etc.

The concentrator was installed about ten years ago and altogether has not been in operation more than a year during that time. It is equipped with a 9- x 15-inch jaw-crusher, rolls, 5-foot Huntington mill, Hartz type jigs, Wilfleys, and vanners. The milling process was not investigated by me, so that no opinion is advanced as to its adaptability for efficiency.

Freight from the mine to the White Pass Railway at Carcross costs \$1 a ton, which includes loading at the mine and transferring to cars at railway. From Carcross to Skagway costs \$2.50 and up a ton, depending on the value of the ore. The railway freight tariff quotes a rate of \$6.25 a ton on sacked ore from the *Venus* mine to southern coast smelter.

This group, as the name indicates, is located on the continuation of the *Venus Venus Extension* vein. It is owned by E. Fleming, of Carcross, Y.T. The claims are *Venus Group*. *Extension*, *Red Deer*, and *Humper No. 1*. Work done on the property is mainly on the *Venus* vein and consists of a tunnel and a shaft. The tunnel has been driven south on the vein from the surface for 500 feet, and must be about the end line of the claim. There is a fraction of about 500 feet between this group and the *Venus*. The drift shows the vein to have the main characteristics of the *Venus* vein, except that it is rather more oxidized. The shaft has been sunk 110 feet on the vein and short drifts run both ways from the

bottom. This was full of water at the time of my visit, but I was able to procure the results of a very carefully taken set of samples down the shaft. These were taken at regular intervals of 10 feet and averaged a trifle over \$15 a ton in gold and silver values (silver, 60 cents an oz.) for an average width of $2\frac{1}{2}$ feet, corresponding very closely to values and width of the *Venus* vein, possibly with a trifle higher gold values. The ore will concentrate about 10 or 12 into 1.



Map showing Vein-outcrops on Engineer and Gleaner Groups, Atlin Mining Division.

The property is equipped with a compressor and boiler plant, installed on the lake-shore, similar to the one on the *Venus*, and connected with the mine by a 4-inch air-line. There are good reasons to believe that, under conditions which will prevail after the war, this property, equipped with a modern concentrator and efficiently handled, can be made a good profit-producing enterprise.

This group* comprises eleven Crown-granted claims—*Northern Partnership Engineer Group*. No. 1, *Northern Partnership* No. 2, *Northern Partnership* No. 3, *Northern Partnership* No. 4, *Northern Partnership* No. 5, *Engineer* No. 1, *Mickey*, *Plato*, *Philadelphia Fraction*, *Mill Brook*, and *Daisy*—situated on the east side of Taku arm, about ten miles south of Golden Gate, sixty-five miles from Carcross, on the White Pass Railroad, and twenty-five miles from Atlin. The claims are located two deep along the shore from the water's edge up the hill. The property was owned by the late Captain James Alexander, who, with Mrs. Alexander, were lost in the S.S. "Princess Sophia" disaster in Lynn canal in October of this year. The captain had "stayed with it" at this one property for over ten years through all kinds of adverse conditions, and was on his way out to close a deal for the property, and reap the reward, when the fates decreed otherwise. No information is available at the present time as to the future plans for the property.

Quoting from D. D. Cairnes's report of 1913, "The ores at the *Engineer* mine occur in veins mainly in Jura-Cretaceous shales and finely textured greywackes that vary from dark greenish and brownish to almost black in colour. The veins range from simple veins a few inches in thickness to compound veins over 200 feet thick, and consist largely of quartz, calcite, and intercalated and brecciated wall-rock. The chief metallic mineral is native gold; in addition, small particles of tellurides, as well as some pyrite and native antimony, also occur. The veins are thus of value only for their gold contents.

"The beds have been invaded by dykes of andesite and granite porphyry, and in places are faulted, folded, and considerably distorted, but have a general strike of about N. 63° W. and dip to the north-east at an average angle of about 35 degrees.

"Two large, central, compound veins or hubs consisting of quartz and intercalated and brecciated shale, slate, and altered rocks occur, from which several veins radiate, most of them in north-westerly and south-easterly directions. In addition, a number of veins have been discovered which are not, as yet, traceable to any central quartz area.

"Hub A is at least 200 feet wide at its widest point and is over 300 feet in length. The mass consists largely of quartz, but also contains a large proportion of intercalated bands of shale slate.

"Hub B is very similar in appearance to hub A, contains a large amount of intercalated and brecciated shale and slate, and is in reality a compound vein. It is at least 270 feet wide. Toward the edges of the vein the proportion of rock gradually increases, producing walls of indefinite character.

"The majority of the narrower veins are compounded almost entirely of quartz, with comparatively little calcite. The quartz is characteristically well crystallized and long delicate prisms are very common; these occur in parallel bands with comb-structures or radiate from a central mass or particle of ore or rock. In the intercrystal spaces that thus result the metallic minerals have largely been deposited.

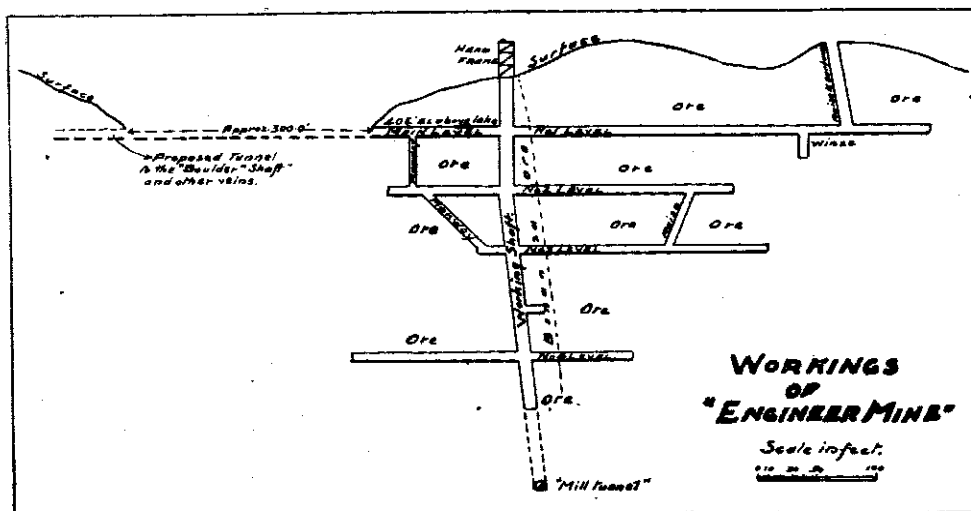
"Native gold is the most common metallic mineral in the veins, and is in places plentifully distributed through pockets or shoots of ore either in fine grains or thin scales. Associated with the gold in places are imperfect prismatic forms or brass-yellow tellurides, probably calaverite."

Development-work done on the property consists of a great number of open-cuts and strippings and several tunnels driven on the most promising-looking veins. This surface work has exposed about twenty-five veins, varying in width from a few inches up to 4 feet, the majority of them showing visible gold at some place in them and a few of them containing shoots and pockets of bonanza ore. Two of these are especially rich, the "boulder vein" and the "shaft vein." The greater part of development so far has been on vein E. (See sketch.) A shaft has been sunk 275 feet from the surface, from which four levels have been run. No. 1 level is 50 feet below the collar of the shaft and is driven from the surface at 460 feet elevation above the lake. This is the working-level to which all ore and waste is hoisted from the underground workings. From the mouth of the tunnel to the shaft is 115 feet, and the tunnel has been continued beyond the shaft for 355 feet, all on the vein. At 270 feet beyond or south of the shaft a raise has been put through to the surface. No. 2 level, 45 feet below No. 1, has been driven 100 feet north and 190 feet south of the shaft, on the vein both ways. A manway has been put through from the end of the north drift to the No. 1 level, coming out about 30 feet from the portal. No. 3 level, 50 feet below No. 2, has a short drift of 30 feet, north from which a

* Dominion Geological Survey, Memoir 37, 1913, by D. D. Cairnes. Minister of Mines' Report, 1904.

sloping manway has been put up connecting with a manway from No. 2 level, and a drift sunk of 210 feet, from which a raise has been driven to No. 2 level. No. 4 level, 90 feet below No. 3, has a drift north of 140 feet and south 90 feet, both on the vein. The shaft has been continued for 40 feet below the No. 4 level during the past summer, showing the vein to be 2 feet in width, with visible gold on each wall. All this underground work has been in ore. There is a bonanza shoot of ore showing for a length of about 30 feet on all the levels on the south side of the shaft, varying in thickness from a knife-blade to 6 inches of heavy gold, in one place reaching a width of 18 inches.

In development-work the waste is broken about 10 feet ahead of the ore, which is afterwards taken down with as little shooting as possible and taken to the sorting-tables, where it is broken up and sorted into three grades. The first grade is that showing visible gold, which is sacked for treatment in a ball-mill. The second grade, no visible gold, is known to be high grade, from \$125 to \$175 a ton, and is sacked for shipment. The balance or third grade is put on the dump for future treatment. The first grade is accumulated until there is sufficient for a run of the mill, from 600 to 1,000 lb. being the usual charge. It is first put through a small jaw-crusher which crushes to about $\frac{1}{4}$ inch size; then into a 5-foot ball-mill using steel balls, where it is pulverized in from two to two and a half hours. Two or three flasks of mercury (from 150 to 225 lb.), according to the estimated gold content of the ore, are then added and the barrel revolved for twenty or thirty minutes (a longer time flours the mercury) for amalgamation. The contents are then thoroughly washed and the amalgam removed, squeezed, and retorted. The record run of this mill was 24 lb. 8 oz. (troy) of gold from 160 lb. of ore. The tailings from the ball-mill are washed into tanks, settled, dried, and shipped to the smelter with the second



grade of sorted ore. The amalgamation in the ball-mill is a great improvement over the old 2-stamp Joshua Hendy mill previously used, the polishing effect on the gold of the ball-mill grinding being of great assistance in the amalgamating. The old stamp-mill was supplied with ore taken for the most part from the surface cuts and packed to the mill on men's backs.

A very comprehensive scheme of development had been carefully planned and considerable of it done this year. (See map.) What is termed the "mill tunnel" was started from a point above the old mill, and driven 309 feet on a line toward a point directly under the working-shaft on vein E. This tunnel, when completed, will be about 1,200 feet long, and will not only tap five or six intervening veins showing on the surface, but will furnish haulage-way for all the ore from vein E when connection is made by sinking the shaft to connect with this tunnel. It is proposed to install a concentrating plant on the site of the old mill. Further development consists of a crosscut tunnel, called the "boulder vein" tunnel, on the same level as the shaft tunnel, No. 1 level, east into the hill to undercut the series of veins exposed farther up the hill, the principal ones being the "boulder and shaft" veins. This will provide for transportation of ore from these upper veins to the shaft, to the "mill tunnel," to the mill. This tunnel has only

been worked at intervals and a distance of 50 feet been driven, requiring probably 300 feet farther to reach the "boulder" vein, and about 900 feet to reach the farthest of the upper series of veins, and obtaining a depth of 460 feet under it. The old 3-compartment shaft at the head of the mill will be sunk from its present depth of 75 feet to intersect a very rich vein cropping at the water's edge, and on which a shallow shaft was sunk a short distance back from the water. This vein is known to run into hub A; consequently can be drifted on from the shaft to the hub, and all ore developed from it hoisted through the shaft to the mill storage-bins. This appears to be a very commendable plan of development, for it will not only provide haulage, but will expose any number of working-faces of ore, from which a large capacity mill can be supplied.

Altogether it is a wonderful showing of gold, and there is every reason to believe that it can be developed into one of the greatest gold-producers on the continent.

This group consists of three claims lying east of and adjoining the *Engineer* **Gleaner Group.** group up the hill. There is a good wagon-road to the *Gleaner* cabin from the shore of Taku arm at the mine landing. The rock formations on these claims are identical with those of the *Engineer* mine; that is, slates and shales intruded by dykes of andesite and granite porphyry. Two or three quartz veins have been discovered and some work done on each of them. A tunnel has been driven for 35 feet on a small 8-inch quartz vein from the north side of a small creek, from which, it is said, several sacks of free-gold quartz was taken. There are several open-cuts and strippings on quartz-outcrops around this creek, none of which apparently amount to much.

Further south, on a lower vein, which is possibly the extension of the *Mickey* vein of the *Engineer* group, some 200 feet of open drifting has been done north of the shaft and also a short drift south of the shaft. The shaft is about 40 feet deep and full of water. It is not known what values were obtained in these cuts or in the shaft. This vein strikes N. 50° W. About 50 feet vertically lower a tunnel was run to crosscut the vein, which, however, was not encountered, the face of the tunnel being now in andesite.

This group of six claims adjoins the *Engineer* group on the south and extends **Kirtland Group.** along the shore of Taku arm. Comparatively little work has been done, and that mainly on the *Jersey Lily* claim, adjoining the end claim of the *Engineer* group. Formation and vein occurrences are similar on both groups. I understand some gold has been found, but it looks as if all the surrounding properties were content to rest on the reputation of the *Engineer*.

This group of seven claims—*Sweepstake No. 1* to *Sweepstake No. 6*, inclusive, and *Golden Hope*—is owned by Ben Nichol and Jack Dunham. The group is **Sweepstake Group.** located north of and adjoining the *Engineer* group, two claims back from the lake, extending along the side of the mountain. The vein, which attains a width of 25 feet in places, is brecciated quartz and slate filling, in some cuts the quartz and slate showing a banded structure. The vein is exposed by open-cuts at intervals of 50 feet, and has a strike of N. 20° W., dipping slightly to the west. At 3,030 feet elevation, or 830 feet above the lake, the vein shows a width of 30 feet of banded slate and quartz. At 3,175 feet elevation the vein is 25 feet wide, and at 3,200 feet the vein is predominantly slate, with some quartz. At 3,450 feet elevation a tunnel has been driven 35 feet on a 12-inch cross-vein of quartz, striking at N. 55° E., in which free gold is said to have been found. Flakes of free gold have also been found in the main vein, but no extent of high grade has yet been exposed. It is a big vein and would produce a big tonnage if the values were sufficient.

This group consists of three claims—*Crackerjack*, *Gold Hill*, and *Gold Bullion*— **Happy Sullivan Group.** and is situated about a mile and a half from the lake on the north bank of Sheep creek. The showing is a big quartz vein 22 feet wide lying beside a diorite dyke on the west; the east wall appears to be an altered, soft, greyish rock through which are small veins of white watery-looking quartz. The vein shows up the hill for a length of 50 feet, at an elevation of 3,600 feet at the lowest exposure. A sample was taken across here by breaking off as average as possible with a prospecting-pick; it gave returns of only a trace each of gold and silver. A tunnel has been started from a gulch below, and is in 48 feet, crosscutting toward the vein. This is a strong vein, and it is to be hoped that, at the depth which the tunnel will obtain, the values will improve, for it is well situated for mining and transportation.

This group of four claims—*Brownie No. 1, Brownie No. 3, Brownie No. 4, and Brown Group. Brownie No. 5*—is owned by Dunham, Nichol, Kershaw & Gilmore. The claims are situated about half a mile up the Wann river, which flows into the arm from Edgar lake, about half a mile south of the *Engineer*. There is a fine water-power available on the Wann river about a mile from Taku arm. Edgar lake is 280 feet higher than the arm, with the greater part of the drop about a mile from the mouth of the river. The two lakes, Edgar and Nelson, drained by the river from an extensive reservoir. The trail from the *Engineer* wagon-road extends up the east side of the Wann river for some distance, and a trail has been built from the upper end, part way down, leaving a small portion along the river unfinished.

At an elevation of about 50 feet above the arm, on the west bank of the river and about 40 feet above the water, an open-cut into the side-hill exposes a vein, 4 feet wide, of quartz sparingly mineralized with galena, blende, and some grey-copper in places. Along one wall there is a narrow vein of high-grade ore. A tunnel has been started at the edge of the river and is just into the solid, showing two seams of quartz carrying galena and blende. The vein is worth exploration on account of the high-grade ore showing in the upper cut.

Along the shore of the arm a number of open-cuts have been put in, following small veins of quartz which apparently are not persistent, being small replacements along the slips in the sheared or gneissoid granite.

This group, as described in my preliminary report, is evidently the *Rupert White Moose Group*; the *White Moose* claims lying along the shore, while the *Rupert* claims are well up on the mountain. The claims of the *White Moose* group are eight in number—*Pansy, Rose, Buttercup, Calder, Primrose, Daisy, Merry, and Daffodil*—and are owned by Mr. Partidge and associates. As I did not examine the showings, I will quote from D. D. Cairnes's Report of 1913.

"The rock formation consists of a greenish schistose amphibolite, much faulted, contorted, and altered. The main showing on the property is a quartz vein from 18 inches to 4 feet wide, fairly well mineralized with grey-copper, pyrite, and chalcopryrite, with a little galena also showing. On the north end of the vein a small shaft has been sunk, exposing the vein 2 feet wide, of nearly solid grey-copper, chalcopryrite, and galena. On the southern end of the claims some open-cuts have been made, a shallow shaft sunk, all exposing ore, from which assays of from \$10 to \$15 in gold were obtained and silver of from 20 to 100 oz. a ton."

This group (described in my preliminary report as the *White Moose* group) is **Rupert Group.** situated on the east slope of Whitemoose mountain, on the west side of Taku arm, across the arm from and a little south of the *Engineer* group. The camp is on the bank, about 100 feet from the water's edge, at which there is a floating dock for landing. I followed the trail leading from the camp up the hill to a tunnel at an elevation of 4,100 feet, or about 1,900 feet above the lake. The tunnel starts on a face of quartz about 8 feet wide lying in the granite formation, and follows the vein for 80 feet where the quartz pitches out; the balance of the distance to the face, 160 feet, is in granite. At 40 feet from the mouth of the tunnel the vein splits, and, as stated, continues to 80 feet. There is a crosscut to the right from the 80-foot point, for the purpose, no doubt, of picking up the right fork of the vein. The water in this was 2 or 3 feet deep, so that it was impossible to examine it. The split in the tunnel shows on the surface, but it is impossible to trace the vein any farther than showing in the tunnel. The vein strikes N. 80° W. and dips 70 degrees to the north. The quartz is sparingly mineralized with chalcopryrite, pyrite, and a little galena.

I have been informed since going over the property that there are three or four more veins on it, and from their description I judge that they all have about the same characteristics, and that the one mentioned is probably the best-looking one of the bunch. It was unfortunate that I had no one with me familiar with the ground, for I could have taken in all the showings of the claims as well as the one I saw.

This group consists of six claims and is owned by the Laverdiere Bros. The **Laverdiere Group.** property is situated on the west side of Hoboe creek, a small stream emptying into West bay at the extreme south of West channel. It is about two miles from the mouth of the creek, the whole distance being a perfectly flat valley-floor, with a fair trail from West bay to the property. The rock formation is a contact between the Coast granites on the west and the greenstone-schists and limestones which form the bed of the valley and extend along the base of the hill.

The main showing of this group occurs in this contact and is of contact metamorphic origin. There is a general mineralization along the contact through to the *Callaghan* group. The best showing yet exposed has been opened up by a tunnel 180 feet long, driven at an elevation of 2,240 feet, or about 40 feet above Atlin lake. In this tunnel the mineralized zone extends from about 30 feet from the collar to about 20 feet from the face, or about 130 feet in width. The body dips 70 degrees to the west. Of the total width of ore, 130 feet, there is between 30 and 40 feet of pretty fair ore, occurring as bands of magnetite, carrying chalcopyrite, up to 10 or 12 feet wide. Further development-work should be done here by diamond-drilling, which would probably be the best, as the depth of the deposit could be more readily determined, or by drifting on the best-looking band of ore to ascertain the extent of the deposit. It can be seen on the surface that there are bunches of magnetite, carrying chalcopyrite, in the limestone-belt for 200 or 300 feet south of the tunnel. A general sample was taken from the dump, which gave assay returns of 1.7 per cent. copper and a trace each of gold and silver a ton. This is probably a fair average of all the mineralized portions of the deposit. The ore would therefore have to be concentrated, for the chalcopyrite is so distributed that, I believe, hand sorting to a shipping grade would be impossible. This is a big deposit and worth sufficient exploration to get the average content and probable tonnage information necessary before a concentrating plant could be decided on.

About 100 feet north of this tunnel another crosscut tunnel has been driven about 40 feet, cutting a deposit of almost pure pyrrhotite, containing less chalcopyrite than the magnetite in the other showing. Some cobalt bloom was noticed in pieces picked up from the dump.

Some 1,000 feet south of the long tunnel another crosscut tunnel has been driven for 213 feet into the limestone, the first straight portion being 168 feet; then 27 feet to the left at right angles; then straight ahead again for 18 feet to the face. A little scattered chalcopyrite shows in the face, and I judge there is a little disseminated throughout the limestone. It is said that free gold was found in an open-cut just above this tunnel.

Probably 1,000 feet south of this tunnel an open-cut and drift has been driven about 50 feet, following a small quartz vein lying in the granites. The face of this tunnel shows only a mud-seam marking the fissure, and about a foot on each side of it of altered granite. A sample across it gave only a trace of each of gold and silver. It is claimed that high silver values were obtained near the mouth of this tunnel in a grey-copper ore. This showing will be tapped by a crosscut tunnel now being driven about 35 feet vertically lower. It was in 40 feet when I was there, and the face then looked as if it were close to the vein, and I have no later information as to the results of this work.

Mining conditions are very favourable for this property, being only two miles from the lake, on a flat grade, plenty of water for power and other purposes, and plenty of timber. The property is under a three-year bond to a Mr. Zortman, who contemplates putting in a small compressor plant and thoroughly investigating the magnetite-showing by sinking 100 feet and drifting and crosscutting at that level. From a general sizing-up of the ore exposed and the formation, there are good reasons to believe that this property will develop into a big concentrating proposition.

This group, consisting of six claims owned by Mrs. Callaghan, is situated **Callaghan Group.** adjoining the *Laverdiere* group on the north and extending through to the shore of West bay. The same ore occurrences are found here in the same formation as on the *Laverdiere*, being on the continuation of the contact of the Coast granites and sedimentaries. The claims are heavily timbered and overburdened, and as little work has been done by way of stripping or open-cutting, no conclusions can be made as to the extent of the mineralization. Two quartz veins have had a little work done on them on the shore of West bay. They lie in a greenish schistose formation which is badly distorted; consequently the veins have no continuity and are of little importance. The quartz carries good gold values, a few pieces picked from one of the open cuts giving assays of 1.58 oz. gold and 7 oz. silver to the ton.

This island is situated on the south end of Atlin lake and has had claims **Copper Island.** staked and restaked from time to time on the copper-showings there. At present I think all the claims have lapsed. The rock formation is a reddish-brown granular basalt, through which are small calcite-filled fissures in which are slabs and seams of native copper. There appears to be no other mineralization, no sulphides of copper of any kind from which the native copper could be redeposited, from which it may be concluded that the native copper was primarily deposited as such. An open-cut 30 feet long, with a face

12 or 15 feet high, shows about 8 inches of calcite, with a streak of native copper through it. No ore of this kind has been discovered in sufficient quantities to be of workable value. The country-rock is slightly mineralized with native copper near these small calcite veins.

There is evidently a wide belt of this volcanic rock which is said to extend north as far as Edgar lake, where it is a better grade on account of the quartz and calcite veins in the vicinity carrying chalcopryrite and bornite. The belt extends south as far as the extreme southern end of Atlin lake. It would seem that this basaltic belt would be well worth thoroughly prospecting, for it is probable that some portion of it will carry profitable quantities of copper.

There are numerous quartz veins cropping all over this mountain, but the only development has been done on the *Imperial* group of four claims, owned by **Munroe Mountain.** James Stokes, of Atlin, B.C., and associates. These claims are about five miles from Atlin. A branch from the main road from Atlin to Discovery runs to the foot of the hill. The property is very accessible and mining conditions perfect.

The showing consists of a vein, with a general north-west and south-east trend and a dip of from 50 to 60 degrees to the west, of from 6 inches to 3 feet in width, lying in a wide diorite-belt. The vein-filling is quartz, carrying a trace of chalcopryrite and pyrite, and for the most part is badly crushed and oxidized. The showing has been developed by a crosscut of 20 feet from the surface to the vein; then a drift on the vein of 20 feet to the east and 160 feet to the west. The ore-shoot for a length of 50 feet has been stoped through to the surface above the crosscut, as well as some underhand stoping below the drift-level. This ore was extracted some years ago and milled in a 5-stamp mill situated at the foot of the hill. It is stated that the feed to the mill averaged about \$7 a ton in free gold. West from the tunnel on the drift-level the quartz has split up and pinched for about 70 feet; from there for 25 feet is good-looking quartz, on which a winze or a small underhand stope has been sunk to a depth of 8 feet.

Another level has been opened about 100 feet below this by a crosscut of 110 feet from the surface to the vein, on which short drifts have been run both ways from the crosscut. The vein on the lower level attains a width in places of 8 feet, very much oxidized and shattered.

The following samples were taken:—

No.	Width. Inches.	Location.	VALUES.	
			Gold.	Silver.
			Oz.	Oz.
1	..	Broken quartz from two open-cuts on the surface west of where stope breaks through.....	0.90	0.3
2	20	Across E. face, upper tunnel, 6 inches quartz, balance oxidized.....	0.02	Trace.
3	6	Quartz, W. face, upper tunnel.....	0.06	0.2
4	22	Quartz, 10 feet back from W. face.....	0.02	Trace.
5	20	Quartz, 20 feet back from W. face.....	0.02	Trace.
6	16	Quartz, at top of W. end of 8-foot winze.....	0.02	0.1
7	10	Quartz, bottom of E. face of winze.....	0.04	0.4
8	20	Quartz, 33 feet E. of E. end of winze, half-way to W. end of stope.....	1.68	0.4
9	24	Broken-up quartz, 20 feet from E. face, lower tunnel.....	Trace.	Trace.
10	18	Quartz, W. face, lower tunnel.....	Trace.	Trace.

Samples 1 to 8 would seem to indicate that some quartz west of the stope is of workable values, but the tonnage would be small.

The continuation of the lower tunnel to get into more solid quartz and away from the oxidizing effects near the surface might expose another ore-shoot containing such values as that stoped from the upper level. Also the continuation of the upper tunnel west might be good exploration. It seems to be about all that can be done.

This group, consisting of six claims—*Lakeview, Lakeview Extension, Lakeview Lakeview Group, No. 2, Lakeview No. 3, Golden Hill, and Golden Hill No. 1*—is owned by Sands, Morrison & Hodges, of Discovery, B.C. The claims are situated on Star mountain, between Birch and Boulder creeks, and are well located for mining and transportation. The rock formation is a dioritic rock, altered for a foot or two on each side of the vein, which is of quartz slightly mineralized with pyrite, galena, and an occasional speck of native gold. A tunnel has been driven 140 feet on the vein, showing it to have an average of 2 feet. It is a fine-looking vein. About 75 feet above the tunnel a shaft has been sunk on the vein to a depth

of 50 feet, and an open-cut run along the vein above the shaft for a length of 60 feet. A sample taken from the dump at the collar of the shaft gave low values in gold and silver. It is a very good showing of quartz, but evidently of insufficient values, so far as opened up, to give much encouragement for further work.

PLACER OPERATIONS.

I am indebted to the Gold Commissioner, J. A. Fraser, for the following information on placer operations of the Atlin Mining Division.

The output of placer gold for this year is less than that for the past few years, due to the increasing scarcity of labour, expensive operating, and, in cases, water shortage. The production totals about \$218,000 for this year, as compared with \$305,000 for 1917.

On McKee creek the only operator has been the Delta Gold Mining Company, working company ground under the management of George Adams. About eight men were employed throughout the season and the output was about \$5,000.

On Pine creek two groups of laymen were operating. Mobley and Schultz had eleven men working at Discovery, using five "giants," three for washing and two for stacking tailings. Two pits were sluiced, producing approximately \$25,000.

About a mile above Discovery, on Tar flats, the Atlin Gold Mines Company, under the management of J. M. Ruffner, had six laymen working. No returns of production available.

On Birch creek the Dominion Trust Company ground was worked on a "lay" by H. P. Pearse and three partners. Water was very scarce and a comparatively small yardage of gravel was moved. No returns.

On Boulder creek Charles Miller had two "lays"—one working seven men, which produced \$21,000; the other, drift-mining, employing three men, whose output was \$4,000.

Above Miller, Gus Anderson with a couple more men took \$4,300 out of his own ground.

Farther up the creek, J. H. Black and partners took out about \$2,500.

On Ruby creek the Placer Gold Mines Company, operating under the management of T. M. Daulton, who had in his employ about fourteen men during the season, produced about \$65,000. This company has good ground, a good outfit, and under efficient handling appears to be operating about as successfully as any in this section.

Hy. Irish and G. A. Colburn were working their own ground on this creek. No returns.

On Otter creek the Mines d'Otter, under the management of H. Maluin (J. E. Moran, foreman), employing about six men, produced \$11,000.

Spruce Creek.—There has been considerable discussion for the last year or two amongst the operators on this creek regarding the construction of a bed-rock drain to serve the different leases requiring it. On instructions from the Mines Department, I made a trip in last winter to look over the situation and get what data and information available at that time of the year. Three alternative routes were selected and submitted to the Department, together with an approximation of the cost of construction. The Department signified its willingness to co-operate with the owners and operators whenever they had a definite plan and agreement amongst themselves. There are many complications in connection with the scheme which will no doubt be worked out to every one's satisfaction in time.

The largest operator on the creek this year has been I. Matthews, who owns and works considerable ground with several laymen. A total of thirteen men produced about \$41,000 for the year.

Otto Miller and partners, on their own ground, with three men working, took out good wages. The same applies to Smith, Conroy & Carlson on their ground, and J. R. Clay on his.

The Atlin Gold Mining Company, under the management of J. M. Ruffner, had several laymen on its ground, the results from which are not available at present.

A few other owners and laymen did a little prospecting.

On O'Donnell creek Noland & Darr did some prospecting.

White & Murphy worked, partly on a "lay." No returns.

A little prospecting was done on several other creeks, with unknown results.

CASSIAR DISTRICT.

ATLIN MINING DIVISION.

REPORT OF 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, 1918.

I regret that the returns disclose a falling-off in production as compared with the preceding year, but it exceeds that of some years in the past, when there was more than twice the number of men engaged in mining in the district. Owing principally to war conditions, there were less than 400 people (men, women, and children) in the district, and not more than 150 were engaged in actually mining the amount produced. The revenue derived from purely mining sources exceeds that derived from similar sources in 1917, as do also the aggregate receipts from all sources. As in other years, a considerable amount of the gold actually produced has not been reported within the year, and, as usual, some not at all. Indeed, one operator has, since December 31st and too late for inclusion in the returns for 1918, reported an output of about \$10,000 which was actually recovered early in the year (1918), and there are other lots of which I have some knowledge, but proper (or any) reports and returns of which I have failed to secure up to date.

The water-supply was very full and satisfactory on some of the creeks, whilst on others it was disappointing as usual, and in one or two instances the chief embarrassment was because of the excessive quantity, and the necessity for proper conservation and storage facilities was again emphasized, as it has been from season to season since the inception of the camp, and the effect was manifested by a lesser amount produced than might otherwise have been. The most serious handicaps, however, were the high cost of labour, of living, and of explosives, the latter being practically prohibitive, and, indeed, the condition of the labour market in conjunction with those other handicaps caused some operators to suspend operations altogether and others to close down earlier than usual.

I may say with respect to the labour situation that quite a percentage of the best men in the camp enlisted for active service while enlistment was possible, and last season practically all who were eligible under the "Military Service Act" were drafted, leaving the labour market at the mercy of foreigners, who did not hesitate to take advantage of the situation, and the result was the prevalence of a rate of wages which only those operating on the highest class ground in the camp could afford to pay, and those not so fortunately situated simply did as little as possible. In fact, unless there is some improvement in this situation which will reduce the cost of production, I anticipate a further falling-off in the aggregate amount produced this coming season.

McKEE CREEK.

Taking the creeks in the same order as in former years, I may say that on McKee creek the Delta Gold Mining Company, under the management of George Adams, commenced operations on May 1st, and with a force varying from sixteen to six carried on until September 2nd, when operations were closed down for the season. The supply of water on this creek was very satisfactory during the above-mentioned period, but, unfortunately, the previous winter's prospecting operations, which were conducted much lower down on the creek, failed to satisfactorily locate the exact position of the pay-streak, which had apparently passed from the bed of the creek at the point where the summer operations were being carried on, under a heavy overburden of gravel on the north side of the creek, and it was deemed advisable to close down and adopt a less expensive method of prospecting. Operations of that nature were commenced early this winter, and will probably be continued until the pay-streak is again satisfactorily located.

PINE CREEK.

Some of the properties held on this creek changed hands during the winter of 1917-18, a new organization known as the Atlin Gold Mines Company, under the management of J. M.

Ruffner, having acquired all the leases, plant, etc., formerly held and owned by the Atlin Consolidated Mining Company. The holdings, plant, and assets of the North Columbia Gold Mining Company, the Pine Creek Power Company, Limited, the O'Donnel Placers Company, and the Columbian Mines Company were acquired by F. H. Mobley, of Prince Rupert, who subsequently conveyed a half-interest to L. Schulz, of this place. I understand another new organization, to be known as the Discovery Mining and Power Company, Limited, has been formed, to which the leases and other assets above mentioned will be assigned in due course by Mobley & Schulz.

On a portion of the property acquired by Mobley & Schulz, known as the *Eastern* group of leases, a crew of laymen, of about twelve in number, operated hydraulically from June 24th until about October 31st with very gratifying results. I am not aware of any work being done on any of those holdings this winter, but I fully expect the new company will be operating in force next season, provided the labour situation does not prevent it.

About a dozen miners were engaged in drift-mining on the leases held by the late Charles L. Queen and the Atlin Gold Mines Company, but with what success I am not in a position to say, but I believe some of these operations were quite successful. There are a few men drifting there this winter.

SPRUCE CREEK.

This was again the banner creek of the district from the standpoint of production, although it was not quite as productive in proportion to the numbers engaged in mining as in 1917.

On the *Tobacco Box* lease and adjacent ground a few men were drifting, with much the same results as in 1917. The same remark applies with respect to the *Gladstone* lease.

On the *Peterboro* bench lease H. O. Morse, with an average force of seven men, carried on drifting operations throughout the winter of 1917-18 with satisfactory results, but closed down on May 1st because of labour difficulties. He opened up again in November and is "carrying on" throughout the winter.

On the *Lovell* group of leases Isaac Matthews still carried on through "laymen" and for some time operated on his own account, but the scarcity of labour affected this work also in the form of a diminished output, but the results per man employed ranked well up to those of former seasons.

On the *Mali* claim William Foley is still operating successfully as in former years.

On *Discovery* claim the Atlin Gold Mines Company, to which this property was assigned by J. M. Ruffner, carried on operations for part of the year, but presumably, owing to the difficulty in securing satisfactory labour in sufficient force, those operations were practically discontinued near the end of the year and its forces concentrated upon its Pine Creek holdings.

Open sluicing was carried on for a portion of the season by Smith, Conroy & Carlson, Otto Miller and partners, Marco Pini & Co., J. R. Clay, and others, with very fair results in some cases and varying success in others.

Nothing worth reporting was done at Blue canyon or Upper Spruce creek, although there were a few miners operating there.

There were about eighty people on this creek during the season, of whom about sixty were engaged directly in mining. There is a number of people on the creek this winter and drift-mining is being carried on quite successfully, the mild weather being very favourable to the prosecution of such operations.

BIRCH CREEK.

On this creek, I regret to report, the anticipations at the close of the former season's operations were not realized, and consequently a small force of men worked throughout the season and moved about 37,000 cubic yards of gravel, besides moving pipe-lines, etc., without realizing sufficient to pay going wages; but with commendable pluck the manager, H. Peplow Pearse, intends to try it yet another season.

BOULDER CREEK.

On Boulder creek from fifteen to twenty men operated throughout the season.

On lower Boulder creek Charles Miller had two sets of "laymen" operating; one crew of seven men was drifting and securing very good results. The other crew of three to four men

was hydraulicking farther up the creek and also secured very fair returns. This crew closed down in October, but those who were drifting are continuing throughout the winter and are realizing handsome returns up to date.

Farther up the creek Gus. Anderson, with about four men, and J. H. Black and partner, with a like number, operated throughout the season; the former by ordinary sluicing and the latter hydraulically. The former realized very fair returns, but the latter ran into some old drift-workings and also a section of poor bed-rock, the consequence being a considerable loss of time when the water was at its best, and a resultant output not up to that of former seasons. Those parties are looking forward to better results next year.

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 fourteen men continued until October 15th.

The exceptionally heavy snowfall the preceding winter resulted in an unusually heavy and excessive flow of water throughout the month of July, which prevented the usual manipulation of the water in the pits and through the by-wash for practically the whole month. This, coupled with the scarcity of labour, was responsible for a considerably decreased yardage of gravel being handled and a consequent diminished output as compared with the previous season, but notwithstanding these difficulties they advanced up-stream an average of 164 feet the full width of the pay-streak, which is 200 feet wide, and realized very satisfactory results.

This company has constructed another dam since high-water passed, which will provide an auxiliary reservoir for future operations, and which, it is expected, will conserve a sufficient additional supply of water to increase the output by 50 per cent.

CRACKER CREEK.

No report as to developments on Cracker creek has been presented, although I believe one or two men spent a part at least of the season on that creek.

GRANITE CREEK.

On Granite creek some prospecting-work was performed which resulted in the location of and application for three leases on said creek. I have no definite information as to further results, but expect next season will disclose those.

WRIGHT CREEK.

On Wright creek two men operated for a portion of the season and seemed well satisfied with the results for the time spent there.

OTTER CREEK.

On Otter creek the Mines d'Otter Creek, under the superintendence of J. E. Moran and the general management of H. Maluin, commenced operations on March 15th, and with a force varying from a minimum of four to a maximum of ten, or an average of six, carried on until the end of October. During that period about 1,200 feet of new sluice-flume was built and the sluice-blocks renewed in the 3,500 feet of sluice previously in use. About 200,000 cubic yards of gravel was removed and about 40,000 feet of a hard-pan bed-rock which underlies the gravel in that portion of the valley was uncovered, but the genuine bed-rock was not reached and the operators believe that it lies at a greater depth and below sluicing (hydraulic) grade, and unfortunately the hard-pan was not found to carry gold in paying quantities.

There was exceptionally high water on this creek early in the season, which threatened great damage and which was only averted by strenuous effort, but after that passed there was rather a scarcity of water, as there was very little rainfall in that locality.

An experiment was made during the season which it is hoped may to some extent solve the formidable cost of riffling and maintaining long lines of sluices. This was the riffling of the sluice with heavy flat rocks held in place by sandboards and relieved by alternate rows of wooden (rifle) blocks. The experiment is reported to have been quite a success and leads those operators to believe that it will be of material value to them.

Some years ago manganese-steel plates were introduced here and worked very well, but even they will wear out, and the price of iron has advanced to such an extent that a satisfactory substitute will be hailed with delight by hydraulic miners.

Some drifting is being done this winter for the purpose of, if possible, locating genuine bed-rock and better "pay," and if they are successful in so doing operations will continue next season, provided sufficient satisfactory labour can be secured; but if better "pay" is not thus located it is probable those operations will be discontinued until conditions improve.

The average wage paid during last season was \$7 a day, and this, taken in conjunction with the high cost of everything else, constrains those operators to believe that they will be justified in awaiting the return of more favourable conditions.

A fair amount of gold was won during the season, but not sufficient to cover expenses.

Nothing worth mentioning was done on upper Otter creek this season.

O'DONNEL RIVER.

On O'Donnel river a few men worked a short time on the *Gold Hill No. 3* bench lease, but the results of their operations have not been reported in any form.

On upper O'Donnel two men sank a shaft at the confluence of Feather creek and O'Donnel river and struck bed-rock at a depth of 50 feet, and just at the close of the season reported finding coarse gold in a drift which they started, leading away from the creek. They seem eager for the return of summer so that they may continue their explorations.

I have not been advised of any development-work being carried on elsewhere on this stream.

OTHER CREEKS.

Two and sometimes three men continued prospecting on Slate creek, but only succeeded in finding sufficient gold to induce them to continue, which, I understand, is their intention as soon as climatic conditions will permit.

I have not received any reports as to the results of development-work upon the properties held on Volcanic, upper Ruby, Davenport, Lincoln, Rapid Roy, Fox, Bull, or Wilson creeks, and, in fact, with the exception of Volcanic creek, I do not believe there has been any during this year; wages were too high and labour too scarce for much attention to be paid to prospecting of that nature.

No new strikes have been reported.

MINERAL CLAIMS.

The scarcity of labour and of capital for development purposes affected the quartz-mining industry also, as was the case last year, so that very little besides ordinary assessment-work was done upon any quartz properties throughout the district, with the exception of the *Engineer* mine on Taku arm and the *Maid of Erin* and associate claims in the Rainy Hollow section.

On the *Engineer* mine the usual force of from eight to fifteen men was employed during the summer, although again (as last year) they appear to have been practically "marking time" because of the illness of Captain Alexander (the recorded owner) and the continued negotiations on the part of certain capitalists for the purchase of the property.

Those were brought to a sudden and tragic end for the time being by the loss, on the ill-fated steamer "*Princess Sophia*," of Captain Alexander and his wife, together with three men who had been inspecting the mine, being a mining engineer, the manager for and an agent of the prospective purchasers, and since then everything about the mine is at a standstill.

On the *Maid of Erin* the owners had from five to ten people employed from June 1st until some time in September, mining, sacking, and hauling ore from the mine to Haines, Alaska, a distance of about sixty miles, for shipment to a smelter. They succeeded in shipping about 26 tons, and demonstrated the possibility of doing so even under the very adverse and trying conditions in the matter of roads and transportation facilities which exist.

The owners of this property, which contains a deposit of high-grade copper ore, believe that if the wagon-road which runs from Haines to the mine was put in such condition as to permit of the successful operation thereon of a Cleveland tractor (of which they have one on the ground) they could ship the product of the mine at a profit, and they are looking to both the Provincial and the Alaskan Governments to put the road in such condition.

Nothing was done towards developing the coal-deposits in the district, nor did the contemplated exploitation of the hydromagnesite-deposits eventuate.

OFFICE STATISTICS—ATLIN MINING DIVISION.

Free miners' certificates (individual)	353
Free miners' certificates (company)	4
Placer records	12
Placer rerecords (representing 241 claims)	226
Leases located	8
Leases issued	0
Leaves of absence (representing 140 claims)	31
Filings	2
Bills of sale (placer)	25
Bills of sale (hydraulic)	42
Bills of sale (mineral)	9
Mineral records	19
Certificates of work	119
Filings	2
Crown grants issued	2
Gold reported (individuals)	\$131,010 00
Gold reported (companies)	105,623 00
Total	\$236,633 00
Royalty paid (individuals)	\$ 1,661 05
Royalty paid (companies)	1,443 10
Total	\$ 3,104 15

Revenue.

Land revenue	\$ 4 00
Water revenue (rentals)	1,403 00
Free miners' certificates (individual)	1,705 25
Free miners' certificates (company)	405 00
Mining receipts (lease rentals)	2,945 00
Mining receipts (lease applications)	160 00
Mining receipts (other sources)	2,537 30
Mineral-tax (royalty)	3,104 15
Receipts from all other sources	8,975 35
Total	\$ 21,239 05

STIKINE AND LIARD MINING DIVISIONS.

REPORT OF 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, 1918.

Although the office statistics show an increase over the previous year, there has been no marked activity in the mining industry, brought about by the scarcity of labour caused through war conditions.

PLACER-MINING.

On Dease creek Hanimann & Ruepp were engaged doing development on the *Kangaroo* lease. On other creeks in this vicinity very little was done.

On McDanie creek a few men under Amos Godfrey carried on development on the *Princess May* hydraulic properties.

QUARTZ-MINING.

Work sufficient to cover assessment was carried out on the principal claims, whilst acreage-tax was fully paid up on all claims held on the Unuk river.

On the Iskut river Crown grants were issued on the following: *Red Bluff*, *Red Bird*, *Mermaid*, and *Homestake*, making thirteen Crown-grant claims in all in this group, held by F. E. Bronson and associates, of Wrangell, Alaska.

OFFICE STATISTICS—STIKINE AND LIARD MINING DIVISIONS.

Revenue collected from free miners' certificates	\$ 262 75
Revenue collected from mining receipts	880 20
Revenue collected from acreage-tax, mineral claims	220 50
Revenue collected from other sources	4,116 18
Total	\$5,479 63

SKEENA DISTRICT.

SKEENA AND BELLA COOLA MINING DIVISIONS.

By J. H. McMULLIN, GOLD COMMISSIONER.

I have the honour to forward you herewith office statistics for the Skeena and Bella Coola Mining Divisions. The annual report of the Resident Engineer, Geo. A. Clothier, fully covers these Divisions and I have nothing to add to his report.

I also enclose report received from the Mining Recorder of the Queen Charlotte Mining Division and office statistics forwarded by the Mining Recorder of the new Nass River Mining Division.

OFFICE STATISTICS—SKEENA AND BELLA COOLA MINING DIVISIONS.

Free miners' certificates (individual)	596
Free miners' certificates (company)	5
Free miners' certificates (special)	2
Mineral claims recorded	253
Placer claims recorded	5
Certificates of work issued	424
Bills of sale, etc., recorded	77
Filings	33
Certificates of improvements recorded	17

Revenue.

Free miners' certificates	\$3,258 00
Mining receipts, general	2,987 20
Total	\$6,245 20

NASS RIVER MINING DIVISION.

This is a new Mining Division created by Order in Council dated August 12th, 1918, given below. The territory comprised therein was formerly the northern part of the Skeena Mining Division.

The recording office of the new Division is at Anyox, with H. Andrew as Mining Recorder, and is under the jurisdiction of J. H. McMullin, of Prince Rupert, as Gold Commissioner.

The following is the official description of the Nass River Mining Division:—

The Nass River Mining Division be created to include the following defined boundaries, viz.: Commencing at a point on the western boundary of Omineca Mining Division where it is intersected by the height of land forming the watersheds between the Nass and Skeena rivers; thence south-westerly along the said height of land to a point where it is intersected by the height of land separating the watershed of the Kinnomax river on the north from the watershed of Khutzeymateen inlet on the south; thence along the latter height of land to a point on the said inlet immediately south of Somerville island; thence westerly across said inlet and along the centre of the channel separating the said island from the mainland, and continuing westerly to a point on the International Boundary-line immediately south of Wales island; and so as to include Wales island, Pearce island, and the said Somerville island in Nass River Mining Division; as well as that portion of the Skeena River Mining Division lying north of the hereby established boundary between the commencing point and the International Boundary.

OFFICE STATISTICS—NASS RIVER MINING DIVISION.

(For period extending from September 1st, 1918, to December 31st, 1918.)

Free miners' certificates (individual)	11
Mineral claims recorded	36
Certificates of work issued	94
Bills of sale, etc., recorded	36
Filings	7

Revenue.

Free miners' certificates	\$ 37 00
Mining receipts, general	453 50

Total \$490 50

QUEEN CHARLOTTE MINING DIVISION.

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, 1918.

PLACER LEASES.

Seventeen placer leases have been issued during the past year—five on the North beach; five at Rose spit, north end of Graham island, under the management of A. L. Flynn; and on the east coast, six under the management of R. R. Smith and one to Percy Sharpe.

These gentlemen are still very optimistic regarding their claims, though conditions have been very adverse for the development during the past year of strenuous war-work. Mr. Flynn has been compelled to cut down operations to the lowest possible limit owing to the lack of transportation facilities. The logging operations under the Imperial Munitions Board having first claim to all available cargo-space, Mr. Flynn found it impossible to get in the necessary supplies. This applies also to R. R. Smith, and in greater measure, as his claims lay farther down the east coast; in addition to which, Mr. Hascoe, partner with Mr. Smith, and inventor and owner, of the special hydraulic machinery now installed, was drafted into the army of the United States.

With the war at an end and the consequent release of labour and supplies, renewed activity is looked for.

MORESBY ISLAND.

Situated on the west coast of Moresby island. Operations on these claims, **Tasu Group.** which during 1917, I understand, shipped 400 tons of ore to Tacoma for the copper and iron values, of which I have received no statement, had to close down owing to the exigencies of the war.

JEDWAY.

Ike Thompson, Deputy Mining Recorder, Jedway, reports considerable activity throughout his territory.

The *Producer* mine, under bond to a Seattle syndicate and under the management of A. J. Cole, has a staff of eight men installing a hydraulic compressor plant, 400 feet of 10-inch pipe conveying the water; 250 feet will be driven to tap ledge 100 feet below bottom of 60-foot shaft.

A. Heino continues to make small shipments from the Copper islands, and several other owners have made small shipments, the returns from which are not yet available.

Wild & Campbell have a shaft 30 feet deep and a very hopeful showing on their several claims.

Ike Thompson has a good dump of ore out, showing 10 per cent. copper.

H. McEachern, on the *Hope* group, has uncovered a large body of good ore.

Ore bodies on the *McMullan* group are also being traced out.

Owing to the prevailing shortage of labour very little active work has been done on these properties; however, the ore shipped to the Granby smelter, Ikedda Mines, Anyox, B.C., for the first ten months of the year was 193 tons. Total contents: Copper, 57,404 lb., value \$12,850.04; silver, 695.74 oz., value \$680.75; gold, 51.45 oz., value \$1,029.10. A later shipment of about 15 tons of high-grade ore containing about 17 per cent. copper, \$7 silver, and \$5 gold a ton; and one of about 150 tons of ore containing about 7 per cent. copper, \$1.50 silver, and \$2.50 gold a ton, returns for which are not yet available.

LOCKEPORT.

Shuttle Island.—In the early part of the year a logging camp started operations on this small island, just off the east coast of Moresby island and in Darwin sound, a few miles south of Lockeport, resulting in the discovery on the beach of coarse free gold, several small nuggets being picked up. One placer claim and twenty-three quartz claims were recorded in consequence.

The Imperial Munitions Board soon closed down this logging camp, and most of the locators were sent elsewhere. No doubt these claims will be exploited now that the men have been released from the camps.

SKIDEGATE.

The closing of 1918 terminates the sixteenth month of active development-work on the *South Easter* group of claims. The work is being done by the Northern Customs Concentrators, Limited, of Cobalt, Ont., under the name of the South Easter Mining Company. A 30-horse-power oil-driven compressor, hoist, and drills have been used in carrying on the work. A continuous line of gold-bearing quartz-outcrops 6 to 8 feet in width extend practically the length of the claim. Near one of the showings a vertical shaft 100 feet deep was sunk; at 50 feet a crosscut intersected the main vein, called No. 2, and 125 feet of drifting was done on this lead. The vein continued strong, averaging 6 feet in width throughout this drift. Some further crosscutting and drifting on this level, amounting to 115 feet, gave three other well-defined veins averaging 4 feet in width, but carrying low values where cut.

On the 100-foot level 350 feet of drifting and raising on the No. 2 vein has indicated an ore-shoot. The continuation of one drift to develop this ore-shoot is in progress. Another drift along this vein in the opposite direction is under way to develop other ore-shoots farther up on the property as indicated by the large surface showings.

The gold occurs associated with galena, and in the clean quartz in very fine particles. This occurrence gives to the high-grade ore the appearance of being stained with patches of yellow mud, but under a glass the individual particles, metallic lustre, and characteristic colour are revealed. One to two ounces of silver and small percentages of lead and copper are associated with the ore. With the return to normal conditions, an increase in operations is contemplated.

OFFICE STATISTICS—QUEEN CHARLOTTE MINING DIVISION.

Free miners' certificates issued	162
Mining claims recorded (quartz)	65
Mining claims recorded (placer)	2
Certificates of work	69
Bills of sale and records entered	8
Placer leases issued	17
Placer leases applied for	2

Revenue.

Free miners' certificates	\$ 662 75
Mining receipts	996 25
Traders' licences	285 00
Firearms licences	155 00
Police Court fines	220 00
Marriage licences	40 00
General receipts	6 50
Poll-tax	15 00

Total \$2,380 50

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, 1918.

George A. Clothier, Resident Engineer, in his report on this Division, has fully reported on the mining operations during 1918.

OFFICE STATISTICS--PORTLAND CANAL MINING DIVISION.

Free miners' certificates	109
Mineral claims recorded	181
Certificates of work issued	270
Bills of sale, etc., recorded	79
Fillings	37
Certificates of improvements recorded	9

Revenue.

Free miners' certificates	\$ 596 75
Mining receipts, general	3,510 70
Total	<u>\$4,107 45</u>

NORTH-EASTERN DISTRICT (No. 2).

REPORT BY JOHN D. GALLOWAY, RESIDENT ENGINEER.

GENERAL REMARKS.

Under the provisions of the "Mineral Survey and Development Act" of 1917, the four Mining Divisions of Omineca, Cariboo, Quesnel, and Peace River were made to constitute the North-eastern Mineral Survey District, with headquarters for the Resident Engineer at Hazelton. A general description of the geographic features of the district, together with a bibliography of all published reports on the geology and mining features of the district, is given in the Annual Report of the Minister of Mines for 1917, so that it is unnecessary to repeat it this year.

In the 1917 Annual Report different portions of the North-eastern District were denoted under different headings as "sub-districts." This year the subdivisions have been extended, and the term "section" is used as more suitable than "sub-district."

The North-eastern District consists of the four Mining Divisions, as stated before, and these Divisions are subdivided for the purpose of this report as follows:—

Omineca Division—Skeena River Section; Hazelton Section; Telkwa Section; Sibola Section; Manson Section.

Cariboo Division—Fort George Section; Quesnel Section; Barkerville Section.

Quesnel Division—Horsefly Section; Keithley Section; Quesnel River Section.

Field-work in this district can only be commenced about the beginning of June and continued until the end of November, as in the higher elevations, where nearly all the claims are staked, there is snow on the ground for six months in the year. For this reason the Resident Engineer, during the first five months in 1918, was in the Victoria office engaged in preparing the report of the previous year's work and assisting in the compilation of the Annual Report of the Minister of Mines.

More attention was given to the Cariboo and Quesnel Divisions this year than in 1917, with the result, as the district is a large one, that less field-work was carried out in Omineca Division than in the previous year. A reconnaissance in the Peace River Division was contemplated for the season, but lack of time prevented this work being effected.

The lode-mineral production for 1918 declined as compared with 1917, and this with a lessened placer-gold output makes the total mineral-output for the North-eastern District less than in the previous year.

The following table shows the mineral production of the North-eastern Mineral Survey District for the year 1918:—

	OMINECA.		CARIBOO.		QUESNEL.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold, placer.....	400 oz.	\$ 8,000	3,000 oz.	\$60,000	1,000 oz.	\$20,000
Gold, lode.....	985 oz.	20,330	.....	.....	.....	.....
Silver.....	84,125 oz.	77,366	.....	.....	.....	.....
Lead.....	128,568 lb.	8,242	.....	.....	.....	.....
Copper.....	643,843 lb.	158,578	.....	.....	.....	.....
Zinc.....	313,112 lb.	21,780	.....	.....	.....	.....
Miscellaneous materials.....	.....	3,600	.....	2,500	.....	1,000
Coal.....	.....	2,350	.....	.....	.....	.....
Total values.....	.....	\$300,496	.....	\$62,500	.....	\$21,000

Total value of mineral production, North-eastern District, \$383,996.

It will be noted that in the above table Peace River does not figure at all; so far as is known, no mineral production has ever been officially recorded from this Division. Prospecting for placer gold has been done on the Peace river and tributary streams, and probably small amounts of placer gold have been taken out in this way; it is certain, however, that this has

never amounted to more than a few hundred dollars in a season. As a hopeful sign for the future, it may be noted that fifteen dredging leases were taken up in this Division during the summer of 1917. Systematic prospecting of these leases, to test them for dredging possibilities, will be carried out next year by the lessees, Wadley & Galbraith.

The copper-output of the district during the past three years has been chiefly from the *Rocher Déboulé* mine, and this year the output from this mine has been less than in former years.

The zinc and most of the silver and lead output comes from the *Silver Standard* mine; this property is now in good shape to make an increased production in the future.

The hydraulic mines in the vicinity of Barkerville, which annually produce the greater part of the gold-output of the Cariboo District, had a poor year in 1918, which served to further lessen the year's production. Spring freshets took off the winter's snow too quickly, and a long dry spell following caused the mines to be short of water most of the season, with the result that a smaller yardage than usual was handled. The production from these mines is almost directly proportional to the water-supply, and the 1918 season was a bad one.

Mining in the Province practically commenced in this district in the working of the phenomenally rich placer-gold creeks of the Cariboo in the early sixties. The gold production of the Cariboo was large for a few years, and then, like all placer-fields, rapidly declined; now the annual production, which comes mainly from a few hydraulically operated properties, is comparatively small. In the last twenty years much money has been expended in the Cariboo in expensive plants to work the deposits of low-grade gold-bearing gravels which could not be worked by the old-time methods. With few exceptions, these enterprises have been failures; lack of engineering skill and adequate preliminary testing of the ground have undoubtedly been the chief reasons for many of these failures. The Cariboo District, however, still has many possibilities for the large-scale working of its low-grade gravels. The great handicap in many instances is lack of water for hydraulic operations, while, in most cases, to lay on an adequate supply of water means a big capital investment for ditches, flumes, and pipes. In the future some areas may be worked by dredging.

Many attempts have been made in the past to mine quartz veins in the vicinity of Barkerville and Stanley, but none have proved successful; many of these enterprises were badly conceived and never had a chance to make good. Repeated failures have given the district a bad name as regards lode-mining, with the result that it has been difficult in recent years to interest capital in any new properties or showings. There is now, however, some renewed interest in the possibilities of gold-quartz mining in the Cariboo.

During the last two years the production of gold throughout the world has seriously declined, due to the economic conditions of high prices for labour and supplies, while the gold produced remained at the same value. In other words, the gross revenue of a gold-mine remained the same, while the operating expenditure was greatly increased, so that the margin of profit decreased, or in some instances vanished, with the result that the mines had to close down. The Cariboo District has suffered from this cause, and also so many men left for active service in the war that the number of individuals placer-mining in a small way was materially less than in former years; and the shortage of labour handicapped larger-scale operations. Now that the war is over this adverse economic condition against gold-mining may be expected to gradually adjust itself. As one result, more interest will be taken in the acquiring and developing of gold properties.

It may be expected, therefore, that with the return of many men from the Front and the renewed interest now being taken in gold-mining, the Cariboo District may again secure the attention that it deserves.

At present the only important active lode-mining area in the North-eastern District is the territory along the Skeena and Bulkley rivers, including the Bulkley and Babine mountains. For some years before the construction of the Grand Trunk Pacific Railway, claims had been staked in this area and some attempts at mining had been made along the lower Skeena river; but it was not until the completion of the railway in 1914 that any great headway was made. Considerable progress was made in 1914 and 1915, but in the last three years mining activity has not progressed as rapidly as had been hoped.

The chief cause of this can be ascribed to conditions arising out of the war. While it is true that metal prices have been high, this has mainly stimulated mines actually producing and

has not induced the development of new properties, except where quick returns were in sight. On the other hand, the scarcity, inefficiency, and high cost of labour, the high cost of mining supplies, especially powder and machinery, and the scarcity of capital for speculation has had a retarding effect on the development of new mining properties. It may be expected, however, that the return to normal conditions will cause greater activity in this district during 1919.

The district has as yet few productive mines, although undeveloped prospects and partially developed properties are numerous.

Considerable interest was shown in the coalfields of the Telkwa Section during the year. The high cost of fuel-oil and the steadily increasing price of coal on the Pacific Coast are conditions which have aroused interest in undeveloped coalfields. During the year the Grand Trunk Pacific Railway, on the division from Prince George east, changed from oil-burners to coal-burning locomotives, and it is quite possible that if a suitable local supply was available the division from Prince Rupert to Prince George would also be equipped with coal-burners.

Production of coal in a small way was started late in the fall from the Telkwa Collieries, situated four miles from Telkwa. By the end of the year an output of about 40 tons a day was being shipped, mainly to Prince Rupert.

In the North-eastern Mineral Survey District many areas contiguous to the Grand Trunk Pacific Railway have been partially prospected and many claims staked, but careful examination, such as has been carried out in some of the older camps in British Columbia, has not yet been done. In addition, there is a great deal of country, both north and south of the railway, which is as yet quite unprospected, but in which the general geological conditions are favourable for the occurrence of economic minerals. It is to be expected that the return of many men to the country now that the war is ended will result in a general revival of prospecting. Undoubtedly many of the prospectors who enlisted will return to their old occupation, while the free, adventurous life of the prospector, with its promise of possible spectacular returns, will make a strong appeal to many returned soldiers who before the war had led indoor lives. The North-eastern Mineral District should secure a considerable number of these returned men who are desirous of following such a life.

OMINECA DIVISION.

SKEENA RIVER SECTION.

This section includes the territory contiguous to the Skeena river and its tributaries, between Copper City and Skeena Crossing. The more important localities in which claims have been staked are: Vicinity of Usk, Kleanza creek, Copper river, Chindemash creek, St. Croix creek, Legate creek, Fiddler creek, and Skeena mountain.

In the 1914 Annual Report there is a report by W. M. Brewer on this section which covers most of the more important properties. Since then the Annual Reports contain further information.

Kleanza and Legate creeks were not visited this year owing to lack of time, although a number of prospectors were busy all season on Legate creek. A description of the more important claims on these creeks can be found in last year's Annual Report. The *Fiddler* group, on Fiddler creek, was described in detail in the 1916 Report, and since that time no further work has been done.

This property, consisting of the *Emma*, *I.X.L.*, and *Boot Jack* claims, is situated on the east bank of the Skeena river about half a mile north from the Government ferry across the river from Usk, a station on the Grand Trunk Pacific Railway. The property is Crown-granted and is owned by the Skeena River Mining Company, the control of which is held by Mrs. Clifford, of Vancouver. The claims were worked about twenty years ago, since when no work has been done. The property is well situated for economical working, being close to the railway.

At a point 500 feet above sea-level, or 200 feet above the Skeena river and 1,300 feet distant from its east bank, there is outcropping a quartz vein which strikes easterly up and down the mountain. This vein varies from 1 to 4 feet in width, and in places is mineralized with chalcopyrite, bornite, and pyrite occurring irregularly disseminated in the quartz; oxidation has in places produced the copper carbonates, malachite, and azurite. The vein is well defined and generally has a talc gouge on both walls. The enclosing country-rock is a fine-grained diorite porphyrite, in places somewhat schistose.

Just below the original outcrop of the vein an adit-tunnel has been driven on the vein for a distance of 170 feet. For the first 65 feet the tunnel is closely timbered and the vein cannot be seen, but beyond this to the face the vein is seen to be continuous throughout, and averages about 3 feet in width, having a dip of about 45 degrees to the east.

The main values are said to be in gold, apparently occurring with the copper and iron sulphides. A sample of the quartz free from sulphides on assay only returned traces of gold and silver. A sample of the mineralized quartz by W. M. Brewer in 1914 returned: Gold, 0.3 oz.; silver, 1.9 oz.; copper, 3.3 per cent.

This vein is reported to outcrop again 1,000 feet up the hill, where an open-cut shows it to be from 6 to 10 feet wide, consisting of quartz mineralized with bornite, pyrite, and copper carbonates. A representative sample by W. M. Brewer gave: Gold, 0.02 oz.; silver, 8.04 oz.; copper, 6 per cent. The vein on this property is promising if it can be shown to carry appreciable pay-shoots of the sulphide ore.

Old Hickory Group. This group of eight claims, owned by A. J. Kelch, is situated close to the Skeena river on the opposite bank from the village of Usk. The showings are distant about a mile from the river in a small hill rising above the general level of the river-valley. Mr. Kelch has a good cabin here and a nice garden

with plenty of small fruits growing in it. The formation at this point consists of volcanic rocks, mainly andesites and diabase. The vein (so called) is apparently a felsitic dyke striking cleanly through the volcanics in a north-easterly and south-westerly (magnetic) direction. This dyke is sparingly mineralized with chalcopyrite and bornite. Low gold and silver values are associated with the copper contents. The dyke-rock forms the gangue, through which there is some development of quartz and epidote.

A tunnel has been driven in some distance on the dyke, but the amount of copper mineral showing in the tunnel or taken out in the work is quite small in amount. Much larger ore-shoots would need to be found before the property would be of possible economic value. Above the tunnel and going up the hill the dyke has been exposed by several open-cuts, but nowhere is there any appreciable quantity of ore developed. There are other indications found on the hill in the shape of copper-stain, and further prospecting might find a more promising place to work than the tunnel showing.

This property, situated close to Usk and owned by the Kitsalas Mountain **Cordillera Group.** Copper Company, was fully described in last year's Report, and there is but little to add this year. Work was carried on during the summer and fall with from four to six men, but later in the year work was stopped and will not be resumed until next spring. Driving of the crosscut tunnel started in 1918 was continued until it had intersected the main vein and for a further distance of 50 feet. The point of intersection is about 200 feet along the strike, from where the surface incline was sunk on the vein. Surface cuts and the incline shaft show the quartz-filling to be mineralized with bornite and chalcocite, and in places free gold associated with the copper minerals, but where cut in the tunnel the quartz has practically no sulphides in it, and consequently little or no values. It is expected, however, that by drifting on the vein towards the surface mineralized outcrops, an ore-shoot carrying sulphides will soon be entered. It has been pretty well proved that the unmineralized quartz carries little or no gold.

In driving the crosscut tunnel, at a point 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. As the indications are encouraging, it is probable that the first work on the property next season will be to continue development of this vein, either by drifting or sinking on it.

This property adjoins the *Cordillera* to the south, and is owned by L. E. Moody and Richard Lowrie. **Lucky Luke.** It 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, chalcopyrite, and a little pyrite. The presence of copper carbonates and iron

oxides indicate the usual surface oxidation. Specimens showing free gold occur frequently, the colours of gold, as a rule, being quite small and associated mainly with the bornite.

A tunnel has been driven 55 feet on the vein, the strike of which is a little west of north and the dip about 60 degrees to the east. In places the vein is well mineralized with the copper minerals occurring in bands and bunches. The showing at the face of the tunnel is good and should encourage the further driving of the tunnel.

A sample of selected ore from a 5-ton dump at the mouth of the tunnel assayed: Gold, 2.48 oz.; silver, 1.52 oz.; copper, 11 per cent. A considerable part of the vein is white quartz, but a pay-streak of this rich ore comes in in places.

About the end of the year a lease on the property was obtained by three men, who erected a cabin on the claim and intend working on the property all winter.

HAZELTON SECTION.

Rocher Déboulé Mountain.

During the last three years the *Rocher Déboulé* mine has been the most important one in the district, but the exhaustion of the developed ore-bodies in the upper levels caused a decreased production in 1918. The mine was closed down in October, the reason given being: "It was thought best to suspend operations until such time as conditions become normal again." This property has been shipping since April, 1915, and up to the end of 1918 had produced 39,833 tons of ore, containing 4,214 oz. gold, 62,865 oz. silver, and 5,746,306 lb. copper.

In the 1914, 1916, and 1917 Annual Reports will be found detailed descriptions of the mine, its ore occurrences and development, so that repetition of this is unnecessary here. A brief summary, however, will be given.

The *Rocher Déboulé* mine is situated on the north-west side of Juniper creek, a short distance below the head of the creek. It is connected by a good wagon-road to Skeena Crossing, on the Grand Trunk Pacific Railway, ten miles distant. The ore is transported to Tramville on the railway by a 4½-mile tramway system consisting of a surface tram and an aerial tram in two separate sections. A hydro-electric plant on Juniper creek supplies power for the mine, in addition to which a 20-horse-power distillate-engine has been installed at the mine as an auxiliary when the water is low. Comfortable bunk-houses, offices, and all necessary buildings and appliances for a working force of 100 men have been erected in the valley of Juniper creek. The office is at an elevation of 4,000 feet, while the upper and first mine-workings are up the hill about 1,200 feet above. An incline power tramway from the power-house to the 300-foot crosscut level was installed for taking men and supplies from the camp up to the mine.

There are four veins traversing the hillside which are approximately parallel, striking N. 80° E. (mag.) and dipping from 45 to 85 degrees to the north. The vein which first attracted serious attention and has been most developed is the one cropping out highest on the hill and known as the No. 4 or main vein.

These fissures have been formed by shearing, which as a rule produced a crushed zone rather than an open fissure. The deposition of ore in the vein was therefore mainly a replacement process whereby the crushed granodiorite was replaced by metallic minerals and gangue-matter. The veins are therefore of the sheared-zone replacement type.

The metallic minerals present are chalcopyrite, pyrite, pyrrhotite, arsenopyrite, galena, zinc-blende, and tetrahedrite. The gangue consists of altered granodiorite, hornblende, quartz, calcite, and siderite. The main important mineral is chalcopyrite, although in one vein the galena-tetrahedrite content is appreciable.

After some preliminary prospecting had been done, the mine was opened up by a 650-foot crosscut tunnel known as the 300 level, which intersected the main vein. From this working four rich ore-shoots were worked out practically to the surface, and by underhand stoping for varying distances from 50 to 175 feet down below the level. A winze was sunk from this level for 200 feet and the vein drifted on at this 500-foot level. The known ore-shoots did not go down this far and no new ore-shoots of importance were found. This level was therefore abandoned.

A comprehensive development plan was laid out in 1916, when the low level, or 1,200-foot level was started. This crosscut tunnel, the portal of which is 900 feet below the 300-foot level,

has been driven in 3,100 feet, cutting three of the veins and a fracture which is very probably the main vein. No. 1 vein, which is an unimportant one, was cut where the backs on it are 180 feet; No. 2, 460 feet; No. 3, 1,050 feet; and No. 4, 1,180 feet to the 300-foot level. Considerable doubt existed as to whether the main vein had been cut, and the tunnel was continued for some distance past the fissure, which was intersected at about the right place for this vein. On the assumption later that this fissure was the main vein, it was drifted on in both directions, but no ore-shoots were found. An incline raise from the 1,200-foot level to the 500-foot level, following as closely as possible the course of the main vein, has been projected in order to explore this vein between the two levels. A start was made on this raise, but it was only put up a short distance when the mine was closed down. It is hoped that by connecting these two levels by this raise and then crosscutting the vein at intervals further ore-shoots may be discovered. Some drifting was also done on the No. 3 vein, where some milling-ore was discovered.

On the No. 2 vein a good shoot of rich ore had been discovered near the surface in a prospecting-tunnel, and much ore was taken out on this level, known as 1,002. Drifting on the 1,200-foot level on this vein disclosed additional high-grade ore, and this vein has now been opened up for 1,500 feet or more. For most of this length the vein contains milling-ore, but only one good shoot of shipping-ore was discovered. All the ore shipped in 1918 and part of that in 1917 came from this vein. Shortly before closing down a winze was put down on this No. 2 vein from the 1,200-foot level which shows a shoot of shipping-ore averaging about 2 feet in width.

No. 2 vein is mineralized in part with silver-lead minerals and in part with copper-iron minerals, the latter being the more important. In many places these two mineral types occur in separate bands in the vein, but occasionally they are intermingled. Where galena and tetrahedrite occur good silver values are obtained. The lead content of this vein as a whole is quite unimportant, but the average gold and silver contents are higher than in the copper ore of the main vein.

With further development this vein, which runs from 2 to 8 feet in width, may provide a sufficient tonnage to keep a small mill running. In addition to this, other substantial shoots of shipping-ore can be expected.

This property was worked continuously throughout the year with a small force of men. The 1916 and 1917 Annual Reports contain reports on the **New Hazelton Gold-Cobalt Co.** property, giving details of the veins, development, etc., up to the beginning of 1918. The property is situated on the western slope of Rocher Déboulé mountain, five miles from Carnaby. The camp is at an elevation of 4,200 feet and the upper tunnel 5,655 feet. Until late in the fall Dalby Morkill was superintendent when Duke Harris took charge of the work. The upper tunnel, which is a drift on the vein, was in 712 feet when work was stopped some time ago. At 40 feet from the portal a stope from the tunnel was put up, extending 30 feet in length and 40 feet upwards, tapering at the ends. At 370 feet from the portal a raise was put up 100 feet on the vein, and from this level a drift run 84 feet to the west. At 450 feet from the portal a winze has been put down 22 feet.

The winze and raise both show the vein to carry ore in bunches and bands varying from 3 to 18 inches in width. This ore is mainly arsenopyrite carrying gold values, together with more or less molybdenite. While the mineralization in the vein is very spotted, some ore could be stoped out.

A lower tunnel was started 250 feet below the main tunnel; it was driven as a crosscut for 75 feet and then as a drift on the vein. On November 1st this drift was in 149 feet and work was being continued. Throughout this working the vein carries a shoot of ore, more or less continuous, and varying in width from 6 to 18 inches. This ore is a mixture of sulphides and arsenides of iron and cobalt and some molybdenite.

The pure arsenical iron-cobalt ore in this vein carries from 2 to 5 oz. of gold to the ton and varying percentages of cobalt up to 7 per cent. The molybdenite content of the vein is quite variable. During the year a car-load of gold-cobalt-molybdenum ore which came from the upper tunnel was shipped to the concentration plant of the Mines Branch at Ottawa. The car contained 53,288 lb. dry weight, and the analysis on it was: Gold, 1.24 oz.; MoS_2 , 1.40 per cent.; MoO_3 , 0.18 per cent.; cobalt, 1.12 per cent.; nickel, 0.60 per cent.; arsenic, 8.98 per cent. The shipment was divided into three lots and treated in different ways in order to find a suitable process for concentrating the ore. The report submitted on the testing says: "The object of the test-

work was to concentrate the values in the ore and also obtain a separation of these values as far as practical. As the cobalt, nickel, arsenic, and gold values were intimately associated, it was feasible to concentrate these by water-concentration and also to obtain a separation and concentration of the molybdenite values by flotation. . . . The actual recoveries on this car-load of ore were as follows:—In table concentrates: Cobalt, 72.6 per cent.; nickel, 87.5 per cent.; arsenic, 84.9 per cent.; gold, 83.5 per cent. In flotation concentrates: Molybdenite, 54.4 per cent. These recoveries should be improved upon in practice where a closed circuit could be maintained and the losses due to handling and slime-overflow would be reduced to a minimum."

A car-load of ore was taken out of the stope in the upper tunnel and was packed down to Carnaby on the railway, but it is believed this was not shipped before the end of the year. The main value in this ore is gold, and it will probably be shipped to some British Columbia smelter. It is expected to assay between \$60 and \$80 a ton in gold. Any cobalt contained would not be recovered if smelted within the Province.

During the summer work was commenced on another vein on the property, which is supposed to be a continuation over the ridge of the main *Rocher Déboulé* vein. Some work was done on it a few years ago before the present company owned the property, but without any definite results.

The outcroppings of the vein are very much leached and oxidized and occur in broken ground and talus material. Owing to these conditions it is difficult to prospect the vein. A tunnel has been driven as a crosscut for 25 feet and a further 93 feet along the supposed strike of the vein. The ground is all broken, but contained bunches of vein material showing copper-stain. Work was being continued to drive ahead this tunnel, and it seemed as if a solid formation would soon be reached where the vein may be found properly in place.

During the year a 1,000-foot 2-bucket tram was erected from the portal of the upper tunnel down the hill. From the terminal of this tram the ore is packed down to the railway. A blacksmith-shop was built and things put in shape for continuing the work all winter.

The holdings of this company comprise the *Delta* and other groups of claims **Delta Copper Co.** and a control of the stock in the company owning the *Highland Boy*; all these claims are on *Rocher Déboulé* mountain, lying to the east of the *Rocher Déboulé* mine. The financial obligations involved in acquiring this property were such as to impose some difficulties on the company, with the result that funds were not available to carry on active development and mining. Not much work has been done, therefore, on the property during the last two years.

At the present time, however, the company is reported to be in good shape, with the property practically paid for and funds in hand for settling outstanding liabilities and providing for further work. Late in the fall a few men were put to work, but it is not expected that much will be done before the spring of 1919. The property has been described in detail in the Annual Reports of the Minister of Mines for 1916 and 1917.

Intermittent work in a small way was carried on at this property during the first half of the year with satisfactory results. Owing to the difficulty of obtaining miners and the general unsatisfactory conditions for development mining, the work was stopped. It is expected development will be resumed next spring.

The driving of a development tunnel on this property was started in 1917 and continued during the first two months of 1918. Work was then stopped and nothing further has been done since.

This group owned by Barney Halloran and William Thompson, is situated near the head of Mud creek on the north-eastern side of *Rocher Déboulé* mountain. From the Hazelton-Telkwa road a trail six miles in length goes up Mud creek to the claims. In the basin at the head of the creek a small

cabin has been built; the workings of the claims lie up the hillside some distance above the cabin. The main vein on the property is a shear zone in granodiorite of varying width up to 10 feet. Where wide the vein consists of parallel fractures with unaltered granodiorite lying between. Bands of quartz appear in places in the vein, but elsewhere the gangue material is altered granodiorite. Metallic minerals are only present in very small quantity. Pyrite was the most abundant sulphide present in the ore, but on the surface it has been pretty well oxidized to limonite, with the result that the whole vein is rusty and iron-stained. Small quantities of chalcopyrite were noted, but not in sufficient amount to be of importance. Molybdenite and

wolframite occur in the gangue, but very sparingly distributed. The property has been considered to be of value on account of the wolframite content in the vein-filling, but average assays show that, at least on the surface, the wolframite content is not of commercial importance.

The vein, which strikes N. 67° W. and is well exposed running up the hillside, which has a slope of at least 45 degrees, crops out right up to the summit of a small ridge, and then continues nearly level for a few hundred feet to where it disappears under rock-slide. Beyond this in a bluff a well-defined iron-stained fissure can be seen which is probably a continuation of the vein.

A number of open-cuts and short tunnels have been made along the strike of the vein to prospect the ore occurrences. At an elevation of 4,900 feet a small opening shows a band of oxidized vein material 16 inches wide, which, however, does not show appreciable mineral content. At 4,940 feet elevation a big cut shows a width of about 15 feet between extreme walls. The vein here consists of a number of streaks of quartz, the widest of which is 1 foot, and bands of granodiorite lying between. Six stringers totalling 4 feet in width in this cut were sampled, and on assay gave: Gold, trace; silver, 0.4 oz.; tungsten, trace. The vein-filling in these stringers is considerably leached, with some limonite and copper-stain through it. Small amounts of pyrite and chalcopyrite were noted.

At 4,965 feet elevation a tunnel has been driven 12 feet. At the face the vein proper is 2½ feet wide, with 14 inches of rotten quartz in the centre. The vein-filling is oxidized and carries black and red oxide of iron, sericite, and other decomposition products, with a 3-inch layer of gouge on the wall. A little molybdic oxide and molybdenite were noted. A sample from this opening only returned a trace of tungsten.

On top of the ridge there are three small cuts on the vein all close together. The best showing on the property is in the most southerly of these cuts. The vein is 3 feet wide, with 1 foot on the hanging-wall which is more mineralized than the remainder. A sample across the vein assayed: Gold, 0.06 oz.; silver, 0.6 oz.; tungstic oxide, 2.56 per cent.

A small cut 25 feet north of the last one shows the vein 5½ feet wide, consisting of leached-out gangue rock, with the exception of an 8-inch streak of quartz carrying pyrite. A sample across 5½ feet returned: Gold, trace; silver, trace; tungstic oxide, 0.4 per cent.

An open-cut at the peak of the ridge, 30 feet north of the last one, shows 2½ feet of a vein consisting of rusty quartz, sericite, hornblende, limonite, and decomposed granitic rock. Some calcite was noted here and quartz crystals are developed in vugs in the vein. A sample only showed a trace of tungstic oxide.

The only opening on the vein which shows an appreciable wolframite content is the main cut on the ridge. Here pieces of wolframite as big as a walnut have been taken out and small crystals are disseminated through the crumbly, oxidized vein-filling. This vein was rather extensively sampled, as it was thought that wolframite might occur throughout the gangue in such small particles as to be indistinguishable to the eye. The results of sampling do not show this to be the case. At the time of examination a series of samples were taken by another engineer, and the results of these were even less encouraging than the results enumerated above.

This vein is strong and well defined and as a vein looks promising. It is possible that further development might show up shoots of wolframite ore which would pay to work. At the present time the demand for tungsten ore is not as great as it was during the war, but it is probable that the market will revive again.

This group of four claims is owned by Leverett Bros. It is situated on the south-east side of Rocher Déboulé mountain at the head of Seven-mile gulch. The elevation of the cabin is 3,945 feet and the showings are up about 400 feet higher. A trail which leaves the *Daly West* road and runs to the cabin is good enough for horses except the last half-mile. The formation here is granodiorite, the location of the claims being well within the granodiorite core of Rocher Déboulé mountain. The first showing is at an elevation of 4,250 feet, consisting of a tunnel driven in 34 feet on an acid dyke which has been considerably decomposed and kaolinized. There is no evidence of valuable minerals in this material. At some distance above the tunnel there is a small vein 10 inches in width striking up and down the hill. This carries a little arsenical iron, which, however, on assay showed only traces of gold and silver.

Near the top of a hog-back and at an elevation of 4,950 feet is a vein striking north-west and lying flat. On the footwall is a 10-inch band of quartz and hornblende carrying some

arsenical iron. Next to this is $1\frac{1}{2}$ feet of granitic vein-filling with hornblende, making a total width of the vein of 28 inches. A sample of the 10-inch quartzose band assayed: Gold, 0.24 oz.; silver, 0.3 oz.

The present showings on this property are not of importance, but further prospecting might show up some more promising parts of the veins.

This group consists of the *Blue Bird*, *Elizabeth*, and *Bromide* claims and is **Blue Bird Group**, owned by Geo. B. Tallman. It is situated five miles from New Hazelton in a southerly direction in the basin at the head of Mission creek. A wagon-road extends from New Hazelton to the *Daly West*, a distance of a mile, and from this road a trail branches off to the *Blue Bird* group. The formation here is entirely granodiorite of a very massive texture. A tunnel has been driven 36 feet, which crosscuts a wide dyke of felsitic rock and then continues on into granodiorite. The dyke strikes north-east and small fractures cut it at 45 degrees north and south.

Slight mineralization with chalcopyrite and pyrite occurs in these fractures. The fractures are so small and discontinuous and the mineralization so slight that the occurrence is of no importance and of no commercial value. The whole dump from the tunnel would not run more than a trace in copper. Further work on this showing would be inadvisable, but on account of the location of the property careful prospecting of the ground for definite veins might be worth while.

Silver Standard Mine.

The *Silver Standard* mine, owned by the Silver Standard Mining Company and situated on the north-western side of Glen mountain, six miles by road north of New Hazelton, had a satisfactory year in 1918, although for a number of reasons the output was curtailed, and at the end of the year the mine was temporarily closed down. Production for the year was 3,500 tons, containing 142 oz. gold, 62,121 oz. silver, 110,868 lb. lead, and 297,372 lb. zinc.

This mine has been described in the Annual Reports for the last six years, in which all details of the early development of the property, geological features, etc., can be obtained.

To summarize briefly: The property was obtained from the original locators, Long & McBain, by the present company in 1910, which carried on steady development until the fall of 1914, when the mine was closed down. Shipments over the railroad were commenced in 1913. In the summer of 1915 the mine was reopened with W. G. Norrie-Lowenthal as superintendent, and satisfactory progress has been obtained since that time. The mine was originally opened by an incline shaft which was put down 450 feet, with drifts at different levels; these workings total about 3,500 feet. A crosscut tunnel was driven at an elevation of 1,581 feet, which strikes the main hanging-wall and foot-wall veins at the 250-foot level of the shaft and connects with the shaft-workings.

The No. 4 vein that was cut by this tunnel has proved to be a valuable one, carrying shoots of high-grade shipping-ore as well as milling-ore. It has been developed by drifting from the tunnel-level and stopes have been started on it.

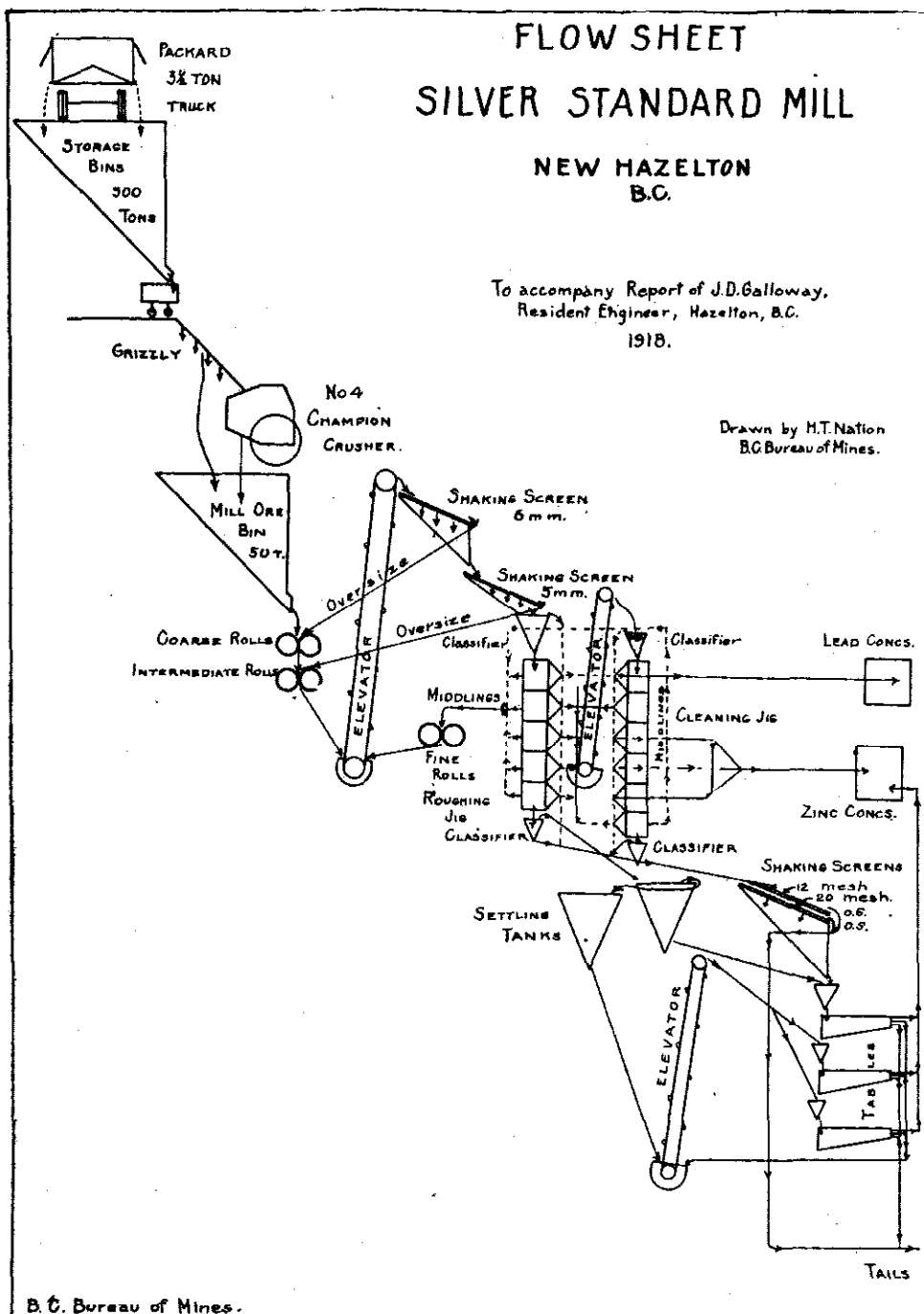
The old steam plant at the shaft has been dismantled, and now the tunnel is the shipping-point for the mine. At this point a power plant consisting of a 60-horse-power distillate-engine and a 5-drill compressor has been erected; the old boiler and compressor from the shaft have also been set up here and can be utilized when necessary.

There are in all nine veins on the property, roughly parallel and striking N. 25° E. (mag.) and dipping steeply to the south-east. The main vein splits into two fissures about the centre of the property, with an angle of about 10 degrees between the strikes of the hanging-wall and foot-wall veins, as the separated portions of the veins are called. The shaft was sunk on the foot-wall vein about 200 feet north of the intersection, and the shaft-workings have developed this and also the hanging-wall vein and the intersection of the two.

Nearly all the veins have been prospected more or less on the surface, but the principal underground workings are on the main fissure and its splits, and the No. 4 vein on the crosscut-tunnel level. Several of these veins will undoubtedly in the future be developed, as the indications are encouraging.

Near the end of 1917 the erection of a 50-ton concentrator was commenced, and this was completed in May. After the delays incidental to getting a new plant in operation the mill worked well and has proved satisfactory. While the mill was being built very little mining was done;

while a part of the time a small force was being kept on development. After the mill started a considerable accumulation of ore in bins and on the dumps was put through, so that very little mining of ore was necessary to keep the mill supplied.



The mill has so far only been run one shift, but in eight hours treats from 17 to 20 tons. It was built by the Faust Concentration Company, of Vancouver. In principle the mill is an

ordinary water-concentrator for the treatment of silver-lead-zinc ores, but most of the machinery is of special design. The jigs and tables are made by the Faust Company and differ somewhat from ordinary types, and a higher extraction is claimed for them. The milling machinery consists of a jaw-crusher, three sets of rolls, elevators, two sets of Faust jigs, three Faust tables, classifiers, screens, settling-tanks, etc.

The mill-site is on Two-mile creek, two miles from the mine. Mill-water is secured from the creek, and also sufficient power to run the tables and the dynamo for the electric plant. Boilers with cordwood for fuel supply the other requisite power. The ore is hauled from the mine-bins to the mill-bins in a 3-ton Packard truck, and from these bins it is trammed into the mill.

The superintendent, W. G. Norrie-Lowenthal, reports that the percentage recoveries in the mill are satisfactory and that the mill is now running nicely. During the year shortage of efficient labour handicapped operations, and in the fall the epidemic of Spanish influenza stopped operations for a time. Development at the mine has been satisfactory during the year, and there are now considerable reserves of milling-ore and also some high-grade shipping-ore. Both the main vein and the No. 4 vein are looking well.

Numerous improvements and additions were made in the way of shops, etc., and comfortable camp buildings have been erected at the mill. A diagrammatic plan showing the flow-sheet of the mill is appended to this report.

Nine-mile Mountain.

During the summer options on a number of the more important claims on this mountain, including the *Sunrise*, *Silver Cup*, *Lead King*, Miller property, and others, were secured by Byron R. Jones, acting for an Eastern syndicate. Work was commenced on the *Sunrise* property and carried on for a couple of months with a small force of men under H. Sparks. This work consisted of surface-stripping and shallow cuts exposing the veins. One vein on the *Sunrise* was exposed 500 feet, maintaining good values and size throughout. Work was stopped in October for the winter, but will be resumed in the spring, when it is expected diamond-drilling will be carried out.

There are a number of veins on these claims, varying from a few inches up to several feet in width and mineralized with galena, zinc-blende, grey-copper, stibnite, and jamesonite. The galena is, as a rule, high in silver content, while the stibnite and zinc-blende also carry some silver. The grey-copper occurs sparingly, but carries a high silver content.

The properties on this mountain were described in the 1914 Annual Report.

This property was not worked during the year. In January and February **American Boy.** 250 tons of ore was hauled from the dumps to the *Silver Standard* mill and later was treated at the plant. It is expected that development on the property will be proceeded with in the summer of 1919.

TELKWA SECTION.

There was not a great deal of activity in metal-mining in this district during 1918. The chief disappointment was the failure of the *Santa Maria* to continue to operate on a productive basis. The lease and bond held on this property by the Jefferson-Dockrill Syndicate may expire before long and the property revert to the original owners. Further prospecting of some of the surface showings would seem to be warranted, and it is to be hoped that next year the owners will do this.

The most important development in the district during the year was the opening-up of a small coal-mine by the Telkwa Collieries, Limited. This is the beginning of productive coal-mining in the district, and although the output as yet is small, it is a hopeful sign for the future.

Hudson Bay Mountain.

There are a number of claims on Hudson Bay mountain which have been prospected to a certain extent for some years back. On the north-eastern slope of the mountain are the Schufer, Martin, Carroll, and Hanson properties; on the southern slope are situated the *Coronado*, *Victory*, *Mamie*, *White Swan*, and several other claims. With the exception of the Hanson property, all these have been described in the Annual Reports for 1914, 1916, and 1917.

In 1914 a sleigh-road was built from Smithers to the *Coronado* group, and short trail up the Hill connects the *Victory* group with this road. A few car-loads of ore were taken out from

these properties in former years, but in 1918 the road was in bad shape. A substantial grant was therefore made from the Mines Development Fund and the road so repaired that it is now a good sleigh-road.

The properties on the north-eastern slope of the mountain are reached by a trail running from the wagon-road near Lake Kathlyn Station, the distance to the Schufer property being about six miles, or ten miles from Smithers. A grant was made during the year to repair the lower end of this trail, but, as it was impossible to secure men to do the work, no repairs were effected. This trail will be attended to as soon as the snow goes off in the spring.

Victory. During 1918 further work was done by the owner, Donald Simpson, working alone on the *Victory* group, and a shipment of a carload of ore was made about the end of the year. This property warrants more extensive development than has yet been done.

Schufer Property. During the summer and fall Shufer & Woods worked steadily on their property. In 1917 a short tunnel had been driven on the upper vein, exposing a shoot of galena-zinc-blende ore which carried good silver values. Last season this tunnel was continued and ore was taken out from the vein, partly from the tunnel and partly from open-cuts on the vein above the tunnel. Thirty to forty tons of ore was taken out, and from this 30 tons was packed down to Lake Kathlyn Station, on the Grand Trunk Pacific Railway. This ore was shipped to New Hazelton about the end of the year for treatment at the *Silver Standard* mill.

This vein varies from a few inches up to 2 feet in width and carries in places a band of solid sulphides of zinc and lead. Most of the ore taken out does not require concentration, but does require a separation of the galena from the zinc-blende, as they occur in about equal amounts. The ore shipped to the mill should run about 100 oz. in silver, 15 to 20 per cent. zinc, and 20 to 25 per cent. lead.

Above the tunnel this vein crosses a limestone-band, and on the surface at the intersection the vein widens with a development of low-grade zinc-pyrrhotite ore. Such an intersection might at some part of it reveal a good shoot of the high-grade ore. Further development will be carried out during the coming summer.

Last Chance. This claim is situated on the north-western slope of Hudson Bay mountain, not far from the Schufer property. The owners are O. Hanson and J. Sealey, but last summer the property was under lease to C. G. Anderson, of Prince Rupert. The showings consist of irregular fractures in the volcanic rock which carry a little chalcopyrite, copper carbonates, pyrite, and magnetite. The fractures are irregular and discontinuous, but in places are sufficiently bunched to give rise to a mineralized zone several feet in width.

The main occurrence is in an open-cut 30 x 6 x 4 feet. All the rock taken out from this cut is mineralized but very slightly; possibly it would average 1 to 2 per cent. copper. The east end of the cut is more heavily mineralized than elsewhere, and the average of two grab samples show that a width of 2 to 4 feet would run about 5 per cent. copper.

A short distance to the north of this open-cut a small showing of ore crops on the surface. A crosscut tunnel was started 15 feet below this and had been driven 30 feet without encountering any ore. It is reported that some low-grade was crosscut later on in the fall when the tunnel was driven further ahead.

Patriotic Group. This property is situated on the bank of the Bulkley river, eleven miles below Smithers and three miles from Evelyn Station, on the Grand Trunk Pacific Railway. George H. Ballard is the owner. The rock formation exposed on this property is a schistose rock, originally of an andesitic type. Intruding this is a wide fine-grained dyke which may be classified as a quartz porphyry. The ore-showings are developed in an irregular fracture-zone in the schist about 50 feet distant from the dyke and roughly paralleling the dyke.

The vein strikes S. 80° E. (mag.) and outcrops at the edge of the Bulkley river, passing in a short distance under the bed of the river, while at high water in the spring the showings are nearly covered with water. The vein is a difficult one to prospect, as, owing to the overburden in one direction along the strike of the vein and the river in the other direction, surface development cannot be carried on. The only way to prospect would be by sinking, and this is difficult on account of the water.

The mineral-showings consist of irregular replacements in small fissures in the schist, which, in general, give an appearance of a vein varying from 1 to 4 feet in width. At the time of examining the property the workings were in such condition that very little could be seen and no showings of ore of any size were noted. The predominant ore-mineral present here is zinc-blende, accompanied by galena, jamesonite, and a little pyrite and grey-copper, the galena and grey-copper carrying good silver values. The gangue consists mainly of schist, together with some quartz and calcite.

The workings consist of a shaft 32 feet deep, which owing to water in it could not be examined, a 50-foot tunnel, and an open-cut. In order to keep away from the river the shaft was started in the hanging-wall, and is sunk on an incline dipping away from the river. The shaft was not sunk in ore and a crosscut back towards the river would be necessary to reach the vein.

The tunnel is in a partially caved condition and it is apparent that it did not crosscut any ore. The open-cut is the only place where ore was seen, and here it was considerably oxidized. A sample taken across 2 feet in the bottom of the cut assayed: Gold, trace; silver, 22.2 oz.; lead, 2 per cent.; zinc, 34.8 per cent. A selected sample of ore returned: Gold, 0.02 oz.; silver, 124.8 oz.; lead, 46 per cent.; zinc, 20.4 per cent.

Babine Range.

This property, which consists of five claims held by annual assessment, is **Harvey Group.** owned by C. G. Harvey and partner. It is situated on the eastern slope of Driftwood creek at an elevation of about 4,000 feet and distant twelve miles from Smithers, the last four miles of which is by trail. Mr. Harvey has worked the property in a small way during the last three years and has made some shipments of high-grade hand-sorted ore; about 25 tons in all has been shipped.

There are two well-defined veins on the property and several other mineralizations which represent mineral depositions in sheeted zones. The rock formation may be classified as andesite, generally of a purple colour; in places it is fine-grained, while in others quite porphyritic. This rock is the normal andesite of the Hazelton formation. The gangue material of the veins is largely andesite somewhat altered, together with stringers and bunches of quartz. The veins, which are of the replacement-fissure type, carry chalcocite, grey-copper, bornite, chalcopyrite, covellite, and, from oxidation of the sulphides, some carbonates of copper. The most important metal content in the ore is silver, which is apparently carried in the grey-copper. Some assays, however, show high copper values and low silver; this would seem to indicate that the chalcocite carries but little silver.

The lower vein is developed by a shaft 18 feet deep. At the bottom the fissure is broken over a little, but is coming in again in the hanging-wall. The vein averages about 4 feet in width and carries copper minerals disseminated through it in an irregular manner. A sample taken across 3½ feet at the bottom of the shaft assayed: Silver, 34 oz.; copper, 1.85 per cent. The sorted ore will run much higher; the gross value of all ore shipped was about \$200 a ton.

The upper vein, which parallels the lower one about 75 feet distant in a horizontal line, is developed by a shaft 65 feet deep; the vein dips steeply at the mouth of the shaft, but gradually flattens out and is apparently broken over. At the time of the examination there was 15 to 20 feet of water in the shaft, but there is said to be a streak of good shipping-ore 18 inches in width in the bottom.

At a point 25 feet down the shaft a drift has been run on the vein for 20 feet and a short winze put down. From here an irregular stope has been worked upwards, and from this most of the ore shipped was taken. In this working a streak of nearly solid copper sulphide of 3 to 4 inches in width can be seen, and lower-grade disseminated ore occurs throughout the vein, which varies from 1 to 4 feet in width.

This group, consisting of the *Lead Creek*, *Victoria*, *Prospector's Dream*, **Victoria Group.** *Morning Star*, *Lakeview*, and *Spokane* claims, is situated in the Babine range just east of the divide on the Babine lake slope. The property is distant from Smithers about twenty-five miles. The wagon-road from Smithers to S. Johnston's ranch on Driftwood creek is followed; then a trail for the balance of the distance. Two miles above

Johnston's ranch the main trail up Driftwood creek is left, and a branch trail is followed over the summit and along the eastern slope of the Babine range to the property. The owner is Patrick J. Higgins, of Spokane, Wash. Each summer for several years back Mr. Higgins has worked the property, doing more than was necessary for annual assessment on the claims.

This group lies about three miles in a direct line from Cronin's mine, and is so situated that a road two or three miles in length would connect it with the sleigh-road to that property at a point about twenty-five miles distant from Telkwa.

The rock formations exposed on this property are almost identical with those occurring at the Cronin mine. Geologically the formations and occurrences of mineralization are the same.

Black argillitic schists and slates are the predominating rocks, but they are intruded by a light-coloured acid igneous rock which may be classified as a rhyolite, although in places it may approach in texture a granite porphyry. The ore-bodies occur at and near the contacts of the schist and rhyolite. More or less definite veins occur, but these will probably be found to follow in a general way the contacts.

The mineralization is the lead-zinc type, the important minerals present being galena and sphalerite. Grains of pyrite quite frequently occur in the ore and associated schist. Grey-copper probably occurs in sparing quantities with the galena and zinc-blende. The silver values are quite good; assays show from 1 to 2 oz. of silver to the unit of lead.

The gangue material consists of quartz and some calcite and siderite; radiating veinlets of quartz in schist often make up the vein. Two or three different veins are recognized by Mr. Higgins, and on each of these some work has been done. These veins or ore-bodies are somewhat oxidized on the surface and are to some extent broken up and irregular; probably there is some faulting, which, however, owing to the conditions of the surface is not easily recognized.

The main vein, which strikes S. 10° E. and dips 70 degrees to the east, lies close to a contact between schist and rhyolite, but is in most places in the schist. It has been developed by surface cuts, a 50-foot shaft, and a tunnel 140 feet in length. The shaft could not be examined owing to water; it is not sunk on the vein, but in schist. From the bottom a 6-foot crosscut was run, but did not strike the vein, and it would seem as if another 15 feet would be required to reach it.

The tunnel is run on a crosscut for 120 feet to where the vein was struck. At the time of examining the property the ore had been drifted on for 15 feet and work was continued for a short time after. At the face of the tunnel there was 2 or 3 feet of mixed ore, galena, and zinc-blende in a quartz and schist gangue; this ore would make good mill-feed. A sample of the clean galena assayed: Gold, 0.06 oz.; silver, 86.2 oz.; lead, 55 per cent.; and a sample of clean zinc-blende returned: Gold, 0.02 oz.; silver, 22 oz.; zinc, 52.8 per cent.

Mr. Higgins reports that he drove this tunnel some 30 feet farther and that the vein is now 4½ feet between walls and well mineralized, an average sample across the vein returning 17 oz. silver and 14 per cent. lead.

A large surface cut has been made on this vein, and from this place a shipment of ore was made a few years ago. This cut is somewhat caved in and had snow in it when examined, so that not much information could be obtained. A sample across 2 feet at one end of the cut gave the high assay of: Gold, 0.5 oz.; silver, 298 oz.; lead, 21 per cent. This high silver content may have been due to the presence of considerable grey-copper.

The No. 2 vein is developed by a 40-foot shaft, from which 5 tons of ore was shipped, assaying 51 oz. silver, 25 per cent. lead, and 38 per cent. zinc. This vein is about 18 inches wide, very much brecciated, and lies in the schist.

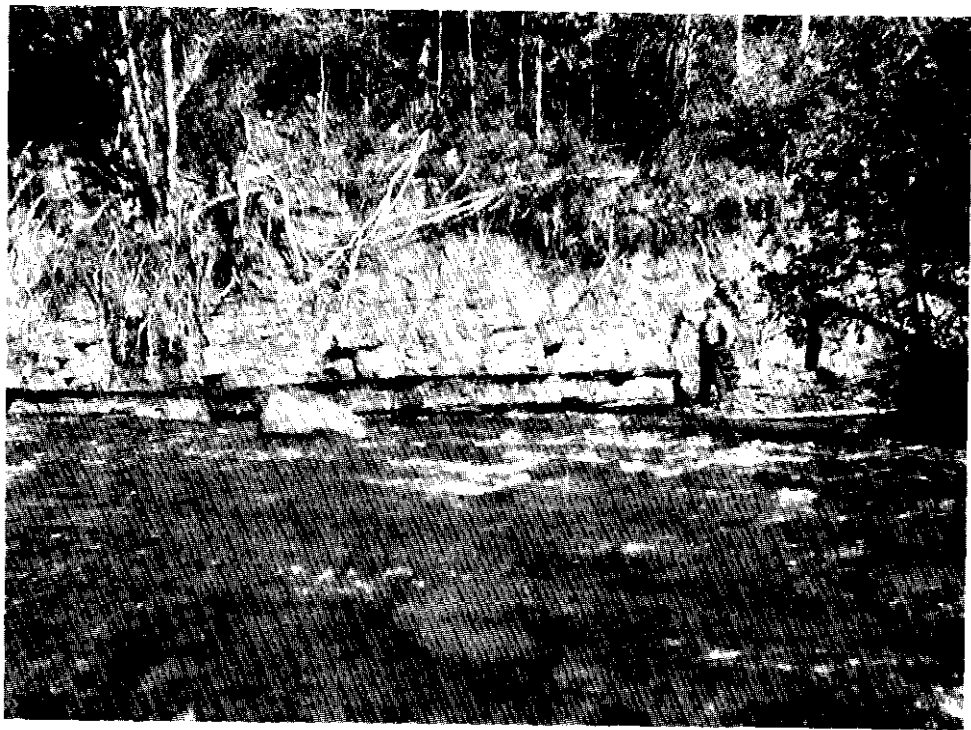
The No. 3 vein is developed by a tunnel 15 feet long, which shows a vein lying between rhyolite and schist and striking S. 25° E. (mag.). The vein consists of from 2 to 4 feet of quartz and is only sparingly mineralized.

The ore-showings on this property are worth further development, as the grade of the ore is good and the geological nature of the ore-bodies is such that considerable shoots of ore may be discovered.

This group is situated on the east side of Cabin creek, one mile below the Higgins property, which is at the head of the creek, and about three miles from the Cronin road. An attempt was made to find the showings on this property, but the most important ones were not found. The mountain rises steeply from the creek, with bluffs above and rock-slide below.



Coal-outcrop, Tefkwa River.



Coal-outcrop, Goat Creek.

Simpson Property. Some small cuts have been made to prospect showings in a bluff 1,000 feet above the creek. These consist of fractures in a rhyolite rock which are slightly stained with copper carbonates. The rhyolite is apparently a wide irregular dyke which has been very slightly fractured along certain zones. Occasional specks of copper-glance can be seen, but copper-stain is scattered throughout a width of 30 to 40 feet. Average samples of the copper-stained rock would not assay more than $\frac{1}{2}$ of 1 per cent. copper.

It was learned later that at the head of a small basin at some distance from these showings there are more promising occurrences of copper minerals.

Social Group. This group consists of four claims—the *Iroquois*, *Carl Marx*, *Parker Williams*, and *Annex*—and is owned by A. P. McCabe and P. McPhee. It is situated on the south-easterly side of the mountain at the head of the East fork of Driftwood creek and about twenty miles from Smithers. The elevation of the showings is about 5,800 feet. The property is reached by the trail which leaves Driftwood creek above Johnston's ranch. This is the trail that goes to the Higgins property, but the *Social* group is a few miles closer to Smithers.

The main showing consists of a well-defined vein occurring in andesite. The foot-wall rock is more porphyritic than the hanging-wall, but both are andesitic in type. The vein is a replacement fissure in this andesite.

The ore minerals present are copper-glance, grey-copper, malachite, and azurite. The sulphides have been very considerably oxidized, with the result that copper carbonates and iron oxide are very freely distributed throughout the vein and exceed in amount the sulphides present. This is probably a surface condition which would change at depth.

The main working is a tunnel 73 feet in length, besides which there are several surface cuts and pits. The tunnel shows the vein to vary in width from a few inches up to 4 feet. Thirty feet in the tunnel the vein is from 3 to 4 feet wide, continuing for a short distance and carrying some nice-looking ore. Then the vein pinches down, but commences to widen again near the face of the tunnel. At the face the vein is 2 feet wide, but only 1 foot on the hanging-wall side is mineralized. A sample taken across this foot of ore assayed: Gold, trace; silver, 1.5 oz.; copper, 6.2 per cent. A sample taken across 4 feet at a point 30 feet in the tunnel returned: Gold, trace; silver, 4 oz.; copper, 13 per cent.

In an open-cut 25 feet above the tunnel there is a nice showing of ore, the liberal distribution of green and blue carbonates making it look quite showy. On the foot-wall there is one streak of copper-glance a few inches wide. A sample taken across 4 feet, the full width of the vein, assayed: Gold, trace; silver, 2.8 oz.; copper, 12.9 per cent. Selected high-grade ore will run about 25 per cent. copper. This vein can be traced up and down the hill for a short distance and can be developed further by a drift-tunnel.

On the *Carl Marx* claim facing into the South fork of Driftwood creek there are a number of irregular stringers and impregnations of copper minerals scattered through the rock.

The country-rock consists of various phases of andesite, in some places porphyritic, and in others brecciated. Narrow bands of limestone and serpentine interbedded with the andesite were noted in places. The ore follows the limestone-band.

Some of the showings were covered with snow and could not be examined. Very little work has been done here yet, and more will have to be done before a proper idea of the ore occurrence can be obtained. The indications are such as to warrant surface prospecting to see if appreciable ore-shoots occur.

A sample typical of the ore in this place gave a return of 4 per cent. copper. In one place there is a width of 10 feet of rock and mineralized stringers which should average up to this sample.

Cronin Mine. This property was worked for a short time during the summer, but in the fall operations were stopped for the winter. The property was examined by several engineers during the season, and it is reported that before next spring arrangements will have been made to develop and equip the property so as to put it on a productive basis. A low-level crosscut tunnel has been projected for some time by Mr. Cronin, and this policy of development may be carried out.

During the year some further work was done on the sleigh-road to the property from Telkwa by the Public Works Department. No ore was shipped during the year.

Dome Mountain Camp.

Dome mountain forms part of the Babine range, but stands out distinctly from the main mass of the range, with lower elevations all around it. It is dome-shaped and nearly flat-topped, rising to an elevation of about 5,300 feet; timber-line is at about 4,700 feet.

The route to the camp is from Telkwa, the first fourteen miles being on a wagon-road and then twelve miles of trail which is in fair condition. This distance could be shortened a few miles by a direct road, as the mountain is about twenty miles distance in a straight line easterly from Telkwa.

Geological Features.—The whole mountain consists essentially of schists of various kinds. The rocks in their original condition were probably mainly of volcanic origin with some interbedded sediments, but by metamorphism they have all been rendered more or less schistose.

The showings of ore are found in well-defined quartz-filled fissures, which vary in width from a few inches up to several feet. There are quite a number of veins all roughly parallel with a north-westerly strike. The metallic minerals occurring in the quartz gangue are arsenopyrite, pyrite, a little chalcopyrite, and small quantities of galena. The main value is in gold, but in some instances the silver content runs up, and in one instance the copper value is the most important. It is evident from numerous assays that the arsenopyrite and pyrite, as a rule, carry good gold values, but that the quartz gangue rarely carries much value. The silver is associated with the galena, but the amount of this mineral in the veins is relatively unimportant. The possibilities of the camp, however, must be considered from the gold values present.

This claim is situated on the north-east slope of Dome mountain and is owned **Silver Fox.** by Geo. Hazelton, Joe Bourgon, and T. J. Thorp. The vein, which occurs in schist, is from 12 to 18 inches wide. It is developed by a shaft 10 feet deep (full of water at time of examination), open-cuts, and stripping. The minerals noted in the quartz gangue were arsenopyrite, pyrite, zinc-blende, and galena. This vein has the prevailing north-westerly strike and dip to the south-west of about 45 degrees. A sample of selected sulphide ore assayed: Gold, 1.3 oz.; silver, 10 oz.; lead, 8.1 per cent. A sample taken from a cut where the vein widened out to 3 feet, but carried no sulphides, only returned a trace of gold and 1 oz. silver to the ton.

The upper vein on this claim varies from 2 to 5 feet in width, and is exposed in open-cuts for a length of 50 feet. It consists of massive quartz carrying a very little pyrite, the whole being somewhat rusty in appearance. It is a well-defined vein, but from the small amount of sulphides present will probably be low grade. It is supposed that this vein is a continuation of one of the *Gold Seal* veins. The strike is the prevailing one and the rock it occurs in is a schistose andesite. A sample taken across 4 feet, which is probably a representative sample of the vein, assayed: Gold, 0.12 oz.; silver, 1 oz.

This claim adjoins the *Silver Fox* and is owned by T. J. Thorp. The vein is **La Petite.** supposed to be, and probably is, a continuation of the *Silver Fox* vein, the distance between the showings being about 1,200 feet. This vein, which is from 10 to 12 inches wide, occurs in a dark-coloured basic rock which is not as schistose as most of the rock formations on the mountain. The dip is about 70 degrees to the south-west. The vein is considerably oxidized and leached on the surface. Development consists of some open-cuts. A sample across 10 inches of ore assayed: Gold, 8 oz.; silver, 8 oz.

Lying to the west of this vein there is another one which may be a continuation of the *Gold King* vein; it is a well-defined fissure 1 foot in width. The quartz gangue contains cube pyrite and traces of chalcopyrite and arsenopyrite. The strike and dip is the usual one and the enclosing rock formation is schist. Development consists of surface cuts. A grab sample from one of the dumps which is representative of the vein-filling assayed: Gold, 1 oz.; silver, 2 oz.

This group of four claims is situated on the northern end of Dome mountain, **Gold Seal Group.** with the showings just above timber-line. The owners are T. Heslip and R. Robertson. There are four veins on the property, approximately parallel and contained in a width of 400 feet. No. 1 vein is the most easterly and has the usual north-westerly strike and dip of about 55 degrees to the south-west. It occurs in schist and carries arsenical iron and a little galena in a quartz gangue. A cut 15 feet long with a 10-foot face shows the vein to be 9 inches to 1 foot in width and well mineralized. A sample across 9 inches gave returns of: Gold, 4.28 oz.; silver, 2.8 oz.

No. 2 vein is exposed on the *Blue Grouse* claim and is exposed by a 10-foot open-cut with a 5-foot face. This vein is irregular and is broken up into bands with bunches of schist between. The quartz is slightly mineralized with cube pyrite and arsenical iron. A sample taken across two bands of 4 feet assayed: Gold, 0.32 oz.; silver, 1 oz.

The No. 3 vein shows on the *Blue Grouse* claim. A shaft 8 feet deep shows the vein to vary between 1 and 2 feet in width, consisting of bands of quartz and schist. The quartz gangue is slightly mineralized with iron sulphides. A sample across 2 feet at the bottom of the shaft on assay only showed traces of gold and silver.

No. 4 vein is exposed on the *Gold King* claim. An open cut 25 feet long shows a vein 3 to 4 feet in width, consisting of mixed bands of quartz and schist. This vein, unlike the others, dips 45 degrees to the north-east; but it has a parallel strike. A rough grab sample representative of the vein returned on assay only traces of gold and silver.

Four hundred feet along the strike and up the hill this vein shows as two stringers 20 feet apart and a stringer dipping at 45 degrees between them. This central band of quartz or stringer is probably the main fissure, with the others subsidiary ones. A shaft has been put down on this 10 feet and on the east stringer another one 15 feet deep.

The width of quartz in these bands is variable, in places only a few inches and in others up to 3 feet. There is some nice ore exposed in these workings. The quartz carries galena, pyrite, and arsenical iron. From the shafts about 5 tons of the most heavily mineralized quartz has been sorted out and piled on one dump. An average sample of this assayed: Gold, 1.52 oz.; silver, 3.6 oz.

A short distance above the shafts a small cut shows a clean-cut vein 1 foot wide and well mineralized. The strike at this point is N. 70° W. (mag.) and the dip is 75 degrees to the south-west. A representative sample of the vein assayed: Gold, 2.90 oz.; silver, 3.6 oz.; copper, 0.5 per cent. A test for nickel was also made on this sample, but it was not found to contain any.

There are two claims in this group held by Higgins & Dobie. The showing
Higgins is practically on the highest point of Dome mountain, which, however, is
Property. nearly flat. A tunnel 30 feet long shows a small vein 6 inches to 1 foot wide lying in schist. The quartz is mineralized with chalcopyrite, arsenopyrite, and pyrite. Above the tunnel the vein has been taken out to a slight depth in a long narrow open-cut. From the rock taken out in these workings about 15 tons of ore had been selected by hand-sorting, but this was never shipped and is still lying on the dump. An average sample of this assayed: Gold, 0.94 oz.; silver, 3 oz.; copper, 3.9 per cent. It is evident that this grade of ore would not pay to pack out, and as the vein is small the proposition was not very promising.

This claim and the *Lucky Boy* are owned by Hazelton, Bourgon & Thorp.
Gold Standard. The vein, which is exposed on a little creek 400 yards east of Hazelton's cabin, is a well-defined quartz-filled fissure striking N. 40° E. and dipping at 45 degrees to the south-east, and occurring in schist. The vein crosses the creek and is well exposed on either side and in the creek; on each side large open-cuts have been made, showing a width of 3 to 4 feet of quartz.

Pyrite and arsenopyrite are the only metallic minerals in the quartz, and these form but a small percentage of the vein-filling. A representative sample of the dump from one of the cuts assayed: Gold, 0.12 oz.; silver, 4 oz. Another sample taken across 3 feet 6 inches on the east side of the creek returned: Gold, 0.26 oz.; silver, 2 oz.; while a selected specimen of sulphide gave: Gold, 0.82 oz.; silver, 4 oz.

This group of two claims is situated on the south-east end of the mountain and near the top. There is here a quartz vein from 2 to 4 feet wide lying very flat and striking N. 40° E. The formation in which it occurs is green schistose andesite. The development consists of a number of open-cuts and stripping, spaced over a distance of about 300 feet, which apparently show two or three different veins, but these may be portions of the one vein separated by faulting.

This vein is quite similar to the others on the mountain, consisting of a quartz gangue carrying iron sulphides and in places a little chalcopyrite. The flat dip of the vein and its broken-up appearance show that it has been somewhat faulted.

A sample across 3 feet in the highest cut assayed: Gold, 0.84 oz.; silver, 4 oz.; another taken from a small dump assayed: Gold, 0.28 oz.; silver, 4 oz. Selected pieces of ore showing some chalcopyrite returned on assay: Gold, 0.20 oz.; silver, 14.6 oz.; copper, 2 per cent.

The most southerly open-cut shows a nice-looking vein about 3 feet in width, well mineralized with pyrite and a little chalcopyrite.

This group consists of the two claims known as the *Ruth* and *Paradise*, owned **Paradise Group.** by Steve Young. It is situated in the Mosquito Pass district, fourteen miles from Telkwa and on the route to Dome mountain. The showings are on the side of a small creek, the waters of which flow towards Babine lake. There is here a shear-zone in green andesite which is from 15 to 30 feet wide. In places in this zone there is a width of from 5 to 10 feet of quartz mineralized with pyrite, magnetite, haematite, and a little arsenopyrite and pyrrhotite. No chalcopyrite was noted. The zone strikes east and west and dips to the south at a very flat angle.

From the appearance of the mineralized quartz it might have been expected to have carried some values in gold and silver, but assays of three samples, including one of selected sulphides, only showed traces.

Chisholm. This claim was owned by Chisholm & Young. A shaft 30 feet deep was sunk on the vein, and from this a shipment of 14 tons of hand-sorted ore was made, which returned about \$50 a ton, mainly in gold values. The shaft had water in it so could not be examined, but there is said to be a width of 8 inches of sulphide ore at the bottom.

In a cut 20 feet north of the shaft the vein is exposed and has a width of about 2 feet. It is sparingly mineralized with iron sulphides, but does not look promising. A sample taken here only gave a trace of gold and 2 oz. of silver to the ton. It is apparent that only the sulphides carry values, and they form but a small percentage of the vein.

Maple Leaf and Shamrock. These claims, which are owned by Hazelton, Bourgon & Thorp, are situated on the east side of Dome mountain, away down in the timber, and about a mile and a half east of the cabin. The showings are on the bank of a little creek and quartz-outcroppings occur in the bed of the creek. Two tunnels have been driven on the south side of the creek, which were commenced in gravel and clay. The most westerly one was driven for 25 feet through the wash, and then strikes the rock and continues for 10 feet farther. The vein was crosscut here, but it is lying very flat as if broken over. Apparently the vein proper is about 4 feet in width, but the walls are impregnated with quartz stringers. The vein is partly quartz and partly schist, the whole being very much leached and rotten. Siderite, pyrite, and a very little galena were noted in the vein. A representative sample only assayed: Gold, 0.02 oz.; silver, 0.05 oz. The dump looks as if it consisted mainly of rock-matter, very considerably decomposed, but a grab sample gave the high assay of 1.62 oz. gold and 4.2 oz. silver to the ton.

Thirty feet to the east the second tunnel has been driven; it is 40 feet long and at the face cuts the vein, which at this point consists of 8 to 10 feet of rock-matter, carrying through it stringers and bunches of quartz. It is really a sheared zone in which some quartz and metallic minerals have been deposited by replacement. No sulphides were noted in the vein material in this place, and the general appearance of the vein was such that it was not considered advisable to sample it.

Telkwa Collieries.

The Telkwa Collieries is a company composed of Prince Rupert and Telkwa men which was formed to acquire and operate a small area of coal land near the mouth of Goat creek, a small stream joining the Telkwa river four miles above Telkwa. A large area of coal land along Goat creek and extending down the Telkwa valley to the Bulkley river is owned by the Cassiar Coal Company. The company has Crown grants for this, including the surface rights, and for some years back has not attempted to do anything with the property.

In 1917 J. Ashman discovered that some sections of land near the confluence of Goat creek with the Telkwa river were vacant, and it is these sections that now form the holdings of the Telkwa Collieries.

The coal-showings on the Telkwa river and Goat creek attracted attention many years ago, before the Grand Trunk Pacific Railway was under construction. These areas were examined and reported on by W. W. Leach, of the Geological Survey, his reports appearing in the Summary Reports for 1906, 1907, and 1908. During these years a number of the coal-showings were tested by surface work and a limited amount of drilling. This early work did not prove very satis-

factory, and before the railway was completed in 1914 all development had been stopped. The exploratory work done on the areas contiguous to Telkwa apparently showed that there were a number of small coal-basins or remnants of a once extensive field, and that the measures in these basins were broken, flexed, and faulted. The quality of the coal in many cases was excellent, but the broken condition of the formations was considered to be a great handicap to successful mining.

Much of the early testing of these coal-basins was done by the Grand Trunk Pacific Railway Company or by others who expected to sell their coal to the railway company. The engineers for the Grand Trunk Pacific finally decided that there was no sufficient available supply of coal, either near Telkwa or elsewhere along the route of the railway in British Columbia, which could be relied upon; and so the railway was equipped with oil-burning locomotives throughout the western division. The best market for coal at Telkwa was therefore shut off.

In the last two or three years, however, the price of fuel-oil has gone up very considerably and the demand for coal has been greater than the supply. The Grand Trunk Pacific is now using coal in its locomotives from Prince George east, and is ready to take coal if it can be supplied from any point on the railway. This has aroused fresh interest in the possibilities of these northern coalfields and further development in the near future is probable.

In the meantime the Telkwa Collieries, although commencing in a small way, is getting along satisfactorily. In the winter of 1917-18 a tunnel was driven on one seam and some test shipments made to Prince Rupert, which proved satisfactory. In the summer and fall of 1918 a branch road half a mile in length was built into the property and repairs were made to the main road up the Telkwa river. Coal-bunkers, camp buildings, etc., were erected, and late in the fall shipments were commenced. By the end of the year the production was at the rate of 30 tons a day, which was expected to be soon increased to 50. The coal is handled by teams to Telkwa (four miles and a half), loaded on the railway-cars, and shipped to Prince Rupert, where it is marketed.

The exposure of coal on which this company is working at present occurs on Mud creek, a small tributary joining Goat creek just a short distance from the Telkwa river. The area of coal formation at this point, as exposed, lies in the V-shaped piece of land lying between Mud and Goat creeks. At this place these creeks run in channels cut down 100 feet or more below the general level of the country. On Mud creek the banks rise steeply and give a section of the coal-measures for some distance going up the creek. At this point some years ago a tunnel was driven in on one seam for 90 feet, when the coal was cut off abruptly by fine sand. This tunnel was driven in the direction of Goat creek, and it is evident that at this point the coal formation had been eroded away and the erosion-channel filled with sand.

The Telkwa Collieries commenced work on a seam 15 feet lower than the other one. Although at a lower horizon, this seam outcrops farther up the creek, as the dip of the seams is to the north, down the creek. On this main seam a tunnel was driven 115 feet which shows 8 feet of nearly clean coal, with the exception of an 8-inch clay-parting. On the upper or 6-foot seam a short tunnel has been driven and connection made to the main seam by a short incline. From the tunnel on the main seam the coal was taken out which was shipped in the spring of 1918. At the time of examining the property (August, 1918) coal-bunkers, etc., were being erected and no work was being done in the mine. Since that time the main tunnel has been driven ahead, rooms commenced, and the property put in shape for steady production.

Goat Creek Seam.

On the property of the Telkwa Collieries there is another nice-looking seam of coal which outcrops in the bed of Goat creek and extends along the creek-bed for about 200 feet. This seam strikes east and west and dips at about 14 degrees to the north. The seam is 8 feet thick, with one main clay-band 8 inches thick. A representative sample of the seam had the following analysis: Moisture, 0.06 per cent.; volatile matter, 33.9 per cent.; fixed carbon, 56 per cent.; ash, 9.5 per cent.

Some attempt was made some years ago to prospect this seam, the work being started away from the creek where the coal outcrops. The work was never carried far enough to prove anything and the openings are now caved in. It would seem from the surface indications that this seam of coal may underlie the country to the north and east for some distance. No boring

has ever been done here, so that this remains a likely field for exploration by diamond-drilling. To the east of the outcrop a short distance is the boundary-line of the Telkwa Collieries land. Beyond this to the Bulkley valley is owned by the Cassiar Coal Company.

SIBOLA SECTION.

The name "Sibola" 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 mountain, and around Whitesall lake. A description of this country can be found in the Annual Report of the Minister of Mines for 1916. Since that time some further prospecting has been done and annual assessment-work has been kept up on many of the claims. No extended development of any kind has been carried out.

The most important property in the district is the *Emerald* group, situated 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 amounts of zinc-blende, pyrite, and chalcopryrite. 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.

This 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 is backed by Idaho interests. It is expected that the property will be actively developed during the coming summer.

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.

The present route into Sweeney mountain is by an indifferent pack-trail which commences at Houston, on the Grand Trunk Pacific Railway; the distance is about fifty miles. Another very rough trail, known as the Bonthrone 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.

For the immediate prospecting and development of this district some better method of getting into it is required than the present trail from Houston. This trail climbs over two summits and is not passable until late in June. Either the old Bonthrone trail should be put in good condition or a new trail constructed starting from the wagon-road at the end of Francois lake.

If a good trail is put into the district considerable development of the properties can be carried out, and after that the question of a transportation system whereby machinery can be taken in and ore hauled out can be considered. A possible route for the ore would be out by a pass through the Coast mountains to salt water on Gardner canal. Another route would be by wagon-road to the end of Francois lake; thence down the lake on boats and a short wagon-haul from the end of the lake to the railway-line.

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.

Buff Group. This group is situated on Houston mountain, three miles north-east of Houston, the elevation of the showing being about 3,000 feet. The road is used for two miles and then a trail up the hill for a further distance of two miles. There are eight claims in the group, owned by Pete Slavin, Joe Allen, Fred Heading, and Andrew Martinsen, staked in 1917. At the time of examination (August, 1918) the group was under option to H. L. Roper and two men were at work; the option has since been allowed to lapse.

The showing consists of a vein 2 to 4 feet in width, occurring in a highly siliceous rock which is probably of igneous origin and of rhyolitic type. This vein is not well defined, but has a general strike of N. 25° E. (mag.) and dips to the north-west. It is sparingly mineralized with bornite, chalcocite, and a little grey-copper, and oxidation on the surface has produced plenty of copper-stain. The gangue is quartz and wall-rock.

A few open-cuts have been made and a shaft was started which was down 8 feet. The vein is only slightly mineralized with copper minerals, a band in the centre from 6 to 18 inches wide generally carrying most of the mineral. A few hundred feet to the north along the strike of the vein an open-cut shows a little copper-stain.

Two hundred feet away there is evidence of a parallel vein, but this one is not as well mineralized as the other. Further development might disclose some appreciable shoots of high-grade copper ore on this property, but the present showings are not extensive. An assay of selected ore returned: Gold, trace; silver, 12 oz.; copper, 15 per cent.

CARIBOO MINING DIVISION.

FORT GEORGE SECTION.

No productive mining of any kind is being carried on in this section of the Cariboo Division, but during the season a little prospecting of a few claims was in progress. These places were visited and notes made of what was being done.

Yellowstone Group. This group, situated about fifteen miles north-easterly from Prince George, is owned by Wm. Bonner and Martin Framstad. A wagon-road somewhat rough on the far end goes close by the property. A car can be driven to within about two miles of the claims. The country here is rolling plateau country and no hills of any size occur, the elevation of the claims being about 2,400 feet. A shaft 27 feet deep has been sunk to prospect a quartz vein which strikes N. 50° E. (mag.) and stands vertical. The vein occurs in soft crumbly rock which has more or less of a slaty structure. The vein-filling is quartz and no sulphides in appreciable amounts were noted. Some of the quartz is stained with iron-rust. A sample taken across 4 feet, the full width of quartz, showed only traces of the precious metals.

Snowshoe Group. This group, consisting of *Snowshoe Nos. 1, 2, and 3*, is owned by Wm. Bonner, Martin Framstad, J. D. McLennan, and Geo. Hughes. The claims adjoin the *Yellowstone* and are to be grouped together. It is intended that a local company with subscribers in Prince George is to be incorporated to handle these claims. The rock formation here is diorite somewhat altered and silicified. In places there are narrow streaks carrying a little chalcopyrite, pyrrhotite, and pyrite, which are either slight mineralizations along joint-planes or in a sheeted zone. None of these mineral-showings are of any importance or value other than to show the possibility of the occurrence of valuable minerals in this locality. A shaft has been sunk 18 feet so as to include a few of these stringers showing slight mineralization. No appreciable ore was taken out in this work and the dump would not

HIXON CREEK.

Hixon creek joins the Fraser river thirty-five miles below Quesnel. Some forty years ago a quartz property was worked on this creek by the Quesnel Quartz Gold Mining Company. A stamp-mill was erected and quite a lot of development carried out. Before long the work was stopped and the property has remained idle ever since.

In 1918 Chas. F. Law secured an option on the property, which he turned over to a Boston company. An attempt was made to open up the old workings, which were, of course, completely caved in, A. W. Koch being sent out to take charge of the work. About a dozen men were employed for two or three months, when operations were stopped and the option allowed to lapse.

The property was examined in July shortly after work had been commenced. The important old workings consisted of three shafts and a tunnel. The tunnel was said to be 120 feet in length, with two short drifts off it, and a winze 40 feet deep from one of the drifts. The best showing was supposed to be at the bottom of the winze, consisting of 4 feet of good ore.

The opening-up of this tunnel, which had just been started, was perhaps more difficult than driving a new tunnel. One of the shafts was also being cleaned out and unwatered. A new tunnel was being driven to prospect a 4-foot vein which had not previously been developed, and some surface-stripping was being done.

This new tunnel was driven alongside the quartz vein in schistose rock for 100 feet, the quartz being broken into at successive points. No values were found in the vein, so the work was discontinued. The surface-stripping also failed to disclose anything of importance. The high-grade ore found in the former workings was discovered as the result of placer-workings, and the shafts and tunnel were laid out to develop these showings, which did not crop on the surface.

To find out anything about these veins, therefore, it would be necessary to completely open up the old workings, and it is not believed that the work last summer was successful in doing this. It was found impossible to make any headway against the water in the old shaft, in which an attempt was made to reach the old workings, the flow of water being so great that power-driven pumps would have been required. It is also reported that the work of cleaning out the old tunnel was stopped before reaching the drifts and winze.

The property therefore remains in much the same condition as it has been for many years—viz., what surface showings occur are not promising and the reported high-grade ore in the old workings cannot be examined.

There is still a little ore left on the dump at the ruins of the old stamp-mill. This consists of quartz containing small quantities of pyrite, chalcopyrite, galena, hematite, and copper carbonates. Free gold and occasionally native silver in small specks occur in some of the specimens.

This group consists of the *Mont Damon*, *Belmont*, and *Virginia* claims and is **Belmont Group.** owned by H. McLarty and S. D. Gillis. It lies a short distance above the Hixon Creek property previously described. A tunnel has been driven in 150 feet, which is mainly in a soft decomposed yellow rock. The tunnel cuts one quartz vein which is from 2 to 4 feet in width, and farther on cuts a 6-inch stringer which was supposed to carry good values; a sample taken, however, only shows 0.2 oz. gold to the ton. The soft yellow rock (schist) was also supposed to carry low values, but a sample from the dump only showed a trace of gold.

The hydraulic placer mines near Barkerville made a smaller production than in 1917. The water-supply during the year was not very satisfactory, so that a smaller yardage of ground was handled than in the previous year. In the early part of the season the winter's snow melted with great rapidity, causing a flood of water which went to waste, and after that a long dry period occurred, during which there was an insufficiency of water for steady hydraulicking. Not much help was obtained from fall rains, so the season as a whole was unsatisfactory as regards water conditions.

The grade of ground handled is believed to have been about the same as in 1917, and no important new developments were made.

In August Dr. B. R. MacKay, of the Dominion Geological Survey, arrived in the district and spent a few weeks examining the country. Dr. MacKay intends to make a complete study of the placer deposits, and his visit this year was to size up the country and plan out his work for the season of 1919. This work is intended to assist the development of the known deposits and indicate the probable courses of the old drainage systems of the country, with the possibility of indicating likely places where new deposits may be found.

Hopp Mines.—These mines, consisting of *Lowhee*, *Stouts Gulch*, and *Mosquito Creek*, which are operated under the management of John Hopp, were worked as continuously throughout the season as the supply of water permitted. The major portion of the placer-gold production of the Cariboo District comes from these three properties. *Stouts Gulch* mine was worked up to its head in 1917, but this year the work was carried on laterally, side channels and benches being worked. There is still a considerable yardage of gravel to work out, but it may prove to be lower grade than the main channel. *Lowhee* mine was worked continuously throughout the season, and it is reported the average grade of gravel handled was well up to that of former years. *Mosquito Creek* mine was handicapped by shortage of water, and only a small yield of gold was obtained.

Point Mine.—This property, owned by Loo Gee Wing, of Vancouver, was worked during the season under the supervision of Jos. Wendle. Owing to shortage of water the season's output was not large.

Chisholm Creek.—The drifting-work of the Cariboo-Chisholm Creek Mining Company was discontinued early in the year and not started again. The future plans of the company are not known.

Perkins Gulch.—I. I. Felker and W. S. Sparkes for several years past have operated a small-scale hydraulic pit on Perkins gulch, a small creek which comes into Lightning creek about a mile

In 1917 the old Killam gravel-mine at Cottonwood canyon was acquired by the Tertiary Gravel Company, and the property was equipped with a mill to treat the cemented gravel.* The mill was tested in the fall of 1917, and shortly after work was stopped for the winter. Operations were resumed in the spring of this year and some changes were made in the milling equipment. During the fall the mill worked satisfactorily, treating 50 to 60 tons a day. It is believed that work will be continued all winter. Further development of the gravel-deposit is also to be carried on.

This gold-bearing deposit is a cemented gravel lying on a bed-rock and carrying values throughout a thickness of 10 to 12 feet. Development has been by a tunnel with lateral drifts from it, and the workings total several hundred feet; the gravel-deposit is of considerable size, but the gold values may be variable throughout it.

This deposit of cemented gravel is so hard that it cannot be successfully worked by ordinary placer-mining methods. The system used is to mine the ground as in a lode mine, using compressed-air-driven drills, and then the product is treated in a mill in much the same manner as gold-bearing quartz.

Lightning Creek Gold Gravels and Drainage Company.

The property owned by this company consists of twenty miles of placer leases along lower Lightning creek. The extensive plant and camp buildings of the company are at Wingdam, where there is a post-office; this place is about twenty-eight miles on the Barkerville road from Quesnel and eighteen miles below Stanley.

Along two miles of Lightning creek in the vicinity of the town of Stanley some very rich placer-ground was worked in former years and several millions of dollars taken out. Below Stanley a deep drifting enterprise was started at La Fontaine and the creek-gravels were mined out for some distance. While this mine was successful in working the gravel, it was financially unsuccessful because the gravel carried insufficient gold to pay to mine. Below La Fontaine to Wingdam, Lightning creek has never been worked to any great extent, the ground being too deep to be worked unless by modern methods with adequate pumping machinery, etc.

The surface gravels on lower Lightning creek were probably worked in a small way, but no definite records of this work are available. About twenty years ago the present mining enterprise at Wingdam, which is now the property of the Lightning Creek Gold Gravels and Drainage Company, was commenced. Mr. Unverzagt is treasurer and manager of this company.

* See 1917 Annual Report.

above Stanley. The deposit being worked is presumably an old channel lying 30 to 40 feet above the present bed of Perkins gulch. During 1918 some rich ground was found and the operations were more successful than in former years. This is a good hydraulic proposition, but is handicapped at present by an insufficient supply of water.

Proserpine Mountain.

Lode-mining in the Cariboo has never as yet proved successful, although for the last forty years intermittent attempts have been made to work various quartz-showings. There are any number of quartz veins in the district, but the majority of them are apparently devoid of gold content. In the early days of these attempts at quartz-mining several stamp-mills were taken in and erected in the district. After short runs all of these suspended operations and in many instances the plants were allowed to go to ruin. The condition of these old quartz properties, which were partially developed, is now such that an examination yields but little information. Examination of the old reports on these various properties shows that in the majority of cases the average value of the ore was quite low, and that, unless worked on a large scale, they could not hope to prove commercially successful. The veins undoubtedly were very pockety, and although some high assays were obtained, on the strength of which much work was done, the average values as disclosed by mill tests were too low to admit of the properties being worked at a profit.

In the early days all costs were probably somewhat higher than they are now, but the chief reason for failure cannot be found in that fact. Undoubtedly many veins were developed which never warranted having any work done on them. Most of the mills put in were 5- or 10-stamp mills, and mining and milling on such a scale required fairly high-grade ore, such as was not shown to occur in quantity in any of the veins that were developed. The result was that quartz-mining in the Cariboo received a succession of "black eyes," which makes it somewhat difficult now to arouse new interest in any gold-quartz showings in the district.

Proserpine mountain is a flat-topped hill lying to the west of Barkerville across Williams creek. Numerous quartz veins crop out on the mountain, some of which were staked and worked many years ago; chief amongst these may be noted the *Proserpine* ledge, which was developed by three shafts. A portion of this ledge is covered by the *Wilkinson* claim, an old 1,500- x 600-foot location Crown-granted and owned by the British Columbia Company. Adjoining this claim are three—the *Proserpine*, *Proserpine South*, and *Proserpine West*—staked by Seymour Baker several years ago and kept up by annual assessment. A description of these claims is given in the 1914 Annual Report of the Minister of Mines.

Proserpine mountain is made up entirely of the formation named by Bowman as the Cariboo schists. This formation everywhere throughout its occurrence in the Cariboo District is characterized by the number of veins, stringers, and bunches of quartz occurring in it. In the opinion of Bowman the source of the placer gold in the stream-gravels of the Cariboo was in this formation. The rocks in this series are mainly slates and schists of varying kinds and some bands of limestone; the whole formation being of sedimentary origin. Dykes cutting this formation are not infrequent, but none were noted on Proserpine mountain. In the bed of Grouse creek, which terminates Proserpine mountain to the east, a porphyry dyke is seen cutting the schists. The Cariboo schists is an old formation and the dykes cutting it are probably also quite old.

The general strike of the Cariboo schists is north-westerly. This formation is as a rule soft and friable, and is eroded easily, except where hard quartzite-bands occur.

The general strike of the quartz veins throughout the Barkerville area is parallel with the strike of the Cariboo schists, but many exceptions occur. The dip of the veins, however, as a rule differs from that of the enclosing schists. Many of the veins stand vertical, while the prevailing dip of the schists is to the north.

A few years ago E. E. Armstrong started prospecting for quartz in the district, and finally located the *Independence* group, which lies considerably to the east of the *Proserpine* group. The two veins discovered by Armstrong on his group did not crop out prominently on the surface and had not been noted before, or at least they had never been staked; so the Armstrong showings constituted a new discovery. The next year a number of claims lying between the *Proserpine* group and *Independence* group and joining on to the latter were staked by Carey, Blair & Tregillus. Continuations of the veins on the *Independence* group are found on these other claims, besides which several smaller veins have been opened up. During the last two summers Carey,

Blair & Tregillus have worked on the claims and have accomplished considerable in the way of surface work.

These quartz properties on Proserpine mountain were reported on in last year's Annual Report, but were re-examined in 1918 in greater detail. The owners, while unable to carry out any extensive developments, have succeeded by their own work in opening up the veins at a number of different places and generally have improved the showings on the properties. All development so far has been by surface work, with the exception of one shaft started in the fall, which was put down to a depth of 25 feet, and during the winter may have been sunk farther.

There are a number of well-defined quartz veins on these claims varying in width from 1 to 30 feet. These veins are mineralized in places with pyrite, arsenopyrite, and a little galena. The main valuable metal content is gold, the distribution of which is somewhat irregular. It would seem probable that the gold primarily was associated with the sulphides, but surface oxidation and leaching have in places scattered free gold through the quartz.

From the results of many samples taken, it is evident that at least portions of the veins would pay to work, and it is quite possible that further development would show considerable tonnages of ore which would pay to mill. The ore will have to be milled on the ground, and much further development is required before a large mill would be warranted. The possibilities for these claims are that when the veins are properly opened up they will furnish sufficient tonnage to mine and mill on quite a large scale, although average values may prove to be comparatively low grade. These properties warrant a thorough investigation by any company looking for gold properties.

This group consists of three claims owned by E. E. Armstrong. They cover a portion of Proserpine mountain and extend a short distance across Grouse Independence Group. creek and up the eastern side. There are two main veins on the property approximately parallel and known as No. 1 and No. 2. These veins stand vertical, have a north-westerly strike, and are from 100 to 150 feet apart. No. 1 vein consists of alternating bands of quartz and schist; the total width between walls in one place is about 30 feet, of which one-half to two-thirds is quartz. Galena and pyrite occur in the quartz, but in small quantities, and a little pyrite is scattered through the schist. By surface cuts the vein has been prospected along its strike for a few hundred feet. The following samples were taken in the big cut on the vein: Across 28 feet (1917): Gold, 0.8 oz. Across 3 feet west side next to foot-wall: Gold, 1.1 oz. Across 7 feet east side next to foot-wall: Gold, 1 oz.; selected sulphide, gold, 2.24 oz. These results are decidedly encouraging and show the vein is worth serious development. The owner, however, has put in most of his work on the No. 2 vein, believing it to carry higher-grade ore.

No. 2 vein is developed by a series of cuts and shafts from 10 to 15 feet deep, which expose the quartz here and there for several hundred feet along the strike. The width of this vein is from 10 to 15 feet, and, as a rule, there are not many bands of schist mixed with the quartz.

Near the boundary-line of the *Independence* and *Kitchener* claims a shaft has been sunk 15 feet. A sample across 13½ feet at the bottom assayed: Gold, 0.32 oz.; silver, 0.6 oz. A grab sample from the dump gave 0.46 oz. gold, and another from a smaller pile of selected "rich dirt" went 0.60 oz.

Some distance to the south-east of the shaft there are three cuts on the vein, all within a distance of 50 feet. These show from 10 to 15 feet of quartz—as a rule, oxidized and iron-stained, and containing only small bunches of schist enclosed in the quartz. Some pockets of honeycomb schist, which is schist that has had pyrite in it, but removed by oxidation, is very rich; a selected sample of it assayed 13.44 oz. in gold. The following table shows the results of samples taken from these cuts and well illustrates the variable nature of the gold content:—

Description.	Width sampled.	Gold.	Silver.
	Feet.	Oz.	Oz.
First cut, east side.....	8½	Trace	Trace
Second cut, east side.....	10	Trace	Trace
Third cut, west side.....	10	1.24	0.2
Third cut.....	5½	0.4	Trace
First cut.....	Grab sample, dump	0.16	4.3
Third cut.....	Grab sample, dump	0.06	0.2
Selected honeycomb.....		13.44	2.2
Selected oxidized arsenopyrite.....		4.62	1.0
Special sample.....		24.54	3.4

Five hundred feet to the north-east and on the *Hard Cash* claim a small surface cut shows the vein again, consisting of 4 feet of barren-looking quartz. A sample of it returned 0.08 oz. gold.

There are a good many places on the property where surface work has been done, of which no description is given, as it is unnecessary. It is sufficient to say that there are two large well-defined veins carrying variable gold values, and only systematic development and sampling will tell whether all or portions of the veins will pay to work.

Two veins crop out in the gulch of Grouse creek, and years ago short tunnels were driven upon them. These are distant about 2,000 feet and 800 feet lower in elevation from the main showings on the *Independence* claim, but are in about the right position to be continuations of the *Independence* veins. Apparently the average values in the quartz at this point are quite low, but here also assays of 1 oz. of gold to the ton have been obtained.

On this claim, which adjoins the *Kitchener*, a small cut shows a vein 3 to 4 feet wide striking north-west. The quartz carries arsenical iron and galena disseminated throughout in small amounts. A rough sample of the vein assayed: Gold, 0.08 oz.; silver, 11 oz. Another vein of rather glassy-looking quartz is exposed on this claim. It is from 8 to 10 feet wide and only in one place does it show a little galena and arsenical iron. An assay of some of it only returned 80 cents in gold and 1.6 oz. silver to the ton. This vein apparently strikes north-westerly with the formation.

Tipperary. This claim, owned by Carey, Blair & Tregillus, adjoins the *Independence* to the north-west. The showings on the claim are close to the line and near the shaft on No. 2 vein on the *Independence*. These two claims expose this No. 2 vein for a few hundred feet along its strike. An open-cut 20 feet in length shows a width of 20 feet of quartz and schist and in the former small amounts of arsenopyrite and galena. A sample across 4 feet of quartz returned on assay: Gold, 0.30 oz.; while a grab sample of the dump gave 0.10 oz. gold.

Warspite. This claim, owned by Carey, Blair & Tregillus, adjoins the *Tipperary* to the north-east. Several open-cuts show an irregular vein made up of alternating bands of quartz and schist. The formation apparently runs south-east at this point, with the vein cutting it in an east and west (mag.) direction. A sample across 4 feet in one cut assayed \$4.80 in gold to the ton. A big cut 50 feet in length shows a number of bands of quartz and schist. A sample across 4 feet assayed \$28 in gold, and a sample across the adjoining 18 inches gave \$18.40 to the ton. A rough grab sample from the quartz on the dump went \$4.40.

The main showing on the *Warspite* is a large irregular-shaped opening roughly 20 x 10 feet and 8 feet deep in the deepest place. This shows a vein of 6 to 8 feet of fairly clean quartz and sulphides. There are some small lenses of schist occurring in the quartz and some cross-stringers branching out from the main body of quartz.

The quartz is mineralized with pyrite and arsenopyrite and small quantities of galena. The amount of sulphides, however, does not form more than a small percentage of the total vein-filling. Considerable oxidation of the sulphides has taken place and the quartz is in many places loose and crumbly. The whole vein is heavily stained with iron-rust. This oxidation is apparently a surface condition and may be expected to stop as soon as a little depth is attained. Specimens showing free gold occur frequently in this open-cut.

This large cut was thoroughly sampled, the results being shown in the following table:—

Description.	Gold.	Silver.
	Oz.	Oz.
Across 5½ feet east side of cut.....	0.18	2.5
Across 22 inches of schist on wall.....	Trace	Trace
Across 17 inches of cross-stringer.....	0.76	0.05
Across 5 feet near centre of cut.....	0.05	0.6
Across 1 foot adjoining last sample of high grade streak.....	1.2	0.3
Across 9 feet west side of cut.....	1.38	0.4
Across 8 feet near centre of cut.....	0.8	0.4
Grab sample of dump.....	1.0	1.0
Selected arsenopyrite, quartz, and some galena.....	9.6	39.6

Taking the average of the first six samples by multiplying the width sampled and assay in gold and then averaging to the foot of vein sampled, the result is 0.99 oz. gold to the ton, which happens to check somewhat remarkably with the grab sample from the whole dump of 1 oz.

Another vein is exposed on the *Warspite* which apparently strikes S. 55° W. (mag.), although the small opening makes it difficult to tell much about it. There is here exposed about 20 inches of quartz fairly well mineralized with galena, pyrite, and arsenopyrite. A rough sample of the vein gave: Gold, 0.8 oz.; silver, 8.3 oz.

This claim is situated on the northern flank of Stouts gulch on Barkerville mountain, three-quarters of a mile from Barkerville and 300 feet above the town. The owner is Dr. Callaghan, of Barkerville. An open-cut 25 feet long with a 6-foot face shows a quartz vein 6 feet wide striking N. 70° W. in schist. A sample of the quartz on assay only showed traces of gold and silver. Four hundred feet to the north-west another cut shows the vein to consist of interbanded stringers of schist and quartz. A sample across 3½ feet returned: Gold, 0.08 oz.; silver, 0.2 oz.

Another vein on the property consists of parallel quartz stringers in schist, with cross-stringers radiating out from the others. A general sample of the vein only returned traces, but a sample from a 6-inch stringer which was reported to "pan well" assayed 4.48 oz. in gold. Another from a 10-inch stringer carried 0.62 oz. gold to the ton.

Hardscrabble Scheelite Deposit.

Introductory.—The property known as the "Hardscrabble Scheelite Deposit" consists of two Crown-granted mineral claims; it is owned by a syndicate of six men, of which J. A. Macpherson, of Stanley, and D. McCaskill, of Vancouver, seem to be most heavily interested.

The claims are situated on Hardscrabble creek, half a mile above the junction of this creek with Willow river. The property is distant about sixteen miles from Stanley. From Stanley the main Barkerville wagon-road is followed to Jack of Clubs lake, and from there a branch road extends to Mosquito creek, a distance of one mile. From this point to the property it is four miles, the first three miles being over a rough road which was built to serve claims on Sugar creek. One mile of new wagon-road and a small expenditure for repairs would give the property good wagon transportation to Quesnel, a distance of fifty-eight miles. From Quesnel there is river transportation to Prince George, on the Grand Trunk Pacific Railway.

Hardscrabble creek was worked in a small way for placer gold many years ago. In the course of the drifting operations small pieces of heavy white and brown minerals were found in the gravel and also in small amounts in the sluice-boxes. This mineral was finally identified as scheelite. Later in the drifting operations the scheelite was found in stringers in-place in the bed-rock; a drift in the bed-rock was run and a shaft sunk for the purpose of exploring the scheelite-deposit. This work was done some years ago and since then no further development has been carried out. Last year the workings were cleaned out and fixed by Mr. Macpherson, so that the showings could be examined.

Workings.—Entrance to the workings is by a shaft 60 feet deep, from which a drift extends northerly for 153 feet. At this point a winze has been sunk to a depth of 20 feet, and a drift run to the east for 49 feet. The main shaft is in gravel throughout, and the main drift north is in gravel for half its distance before breaking into solid rock.

Thirty feet below these workings a drain-tunnel 1,900 feet in length was driven from near Willow river. This was part of the placer operations and was driven to draw the water from the gravel to facilitate the workings of the placer-gravel. South of the main shaft an opening downward connects with this drain-tunnel and the water is carried off. Above the main workings numerous gravel-drifts have been made in the course of mining out the auriferous gravel.

Ore-showings.—The main showing of scheelite occurs along the first 15 feet of the east drift commencing at the winze. The country-rock is a schist, in places highly micaceous. The strike is approximately N. 60° E. (mag.), with a dip to the north. The east drift follows approximately the strike of the schist country-rock.

The scheelite apparently occurs in irregular stringers and bunches. There would seem to be two main series of fractures, one striking N. 60° E. (mag.) with the formation, and the other north and south (mag.). Of these the latter would seem to be the more important, and in all cases noted they cut the stringers running with the formation.

With the limited development-work done and entire absence of surface exposures, it is difficult to ascertain the true strike of this scheelite-bearing zone. It would seem, though, that the schist had been slightly fractured in the first place along a line of N. 60° E. (mag.) and some quartz deposited in the fractures. Later this schist has been fractured along a north-and-south line, and in these fractures quartz, calcite, and scheelite have been deposited. From these fractures some scheelite has been fed into the quartz stringers running N. 60° E. (mag.), this giving rise to the opinion that the scheelite-zone followed the formation. More work is necessary to determine definitely the true strike of the zone.

In addition to the mineral already noted, a little pyrite and galena occur in the stringers, but not in appreciable amounts. Wolframite, tungstite, and molybdenite are said to have been found in the deposit, but none were seen by the writer.

The stringers are narrow, from 1 inch up to possibly 6 inches. In 12 feet of rock-matter six stringers running north and south (mag.) were seen. The stringers running in the other direction are very irregular and are more in the nature of bunches.

The schistose and quartzose rock-matter between the stringers is said to carry a little scheelite, but this is not visible to the eye. A sample taken to determine this point, on assay, showed no trace of tungsten. It is improbable that the schistose rock carries any appreciable percentages in tungsten, so that from an economic view-point only the narrow stringers carrying scheelite need be considered.

Values.—The small stringers carry small bunches of scheelite which in places are pure mineral. Assays of these selected specimens would therefore give high results. If 6 to 10 feet of the scheelite-bearing zone were mined out the tungsten content would undoubtedly prove to be quite low, although possibly sufficiently high to be economically worked. Selective mining and hand-sorting of the pure scheelite might yield a small production.

The property is at present quite undeveloped and some further work should be done before intelligent and exact sampling can be done. With the present price of tungsten, the indications of tungsten-bearing ore in this property are such as to warrant some further development to ascertain the extent of the mineralized zone.

QUESNEL MINING DIVISION.

Quesnel Mining Division was at one time the scene of important and productive placer operations, but in recent years the industry has declined until the annual output only amounts to from \$10,000 to \$20,000. In the early years of the Cariboo gold-rush the Quesnel Forks-Keithley country was very actively worked. Later on, several large-scale operations were commenced at different places around Quesnel Forks and Harpers camp. These were worked for varying lengths of time and eventually closed down.

The most famous of these and up to that time the most important hydraulic-mining enterprise in British Columbia was that of the Consolidated Cariboo Hydraulic Mining Company, more familiarly known as the "Bullion" pit. This property has been tied up for the last five years in litigation over ownership, but it is probable that when this is settled operation will recommence.

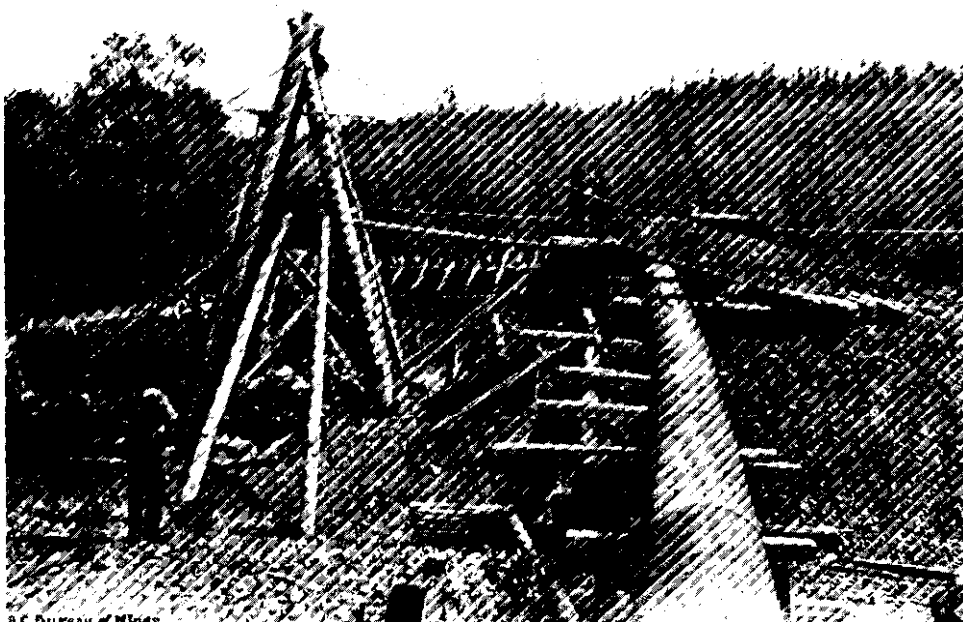
At the present time there are only a few men left at Quesnel Forks, and in the whole of the area around there is no placer-mining going on. On Keithley creek one property is being worked in a small way.

On the Quesnel river the 20-Mile hydraulic plant is being operated. At Harpers camp there was a little activity during 1918, consisting of the installation of the plant of the International Dredging Company. Up the Horsefly river, at Black creek, some Keystone-drilling was done but, with inconclusive results.

HORSEFLY SECTION.

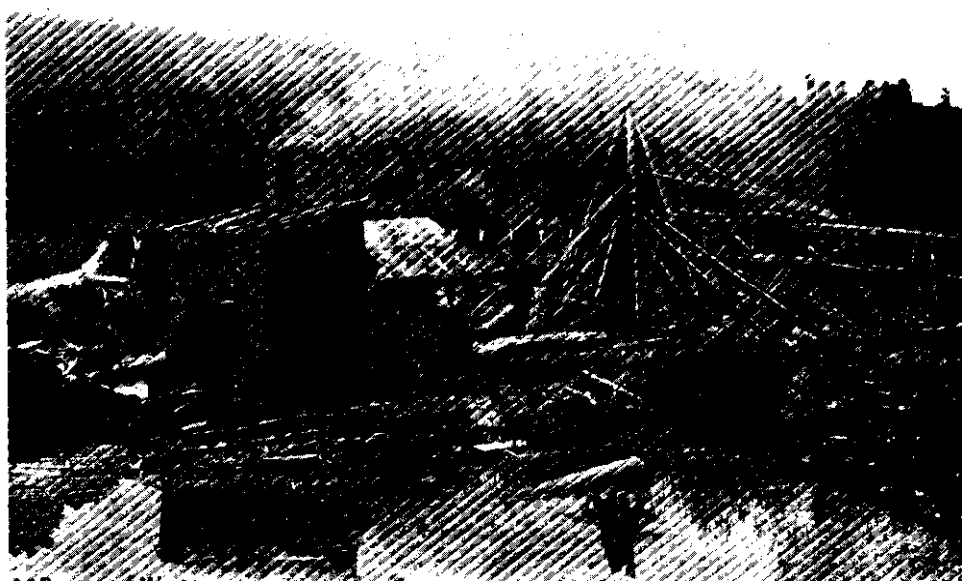
Proposed Keystone-drilling at Harpers Camp.

Introductory.—Harpers camp is situated on the Horsefly river, thirty-five miles in an easterly direction from 150-Mile House on the Cariboo Road. A weekly stage from 150-Mile gives access to the camp. The history of placer-mining in this section is much the same as in other parts of the Cariboo District, viz.: First, vigorous mining in the early sixties of the easily available rich ground; secondly, intermittent mining by Chinamen and others; and, thirdly, working of the ground on a larger scale with the aid of modern machinery.



S.C. Bureau of Mines

International Dredging Co.'s Dredge.



S.C. Bureau of Mines.

International Dredging Co.'s Steam Plant.

The important productive ground near Harpers camp was an area lying in and along a bend of the Horsefly river, and consisting in all of not more than 10 acres. The estimates of the amount of gold taken from this area vary considerably, ranging from \$500,000 to \$1,250,000. This ground was first drifted by the old-timers, and was eventually worked by R. T. Ward by hydraulic methods and using an hydraulic elevator to raise the gravel from pits to the sluice-boxes. It is quite certain that the early work paid handsomely, but it is difficult to ascertain whether or not any profit resulted from the operations of R. T. Ward. Some portions of the ground paid, but others did not, and the whole average result is unknown. It must be remembered, though, that the Ward ground had the best of the gold taken out by the old-timers.

It is believed by some of those familiar with the work done at Ward's Horsefly that there is still some unworked ground left in this area which will pay to work. With the idea of reworking this ground the International Dredging Company was formed three years ago. This company has spent three seasons in preparation and has only commenced active operations this year.

The plan of operations is to dig and elevate the gravel by a scraper operated by a powerful donkey-engine. The gravel is elevated, washed in sluice-boxes, and an undercurrent product treated in a patent rocker. To begin with, the ground handled will consist of old tailings, which it is claimed carry sufficient gold to pay operating expenses, and eventually new ground will be reached. The operations of this company are described in more detail later in this report.

The character of the gold taken from this ground (known as Ward's Horsefly) was uniformly fine, flat, and well worn; grains the size of flax-seed formed the greater portion of the gold taken out. It is quite evident that the gold in this area of ground had travelled a considerable distance and is not of local origin. Presumably it had its origin at some unknown point away up the Horsefly river.

The Horsefly river, both above and below Ward's Horsefly, has been fairly thoroughly prospected and a little gold has been taken out in places; no place comparable in richness with the Ward ground has, however, been found. The conclusion has therefore been reached by many that the gold in Ward's Horsefly did not get there by following the present river-channel. An old channel of the river is postulated in order to account for this remarkably rich spot with barren ground above and below.

Some work has been done to prospect the adjacent territory for this supposed old channel, but it is claimed that this work, while unsuccessful in finding gold, has not been sufficiently extensive to settle the matter definitely.

A considerable amount of money was spent in what is known as the "Miocene" shaft. This enterprise was carried out by the Miocene Gravel Mining Company with the expectation of finding a continuation of the rich channel worked at Ward's Horsefly.

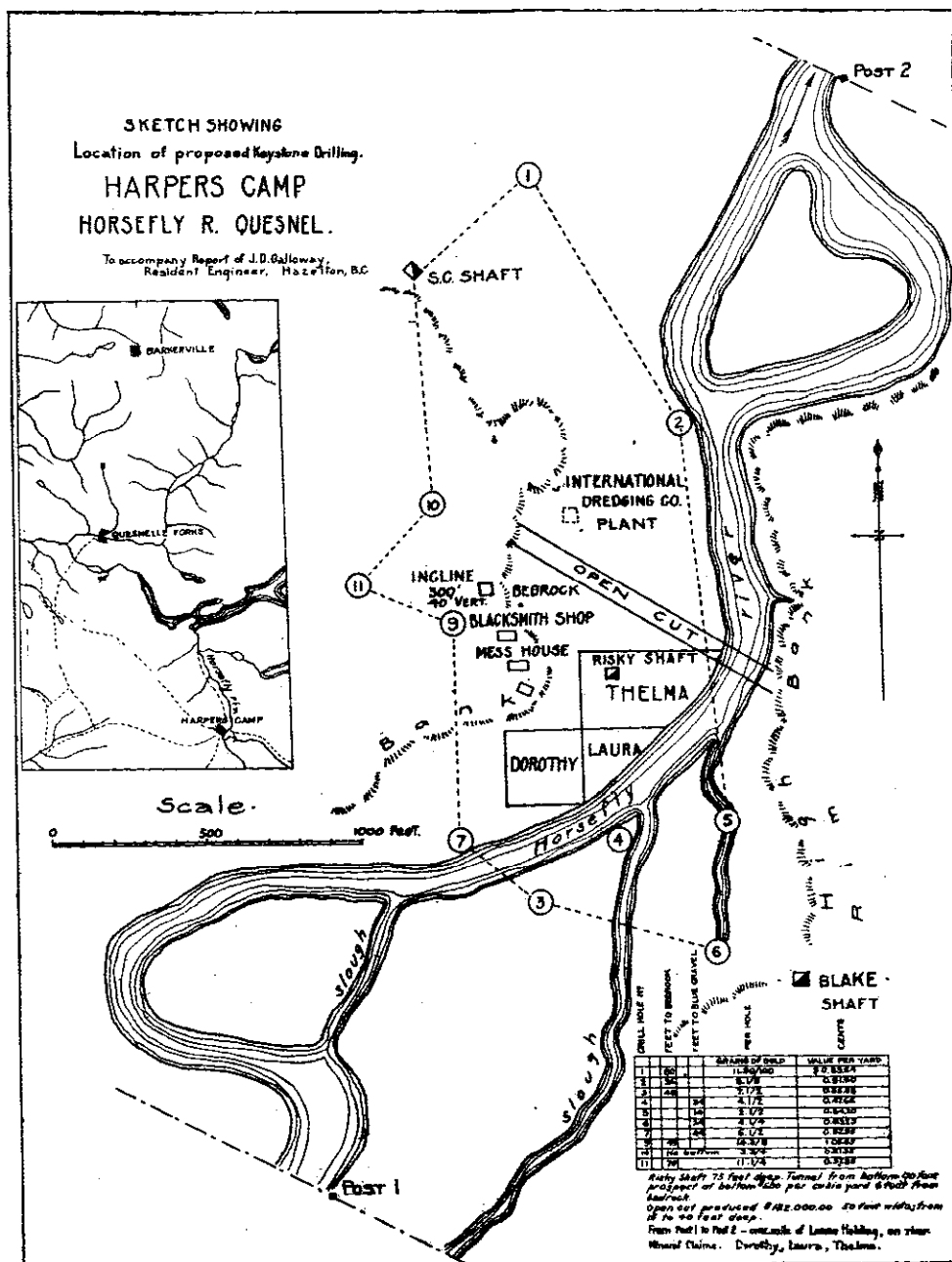
The main shaft was sunk at a point about one-third of a mile south of Ward's Horsefly pit; it was put down 500 feet before striking bed-rock. The whole work was well done, the shaft being 3-compartment and well timbered and the machinery complete for the purpose. In sinking this shaft the gravel was found to be capped with about 100 feet of blue clay, after which about 400 feet of gravel was passed through, containing gold, but not in paying quantities. This gravel is free and very uniform in size, being composed almost entirely of smooth, worn, white quartz pebbles. In this it differs materially from the wash as seen at Ward's Horsefly, which is bluish in general colour and contains many different rocks besides quartz pebbles.

During the spring of 1900 the pumps, pumping-station, and machinery generally were overhauled and the shaft sunk 50 feet deeper in bed-rock. From this level a drift was run for 500 feet in the direction of and under the channel. From this rock drift upraises were made into the gravel-channel. When the last upraise was put up which struck gravel in 15 feet, the rush of water and gravel flooded the workings. Since this occurred no further work has ever been done in the shaft.

Reports vary as to the gold-tenure of the gravel taken from the upraises into the channel, but it would seem that it at least contained some gold and in places sufficient to pay to work. The "sampling" of the channel by means of breaking into the gravel with three or four upraises was quite insufficient to form any proper estimate of the average gold values in this channel. It is to be regretted that when so much capital was expended in this enterprise the testing of the channel was not carried further.

Some drilling has also been done in the vicinity which will be described later, and also some attempts were made at sinking shafts by hand where the ground was supposed to be shallow.

Five miles down the Horsefly river "Hobson's Horsefly" is situated. This was a hydraulic pit equipped and operated on a large scale by J. B. Hobson. The deposit of gravel worked here



lies only a short distance from the Horsefly river and represents a former channel of the stream. The project was unsuccessful owing to the outside gravel changing to a cemented gravel, which is virtually a conglomerate. Hydrauicking was therefore of no avail and a small stamp-mill

was erected to grind the cemented gravel. It was obvious that unless the ground was extremely rich placer-ground it would not pay to operate in this way. The mill was only operated a very short time when work was finally stopped.

The presence of a former channel of the Horsefly river at Hobson's Horsefly strengthens the theories that in other places (as, for instance, near Harpers camp) the present channel is in part diverted from the old channel down which the richest gold-bearing gravels were transported.

Physical Features.—Attached to this report is a map showing that portion of the Horsefly river which includes Ward's Horsefly pit and adjacent territory, and the location of drill-holes already put down in former years. The country is flat, except that the river cuts down 20 to 30 feet below the general level. The grade of the river is slight, not sufficient to carry off hydraulic tailings. In all the work done here it has been necessary to elevate the gravel in order to make an artificial dump.

In the Ward workings the bed-rock was found at depths varying from 20 to 60 feet depth. The bed-rock that can be seen now in certain places is so decomposed and softened into clay and sand that it would seem doubtful that it is the true bed-rock, but those familiar with the work while it was in progress say it was more rock-like in character when first exposed. From a point near the centre of Ward's Horsefly the bed-rock dips off in all directions; at the Miocene shaft the depth is about 500 feet, and in other directions the depths are unknown at any great distance from the pit. The way in which the gold occurs here on the highest bed-rock is somewhat puzzling and accounts to some extent for the different ideas as to where it came from.

The pay-strata in Ward's Horsefly is locally called "blue gravel." It has a thickness of 5 to 20 feet, resting on the bed-rock. Concentrations of gold on bed-rock were of frequent occurrence. This blue gravel is not particularly hard and presents no serious difficulties in mining. Above this blue gravel are other stratas of clay and gravel carrying in places some gold. It is impossible now to get any exact estimate on how the gold was distributed in the gravel, average yardage value, etc.

Provided a continuation of pay-gravel beyond Ward's Horsefly pit was found, it is doubtful how the ground could be worked. All the evidence available indicates that the ground would be deep. Straight hydraulicking cannot be carried out in this area owing to lack of dump. Hydraulic elevators are never very satisfactory and cannot be operated to any great depth. Drifting operations to be successful must have rich ground; i.e., the values must be concentrated in one thin strata and not be disseminated through a great thickness of gravel. Ground deeper than 80 feet could not be worked by dredging.

Previous Drilling.—As shown by the attached plan, ten holes (numbered 1 to 11, with No. 8 missing) were put down around Ward's Horsefly pit. This work was done by some Eastern syndicate. The following table shows the average values said to have been obtained in these holes, but no guarantee can be given as to the accuracy of these figures:—

Drill-hole No.	Feet to Bed-rock.	Feet to Blue Gravel.	Value per Yard.
			Cents.
1.....	80	..	53.64
2.....	36	..	81.00
3.....	49	..	55.08
4.....	..	34	47.68
5.....	..	14	64.20
6.....	..	24	63.75
7.....	..	44	52.96
9.....	49	..	105.55
10.....	No bottom	..	21.35
11.....	70	..	57.85

The above values are quite high, and if correct would show the ground to be first-class dredging-ground. The depth of ground is also within the dredging limit. No reason is known why the Eastern syndicate stopped drilling and gave up the investigation of the ground. No reliance can be placed on any values obtained by drilling unless the work is carefully done by an experienced driller and an exact log of the hole kept.

The scraper system of mining (which may be considered a dredging operation) now being operated by the International Dredging Company should be able to handle the ground included in the drill-holes shown, and if the values are as claimed a fair margin of profit should be made.

Proposed Drilling.—The ground Mr. Campbell wishes to drill lies across the river to the east of Ward's Horsefly pit. A depression extending for a considerable distance in this direction is believed by him to be an old channel of the Horsefly river. This is virgin ground and nothing is known of it one way or another. Some shafts have been attempted near the bank of the river, but none reached bed-rock. Drilling of the ground would undoubtedly settle the matter as to whether or not there was an old channel in this direction. Before doing any extensive drilling a detail topographic map of the area would be of considerable value, and some time should be spent in an examination of the surrounding country.

Ownership of Ground.—So far as was ascertained, the only locations held in this locality are three creek claims (250 feet each) owned by the International Dredging Company, which occupy part of the old Ward's Horsefly pit, and a dredging lease along the river held by R. T. Ward; this lease (No. 1360) is subleased to the International Company. Application for a dredging lease adjoining Ward's lease down the river has been made by Williams, who also has a pre-emption covering the ground to which he has just secured title. The ground Campbell proposes to drill has not as yet been leased to anybody.

Conclusion.—Following are the main facts known regarding the occurrence of placer gold at Ward's Horsefly:—

(1.) The ground worked was very rich, probably nearly \$1,000,000 being taken out of a small area of 8 to 10 acres.

(2.) Ground on the river immediately above and below this pit has been found to be practically barren of gold.

(3.) The character of the gold obtained in Ward's Horsefly is such that it is certain that it must have been transported a considerable distance.

(4.) It is unlikely that such a concentration of gold would occur at one point without a feeding channel coming into it. Such channel, however, may not carry much gold, as the local conditions at a particular point may cause a concentration of gold at that place.

(5.) All prospecting and testing of ground adjacent to Ward's Horsefly have been unsuccessful.

(6.) Several places which could possibly lie along the line of the supposed old channel have not yet been tested. From a purely business standpoint there has not apparently been sufficient chance of success in this proposition to make it worth while spending the money required to carry out a systematic campaign of drilling; consequently if left to private enterprise it is unlikely that any further work would be done in this area, and therefore the only hope left is for the Government to do some drilling. The justification for the Government doing such work is that, if successful, a productive placer camp would be re-established.

If, however, the Government decides on the policy of doing this drilling in the interests of the country, then it would be desirable that a further and more extended examination be made and the drilling laid out on a definite plan. The drilling will be of no value unless carefully supervised and results kept in such a way that they will be accepted as a correct record of the value of the ground.

International Dredging and Exploration Company.

This company was incorporated about four years ago for the purpose of working placer-ground at Harpers camp by a new system—the Stanley scraper, a patented process. The company was mainly financed in Victoria, B.C. The ground to be worked, consisting of three creek claims and a sublease on dredging lease No. 1360 on the Horsefly river, is at Harper's camp, practically on the site of the old Ward's Horsefly.

This ground in part covers the small area at Harpers camp which in the past was so highly productive. It is believed that some equally rich ground still remains to be worked in this area, but before getting to this an accumulation of tailings will first have to be worked through. It was believed that by the use of improved gold-saving devices some values might be recovered from these tailings, but this is by no means certain.

As is usual in such an enterprise, difficulties were encountered which were not foreseen to begin with, and so, although the company has been working during the past three seasons getting things in shape, only in the summer of 1918 was the plant ready to operate. The mechanical part of the plant now consists of a 100-horse-power upright boiler, a 40-horse-power double-cylinder Empire 2-drum engine, and the Stanley scraper with cables, blocks, etc.

The Stanley scraper is somewhat like an enlarged horse-scraper, with sharp teeth for cutting in and longer sides than the bottom. It is of heavy construction throughout and has a capacity of 2 cubic yards. By means of cables, blocks, and poles this scraper can be moved backwards and forwards by the engine. It is fitted with a double haulback, so that it can be "spotted" anywhere within the triangle that is being worked. This scraper will haul gravel 500 to 600 feet and should dig down 40 feet in depth or more. The scraper drags its load up a gradual incline and delivers it to a sluice in which a sufficient head of water is running to carry off the gravel, the gold being caught in the riffles. The scraper takes about two to three minutes for a round trip and should handle 750 yards in twenty-four hours.

The plant was operated for a short time in 1918, working entirely on tailings. The recovery of gold is not known, but it is not believed these tailings yielded any appreciable amount. Work will be resumed next year, and it is expected gravel will be reached which has not previously been sluiced.

The water-supply is obtained from Moffatt creek. An old ditch-line was repaired and renewed, bringing the water to a small lake near Harpers camp, which has been converted into a reservoir by building a dam at the outlet. This water system will supply from 500 to 1,000 miners' inches of water.

Black Creek.

Black creek is a small tributary of Horsefly river, coming in some twenty miles above Harpers camp. This creek was prospected for placer gold many years ago, but from the conflicting accounts it is hard to determine how successful these early attempts were. It seems fairly certain, however, that no very rich ground was found and that the quantity of gold recovered was small. The old workings, which are not extensive, are in several places from one to two miles up-stream from where the creek joins the Horsefly river.

Early in 1918 the Western Mines Exploration Syndicate, of Vancouver, for which Mr. Turner is engineer, secured leases on the creek with a view to testing the value of the ground. The testing of the ground was recommended by Phil Fraser, an old-timer in the district who had worked on the creek, and also had been in charge of work at Harpers camp many years ago. Fraser considers that an ancient channel of the Horsefly river lies upon the bench and at 1,000 feet higher elevation than the present river. His idea is that Black creek cut through this old channel and thereby obtained the gold found in its gravels, and that if this old channel could be found it would prove very rich. There is very little material evidence, other than a slight depression along the bench, to support this theory of an old channel of the Horsefly existing at this place.

The first work of the syndicate was an attempt to prove the correctness or otherwise of Fraser's old-channel theory. A Keystone drill, then owned by R. T. Ward, but since acquired by the Government, was taken up to the ground. This drill had been used some years ago lower down the creek.

Mr. Fraser was in charge of the work, and the site selected for the drilling was upon a bench some 80 feet above the creek on the south-easterly side and two miles up from the mouth of the stream. Five holes were put down running in a general direction up-stream, and therefore crossing the old channel which supposedly runs at right angles to Black creek.

This section of holes showed a slight depression to exist at this point, and the deepest hole at 81 feet failed to reach bed-rock, the shoe breaking at this depth. The other evidence, however, does not support the idea that there is an old stream-channel at this point. No appreciable gold values were found in the material drilled through. An examination of the logs of the holes showed that the material on the holes consisted of clays and gravels that might occur on any bench.

While the drilling was progressing an attempt was made to sink in the gravel by the bed of the creek in order to ascertain the values on bed-rock. On account of water it was found impossible to get down by hand-sinking more than 10 to 15 feet, so that no results could be obtained.

There is a considerable amount of gravel in and along Black creek which may carry sufficient gold to pay to hydraulic. The easiest way to test this ground would be by means of drilling with the Keystone drill. Black creek is small and would hardly supply enough water for large-size hydraulicking, but possibly during the high-water season sufficient water would be obtainable.

The creek has sufficient fall to provide dump-ground for tailings from hydraulic operations. Further testing of the gravel in and along Black creek may be carried out by the syndicate to determine whether the gold-tenure is sufficient to warrant the installation of a hydraulic plant.

Quesnel Hydraulic Gold Mining Company.

The Quesnel Hydraulic Gold Mining Company was promoted and organized by Howard DuBois to work on a large scale the immense gravel-deposits on Twenty-mile creek, a tributary of the Quesnel river which enters twenty miles below Quesnel Forks. Twenty-mile creek had been worked in a small way by both whites and Chinamen, but on account of a small supply of water only certain small areas were attacked. The assumption on which the Quesnel company went ahead was that the immense deposits of glacial gravels and clays on both sides of Twenty-mile creek all carried values, even though lower grade than the small patches previously worked. The problem as stated by Mr. DuBois was "not to find gold, but to find water." Some preliminary testing of the gravels was done by tunnelling and shaft-sinking on a small scale, and the results obtained apparently confirmed the opinion that the gravels carried sufficient values to pay to hydraulic on a large scale. The later operations, however, showed that the values were lower and more "spotted" than had been anticipated.

While making investigations in the Quesnel Division Mr. DuBois discovered a source of water-supply on upper Swift river that seemingly had been overlooked by others, and ascertained that it would be practicable to bring this water on to deposits of gravel on the Quesnel River slope.

About \$1,000,000 was expended in putting in the water system and equipping the property. The water plant is the best in the Province, as it can easily supply 5,000 miners' inches at a head up to 400 feet for six or seven months in the year. Equipping of the property was completed in 1911, but the first real test of the gravel was the season's run of 1912. This test, however, was entirely unsatisfactory, as less than 2 cents a yard was recovered from the gravel handled instead of from 5 to 8 cents as had been expected. Operating costs were said to be about $1\frac{1}{2}$ cents a yard; this low cost shows the mechanical excellence of the plant installed by Mr. DuBois.

The property was not operated in 1913 or 1914, but in 1915 further testing of the ground was commenced under the supervision of K. C. Laylander. This work has been continued each season since that time.

It has now been pretty well demonstrated that the great accumulation of gravels and clays through which the present Twenty-mile creek has cut is, as a whole, not sufficiently auriferous to pay to work. Certain terraces of gravel deposited in bays by the stream in its cutting-out process, which are really partial concentrations from the older gravels, do carry values. These, however, are relatively small in extent and are such areas as were worked by the old-timers. Furthermore, it is extremely doubtful whether the values saved in the small-scale testing of the ground in rockers, etc., can be saved in a short sluice carrying 3,000 or 4,000 miners' inches of water. A percentage of the values, possibly a large percentage, is in the form of flour gold which cannot be so saved in the ordinary hydraulic sluice. After the 1912 run some doubt was also expressed as to whether the method of working the pit had not left most of the values in the pit, as bed-rock was only reached and cleaned up in places. Mr. Laylander, the present manager, however, claims that working to bed-rock makes no appreciable increase in the value per yard recovered.

The work of the last few years has shown some areas of the gravel which will pay to work, but which will not show any great margin of profit. One pit is now being carried ahead with the idea of breaking into a supposed old channel lying at some distance from the present creek. During the season of 1918 the problem of recovering the total values in the gravel handled was attacked, the chief incentive to this being the idea that the black sand, which occurs in sparing quantities in the gravel, carried appreciable platinum values.

It has long been known that some of the black sand (a concentrate from the placer-gravels) in the Quesnel River district carried more or less platinum contents. The amount of this platinum is quite variable; many samples of black sand on assay do not show a trace, while occasionally quite high assays have been obtained. From many places up and down the Quesnel river and its tributaries platinum has been reported, generally in small amounts. No appreciable quantities of platinum were ever recovered from the placering operations in the Quesnel Division,

what platinum there is apparently occurring in almost microscopic grains with the black sand, which latter has seldom been saved. The presence of this platinum can rarely be detected by the eye, and it is only through assays of samples of the black sand that its occurrence has been noted. The Annual Report for 1902, page 64, gives a list of such assays, with localities. These assays were made on a number of samples of black sand and the ratio of concentration of which was quite unknown, so that they only indicate the presence of platinum in the gravels without giving any idea of the value to the yard. It may be well to point out here that the usual small quantity (amounting often to about an ounce or less) of black sand obtained from panning a full pan of gravel represents a very high degree of concentration—say, 1,000 to 1. It follows, therefore, that the platinum content in the black-sand concentrate must be quite high before the value per cubic yard of gravel becomes of commercial importance.

From a number of samples of black sand taken in 1917 from the hydraulic pit at Twenty-mile, assayers in the United States returned varying amounts of platinum. Granting that the samples were representative and the assays accurate, the platinum content of the gravels was of importance; in addition, the assays showed a considerable gold content in the samples.

Mr. Laylander therefore decided during the season of 1918 to recover the black sand in a commercial way with a view to making a thorough determination of the flour gold and platinum contents. The hydraulic pit was operated as usual with a large head of water, but an under-current was put in the sluice-box by means of which a portion of the fine material passing through the sluice was drawn off through a grizzly. This material, consisting of fine gravel and sand, is elevated in an hydraulic elevator to a mill where it is treated.

In the mill the gravel and sand is fed to two Neal jigs, which make a partial concentration. These jigs are of a special design recently patented for use on California gold-dredges as part of a process to recover black sand. This jig is fitted with a 30-mesh screen on which there is a layer of chilled shot. Underneath this screen a set of paddles moves back and forth, giving rise to an alternate lifting and suction of the material on the screen. The material to be treated is fed into the jig and forms a layer on top of the chilled shot. A continuous flow of water fed in with the gravel keeps the jig-box full of water and the overflow carries off the tailings. The fine heavy particles sink and are drawn through the layer of shot and finally through the screen, forming a hutch product which is the concentrate from the jig.

The capacity of a Neal jig working on this class of material is about 40 tons a day. The concentrate is continuously discharged to a dewatering-cone, from which it feeds to an Overstrom table, one table handling the product of the two jigs. A clean concentrate of black sand is made on the table without difficulty. The amount of black sand in the gravel-deposit varies considerably, some strata yielding a fair percentage and others practically none. During the season the production of the mill was from $\frac{1}{4}$ to $\frac{1}{2}$ ton a day of black sand. Only a small proportion, however, of the fine material passing through the hydraulic sluice was recovered.

The mill is run by a Pelton wheel, a short pipe from the main pipe-line supplying the water. A 5-horse-power electric generator has been installed for lighting purposes.

The average values which this black sand contains in gold and platinum are still undetermined, for while some high assays have been obtained, others show only traces of these metals. Tests are now being carried out to find the average value of this concentrate, of which a considerable quantity was secured during the season, and also as to how these values can be extracted.

KEITHLEY SECTION.

Keithley creek is one of the famous placer-creeks of the early Cariboo gold excitement, and is credited with a production of about \$6,000,000 from a distance of eight miles up the stream from its mouth. Above this point there is a falls on the creek, and beyond the falls practically no gold was ever taken out. The most of the gold from the creek was flattened and well worn, about the size of flattened grains of wheat, although occasionally coarse nuggets were found. Practically no black sand is found as a concentrate from panning the gravel anywhere on the creek and platinum has never been reported.

The most of the gold from Keithley was taken out from the present creek-bed by cleaning up the stream-gravels to bed-rock. In addition, an old channel on the bench on the north-east side of the stream was worked and in places yielded very rich "pay." This channel was very erratic, so that it has only been worked in certain places at irregular intervals.

This placer claim is situated on Keithley creek one mile above the mouth. **Kitchener.** It is owned by R. W. Harrison and E. J. Worth, but has been operated by Harrison alone for the last three years, his partner having enlisted shortly after the outbreak of the war. The property consists of one 1,500-foot lease and one record claim. Work was commenced in October, 1914, and has been carried on more or less continuously since.

The Kitchener workings are on the old channel 130 feet above the creek. The channel here is irregular and would appear to have somewhat the shape of the letter S. Many years ago the ground was held as the *Howick* claim, but a new portion of the channel is being worked by Harrison. The workings on the *Howick* claim were never very productive. A short distance up-stream was the old *Onward* claim, which yielded big pay.

The first working by Harrison is a tunnel driven in 300 feet, which was successful in finding the old channel. A lot of ground has been drifted out from this tunnel and is said to have averaged 5 oz. to a set. The ground, however, was hard to handle and the mining expenses were unduly high in consequence. Eventually work was stopped on account of heavy ground and water-pressure.

Another tunnel was started then a short distance down-stream from the other one. On October 14th this was in 130 feet and the driving of it ahead was being continued. This tunnel is for the most part driven in rock, but the last part is partly in gravel, there being about 2 feet of gravel carried along at the face. This gravel, it is claimed, carries about 2 oz. to the set, the sets having a 10-foot cap. The gravel consists partly of well-worn stream-gravel and partly of sharp angular fragments of rock, very similar to talus material.

As far as can be ascertained, many of the attempts to find this old channel along the bench were unsuccessful, but there seems to be a strong probability that the channel is continuous, although somewhat broken and irregular. There may therefore still be plenty of pay-ground left to work. The most satisfactory way of testing the ground would be by Keystone-drilling. The ground held by Harrison and other parts of the same channel could best be worked by hydraulicking. Keithley creek carries plenty of water even in the lowest stage for large-scale hydraulicking. With two miles and a half of ditch and flume a head of over 200 feet could be obtained. There is an excellent dump in the 100-foot drop from the bench to the creek and the stream itself has a sharp descent. The expense of installing an adequate hydraulic plant on this creek would be, comparatively speaking, quite low. This proposition is well worth examination and detailed investigation.

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, 1918.

Owing to having only arrived in the district in July and my previous non-acquaintance with the district except in a very general way, I am not in a position to go so thoroughly into conditions as I should desire, but as the Resident Engineer, J. D. Galloway, has made two visits to the district this year, and a Dominion Geological Survey party under B. R. MacKay spent some months in preliminary work, their reports will, if consulted, be found to cover all operations in a much more instructive and technical manner than I could hope to.

Owing to the very late season hydraulic operations were greatly impeded. When the thaw did come, it arrived with a rush and miners obtained very little good from it. This, followed with a very dry summer and autumn, practically cut the season in two, and, as a consequence, hydraulic operators all report very poor results.

Stouts Gulch, Lowhee Creek, and Mosquito Creek properties, operated by John Hopp, only produced about half their usual averages.

Slough creek, operated by the Point Hydraulic Mining Company, Limited, had a short season with a fair output.

On Jack-of-Clubs creek, McDougall & Reed have sunk their shaft to a depth of 96 feet, and at time of writing have run their drift some 30 feet from the bottom of the shaft. They expect to have to go at least 70 feet farther with the drift, when they hope to tap the old channel.

On Williams creek Joule & Mason worked the old *First of May* property, but owing to water shortage the results were disappointing.

On Grouse creek the old Waverly Company, reorganized, did considerable preliminary work, including the sinking of some test-holes, erecting sawmill, logging, etc., with a view to carrying on active mining operations during the ensuing year.

On Antler creek Houser Bros. & Fraser have carried on development-work on the *Gold Seal Consolidated* group of leases, and a Vancouver syndicate has been doing preliminary work on Nugget gulch.

The Lightning Creek Hydraulic Mining Company, the West Canadian Deep Leads, the Thistle Gold Company, and the Cariboo-Chisholm Creek Mining Company were idle during the year, presumably owing to the shortage of labour, high cost of supplies, and fixed price of gold.

I. I. Felker reports on Perkins Gulch operations as follows: "During the three seasons previous to 1918 we worked out the channel next to the left rim for a length of 600 feet and a width of 150 feet. This work revealed no sign of the right-hand rim, so with the bank getting high and the pressure low, we decided to back up and open a new pit about 150 feet to the right. The present season's work has uncovered a channel 100 feet wide and 30 feet lower than the bed-rock in the old pit. The bank shows two strata of gold-bearing gravel—one pre-glacial deposit on the bed-rock 100 feet wide and 4 to 6 feet thick; the other, a post-glacial deposit, on top of a 20-foot layer of clay, 100 feet wide and 6 to 10 feet thick. These two deposits carry about equal values. The bed-rock gold is heavier, but the top gold is more smoothly washed. The top run is evidently the one that Sam Montgomery spent so much time in prospecting for. At the beginning of this season we installed a No. 2 plant in place of the No. 1, which materially increased the output. We had about five weeks' run with a full head in the spring, working four men. The remainder of the season we operated, using the reservoir, with only two men. Amount of gravel moved, 22,000 yards. Advanced the flume twelve boxes, added two boxes to dump end, which furnishes dump for season's work. Have dug a 2-foot ditch 440 yards downstream to catch water from springs and snow."

I have no information regarding operations in the Fraser River canyon, nor a report on the work carried on during the year by the Lightning Creek Gold Gravels and Drainage Company at Wingdam, beyond the current local knowledge that this work consisted largely of drilling.

In regard to quartz-mining, there have been quite a number of locations made, principally in the neighbourhood of Prince George, but the Deputy Mining Recorder at South Fort George informs me that beyond a little prospecting he can find nothing of importance to report on.

The holders of the Proserpine Mountain properties, E. E. Armstrong and Carey, Blair & Tregillus, are most optimistic, and since Mr. Galloway's last visit in October have erected a shaft-house and continued their shaft on the *Warspite* to a depth of 24 feet 6 inches, and, crosscutting the ledge at that depth, found it 3 feet wider than on the surface, and from appearances it is practically vertical. Cross-channel samples have been submitted to the Department of Mines for assay, but owing to the owners having worked until Christmas, when the samples were taken, no returns have as yet been received. At about 12 feet they appear to have run through the oxidation, and it should now be simple to determine whether the showing is such as will warrant the belief that they have the making of a mine.

In conclusion, it appears to me that to have a stabilizing effect on the gold-mining industry and economic conditions throughout the district other methods of mining than the short season of hydraulic mining must be introduced, and, from what I can gather, there should be a great future for dredging on a great many of the streams, as it is possible to work a dredge with a very limited quantity of water the year round, and with the introduction of dredges and development of the quartz properties the output from the Cariboo should rival the old golden days.

The office statistics show the revenue collected to be about the same as last year, which, considering it was the fourth year of the war, appears to me to be most satisfactory, as, owing to the greatly increased cost of mining with gold at its standard value, operations were reduced to a minimum. I shall be greatly disappointed if from now on the revenue does not largely increase and gold-mining become very active again.

OFFICE STATISTICS—CARIBOO MINING DIVISION.

Free miners' certificates issued (not including South Fort George)	141
Free miners' certificates (special)	3
Placer claims recorded	6
Placer claims rerecorded	27
Mineral claims recorded	119
Certificates of work issued	96
Placer-mining leases granted	20
Leaves of absence, placer, granted	15
Conveyances and other documents recorded	71

Revenue.

Free miners' certificates (including South Fort George)	\$2,238 25
Mining receipts, general	6,076 60
Revenue from other sources	1,392 15
Total	\$9,707 00

OMINECA MINING DIVISION.

REPORT BY STEPHEN H. HOSKINS, GOLD COMMISSIONER. (OFFICE AT HAZELTON.)

I have the honour to forward herewith office statistics for the Omineca Mining Division for the year 1918. It will undoubtedly be noted with satisfaction that the revenue derived from this source again shows a slight increase, being very close to \$600 in excess of the amount received under the same subhead during the year 1917.

Mining throughout this Division became very quiet toward the end of the year, but a few of the properties throughout the district are still undergoing development, concerning which the District Resident Engineer will undoubtedly report upon *in extenso*.

It will be observed from the office statistics that placer-mining in this Division has received some attention, but I regret I am unable to report that the earlier stakings have undergone development.

OFFICE STATISTICS—OMINECA MINING DIVISION.

Free miners' certificates issued (ordinary)	458
Free miners' certificates issued (company)	6
Free miners' certificates issued (special)	4
Mineral claims recorded and issued	300
Placer claims recorded and issued	4
Certificates of work	677
Bills of sale and other mining documents	113
Powers of attorney recorded	40
Mining documents filed	38
Certificates of improvements recorded and issued	31
Crown grants of mineral claims	31
Applications for placer-mining leases (Omineca Division, 17; Peace River Division, 33)	50
Placer-mining leases issued (Omineca Division, 12; Peace River Division, 33)	45
Placer-mining leases not granted (Omineca Division, 5)	5

Revenue.

Free miners' certificates	\$ 3,861 00
Mining receipts, general	11,527 25
Total	\$15,388 25

QUESNEL MINING DIVISION.

REPORT BY R. M. MCGUSTY, ACTING 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, 1918.

The past season has been one of the least productive for a number of years. The main causes of lack of production may be attributed to the fact that this Mining Division is, so far, dependent almost entirely on the output of gold, and that no change takes place in the value of this standard metal, although the cost of production has steadily increased during the last few years, due to the increase of wages and the high cost of living; on the other hand, there have been very great increases in the values of other metals, through war-time demand for same, with a consequent increase in the price of wages, the net result being that many of the miners have left this district, attracted by the higher wages offered.

In the Quesnel Forks section a certain amount of prospecting has been done, but no development-work to any extent.

In the Keithley section the *Kitchener* mine (Harrison & Worth) has only been operating on a very small scale, gold to the value of about \$1,400 being shipped.

The Quesnel Hydraulic Gold Mining Company is the only company in this district that has carried out development-work to any extent, employing a crew of about twenty men for the greater part of the season.

Both the *Kitchener* mine and the Quesnel Hydraulic Gold Mining properties were inspected by J. D. Galloway, Resident Engineer, during the past season, and I understand he is furnishing reports thereon to the Department.

In the Harpers Camp section the International Dredging Company, Limited, continued work during the earlier part of the season.

The Western Mines Exploration Syndicate, Limited, has during the past season been operating a drill and prospecting the properties with satisfactory results, and it is probable that active development-work will be commenced next season.

In the Lac la Hache section (Timothy mountain) Ryan & Hamilton have been busy during the past season exposing veins on their molybdenum properties.

During the past season there have been numerous inquiries as to tungsten properties.

OFFICE STATISTICS—QUESNEL MINING DIVISION.

Free miners' certificates (individual)	128
Free miners' certificates (company)	1
Placer claims recorded	1
Placer claims rerecorded	14
Mineral claims recorded	30
Certificates of work	18

EASTERN DISTRICT (No. 5).

REPORT BY A. G. LANGLEY, RESIDENT ENGINEER.

INTRODUCTORY REMARKS.

This district includes the following Mining Divisions: Golden, Windermere, Fort Steele, Revelstoke, Lardeau, Alnsworth, Slocan, Slocan City, Trout Lake, Nelson, Arrow Lake, and Trail Creek, generally referred to as the East and West Kootenays. This is the oldest lode-mining district in British Columbia; in it there are as many mines being operated as in all the other districts put together, although some are only producing in a very small way. With the exception of a very small percentage, it is responsible for the entire lead and zinc production of Canada. In 1918 it produced 70 per cent. of the silver-output of the Province, about 33 per cent. of the total gold-output, and 28 per cent. of the coal.

The first metalliferous mine to be staked in the district was the *Blue Bell*, on the shore of Kootenay lake. It was located in 1865 and is being operated at the present time.

The Rossland mines, which are now being operated by the Consolidated Mining and Smelting Company, were located in 1890.

The *Slocan Star*, which was staked by Bruce White in 1891, is being operated by the Silver-smith Mines, Limited.

The *Sullivan* mine, in the East Kootenay, which is being mined by the Consolidated Mining and Smelting Company, and promises to become one of the famous mines on the American continent, is of more recent date.

There are many other properties which were staked years ago that are still being operated, although some of them have been forced to close down from time to time on account of market conditions; but the fact remains that the total production for British Columbia of silver, lead, and zinc alone totals over \$93,000,000 up to the end of 1917, and conditions look promising not only for the present production being maintained, but being increased during subsequent years.

Generally speaking, the production of all the above-mentioned metals compares favourably with that of last year, in spite of the industry being severely handicapped by lack of efficient labour and the high price of machinery and supplies.

The gold production of recent years has been principally derived from the Rossland camp, but it will not do to overlook the placer-deposits of the Kootenays, from which large quantities of gold have been recovered in the past, and which undoubtedly still have possibilities.

The discovery of placer gold on Wildhorse creek, near Fort Steele, first attracted mining men to the Kootenays in the early sixties. Since this time mining has been carried on to a limited extent.

Shortly after the Wildhorse Creek rush new discoveries were reported up in the "Big Bend" of the Columbia river, some fifty miles north of Revelstoke, where gold was found in the gravels of Carnes, Downey, McCulloch, Gold, French, and Smith creeks. There was great excitement over these diggings for a time, and, although quite a little gold was recovered, it was only from shallow diggings. Gold was known to exist on the bed-rock, and a good deal of money was spent in endeavouring to reach it, but boulders and much water prevented economical mining. The excitement subsided and the crowd left the district, leaving behind only a few men, whose tenacity and dogged perseverance have kept some of them there, even up to the present time.

Other placers which were worked some years ago, and are again attracting attention, are located on Perry creek, which is a tributary of St. Mary river, in Fort Steele section.

Oil-seepages have been found in the Flathead section, and according to Ralph Arnold's report, which is published in the Annual Report of the Minister of Mines for 1915, the possibilities of finding oil in commercial quantities are favourable.

Good transportation facilities are provided throughout the district by the Canadian Pacific Railway Company, and the mining centres can be comfortably reached by boat or train, while to the majority of the prospects there are good trails over which it is possible to travel on horseback.

The Consolidated Mining and Smelting Company's smelter at Trail, which is conveniently situated to the mining centres, accepts silver-lead, copper, and gold ores for treatment.

Nature has not only endowed this section of British Columbia with great mineral wealth, but also with fine timber, rivers, and streams, so that there are few places indeed where fuel and water-power are not available for mining purposes; while the grandeur of the scenery and the excellent climatic conditions tend to make mining a more pleasant occupation than in the dry arid regions and semi-tropical climates of the south, or, in the intense cold of the far north. During the season the writer's time was taken up in visiting prospects and attending to claims for Government assistance under the "Mines Development Act" for roads and trails to mining properties.

Proposed trips to some of the leading mines during the latter part of the year were postponed on account of the influenza epidemic, which was very bad throughout the country, and led to some of the camps and many of the mines being placed under quarantine.

The duties of the Resident Engineers are to advise and assist the small operator and prospector, with a view of increasing the production, rather than to report on the mines operated by large companies, which are well able to take care of themselves.

FORT STEELE MINING DIVISION.

Sullivan. Located near Kimberly, in the Fort Steele Mining Division; owned and operated by the Consolidated Mining and Smelting Company, Limited. The property was staked in 1895. In 1902 the Sullivan Group Mining Company erected a small smelter at Marysville, which closed down in 1908. In 1910 the property was acquired by the Consolidated Mining and Smelting Company, and has since been extensively developed, and is now considered to be a great mine. For a long time the problem of treating the complex zinc ores prevented large tonnages high in metallic content from being considered of commercial value. In 1918 a satisfactory solution of this problem is said to have been obtained, and thus many millions of tons of ore previously considered to be of no commercial value was added to the already large reserves. According to the management, by mining and treating this ore on a large scale they will be able to produce zinc and lead at a profit on any market that existed in recent years, providing the price of labour and supplies drops with the prices of these metals. The long adit-tunnel, which now has a length of about 8,000 feet, is reported to have reached the ore-bearing zone.

The Kimberly section, in which the *Sullivan*, *North Star*, and *Stemwinder* are located, is underlain by the Aldridge formation. The deposits are replacement deposits in the argillaceous quartzites of the Aldridge formation. At the *Sullivan* the walls are not well defined and the ore gradually grades into the country-rock. The core of each ore-body is composed of fine-grained galena and zinc-blende, which gradually passes into an exterior of an intimate mixture of pyrite, pyrrhotite, and zinc-blende. This property is the largest producer of lead and zinc in the Province. During last year it produced 31,622 tons of lead ore, 98,532 tons of zinc ore, and 4,334 tons of iron pyrites.

Stemwinder.—This mine, situated on Mark creek, was bonded by the Federal Mining and Smelting Company, who did two or three months' diamond-drill work, but the results were evidently not satisfactory, as the project was abandoned.

North Star.—This property has been worked under lease by O. Brander and O. C. Thompson during the latter part of the year; about 2,500 tons of ore has been shipped to Trail. Indications are reported to be favourable for the continuance of shipments.

St. Eugene.—Situated at Moyie. This property has been worked by the Consolidated Mining and Smelting Company and by leasers. Shipments to Trail total 1,200 tons.

Victor.—Very little work has been done on this property during the year. It is reported that the company is being reorganized with a view of obtaining more capital to carry on progressive development-work.

Renewed activity has been in evidence at the placer-gold workings on Wildhorse and Perry creeks. On Perry creek a company has taken over the property owned and formerly operated by the Perry Creek Hydraulic Company. A considerable amount of work has been done in preparation for next season's operations.

Successful results were obtained from work done on a small scale on Wildhorse creek, where \$600 is said to have been taken out of three sluice-boxes.

Yellow Metal Group.—Further prospecting-work has been carried on at this property by W. van Arsladen, of Cranbrook, who is one of the principal owners. It is a gold-quartz property.

WINDERMERE MINING DIVISION.

Paradise.—This property, which is owned by Robert Randolph Bruce, of Invermere, has been operated steadily during the year and has shipped 2,768 tons to Trail, which is an increase over last year's shipment of 400 tons. Thirty-five to forty men are employed at the mine.

Silver Belt.—Situated in Spring Creek basin, below the *Paradise*; owned by C. M. Keep, of Kendrick, Idaho. During the year a shipment of 31 tons was made to Trail. The ore is somewhat similar to that at the *Paradise*.

Lead Queen.—Situated on Frances creek. Tom Brown, of Athalmer, is the principal owner. The property is reported to have been bonded this year to Paul Denhart, of Seattle, who has a small crew working at the property. Shipments will probably be made this winter. Between 70 and 80 tons of ore was sacked last winter, but unfortunately a bridge was carried away, which prevented shipments being made. The ore carries about 30 or 40 oz. in silver and about 65 per cent. lead.

Tailor Group.—R. S. Gallop has been doing some development-work on this property. The group, consisting of twelve claims, is situated at the head of the South fork of Horse Thief creek. The metallic contents of the ore are principally copper.

Hot Punch.—On the North fork of Toby creek. It is reported that a car-load of ore was hauled from this property during the season.

BOULDER CREEK.

This property, consisting of a group of six claims, was acquired early in 1918 by F. W. Wonn, of Seattle, who formed a company called the Trojan Copper Mine Corporation, and development was started on the property under the supervision of E. D. Smith. The property is situated at a distance of about eighteen miles from Athalmer, which is the nearest point on the railway. Five miles of road was built this year up Boulder creek, and three miles of 4-foot trail from the end of the road to the *Trojan* camp. The elevation of the camp is 4,600 feet, and is easily accessible, being located on the grade of the new trail. Since acquiring the property the company has built a two-story log cabin, which is used as a cook and store house, 18 x 26 feet, and a bunk-house 20 x 34 feet.

The ore occurs in a broken quartz vein which outcrops along the bank and about 100 feet above Boulder creek. The country-rock, consisting of talcose schists and slates, is greatly folded and contorted in the immediate vicinity, and until further development-work is done it is impossible to arrive at any definite conclusion as to the probable continuity of the ore with depth or along the strike of the vein.

The principal ore-mineral is chalcopyrite, which on the surface has been partly oxidized to carbonates of copper; the associated minerals are tetrahedrite and iron pyrites; the gangue is highly siliceous. A sample of the sorted ore for shipment ran: Gold, trace; silver, trace; copper, 15.5 per cent. At the time of examination there were between two and three car-loads of high-grade ore available for shipment, and since then further development is reported to have disclosed a considerable tonnage. The manager reports that he intends to haul ore this winter, and to install a 9 x 8 Ingersoll-Rand compressor and 30-horse-power Diesel type engine.

The development-work consisted of 116 feet of tunnelling and three open-cuts along the strike of the vein. Seven men were employed.

Conditions at this property have not changed to any appreciable extent since last year. Some 300 sacks of high-grade ore was extracted from the upper tunnel, in which there is reported to be a good showing of ore. This tunnel cannot be worked during the winter on account of snowslides, and at the time of my visit on June 29th it was hidden somewhere under 15 or 20 feet of snow. The old shaft, from which 7 tons of high-grade silver-lead ore was sacked last fall, was full of water and ice. A sample of the sacked ore from this shaft ran: Gold, 0.01 oz.; silver, 116.2 oz.; lead, 19 per cent.; zinc, 3 per cent. Last winter a snowslide carried away part of the cabin, which has been abandoned and a small one erected near by.

The erection of a light tramway was started last autumn, and a cable consisting of four No. 9 wires twisted together was taken up the mountain and fixed on light towers; which was

no small task, as the distance spanned is 2,100 feet, and the mountain-side is rugged and precipitous.

As it was not found practical to carry on mining operations at the upper workings during the winter months, the company proposes to run an adit tunnel at a location easily accessible and free from snowslides, to tap the vein at a point vertically below the old shaft. To facilitate this work the installation of a compressor is contemplated.

This property is located on the south side of Boulder creek, within half a mile of the *Trojan* cabins. The development-work which was done some years ago, according to old reports, consists of a 15-foot drift on the vein and a 90-foot crosscut. These workings were caved in, and hence could not be examined. Only a few tons of ore was in evidence on the old dumps. A sample from a small lot of sorted ore ran: Silver, 1.4 oz.; copper, 14.2 per cent. M. E. Olson is reported to have bonded the property and to have started some men to work. For further reference see Annual Report of the Minister of Mines for 1915.

From this property a good trail which leads over the divide to the *Paradise* mine was followed for a distance of about three miles up to the summit. Near this trail, on the Boulder Creek slope of the *Paradise* mountain and in a northerly direction from the mine, a narrow belt of limestone forms a ridge of low but rugged crags above the surface of the surrounding country, which is covered to a considerable depth with broken fragments and splinters of slate. In places near the contact of the limestone there is evidence of ledge material composed of broken fragments of quartz and limestone heavily stained with oxide of iron. Claims have been staked on this ground and some prospecting done with the expectancy, no doubt, of finding silver and lead values in the form of oxides and carbonates. According to reports, no satisfactory values have yet been obtained.

Surface conditions in this area are somewhat similar to those at the *Paradise*; hence I would consider it worthy of further attention from the prospector. The limestone ridge terminates in a bluff near Boulder creek, near the foot of which E. D. Smith has staked some claims on a quartz vein near the contact of the limestone and schist, and from which he claims to have got fair values in silver and copper. No work has been done on these claims yet.

This group, comprising the *Bald Eagle*, *Blue Grouse*, and *Mayflower* mineral claims, is situated on the Boulder Creek slope of the *Paradise* mountain, and at a distance of about a mile and a half in a north-westerly direction from the *Paradise* mine. J. Burman started work on this property in the fall of 1917, and in a few months accomplished a lot of work single-handed including the building of a small cabin, blasting out a short length of trail around the bluff, 100 feet of tunnelling, and sinking a 7-foot winze. At the time of visiting the property he was busily engaged driving a crosscut in the slide material at the foot of the bluff, with the object of tapping the vein at a vertical depth of about 200 feet below the tunnel.

The tunnel follows the vein for a distance of 55 feet, where there is a lenticular shoot having a maximum width at the roof of the drift of 8 inches, which widens to 12 inches in the bottom, and is said to increase to 20 inches at the bottom of a 7-foot winze, which, however, was full of water. Beyond the winze the tunnel has been continued for 40 feet, but no ore was encountered, and the face was in schist.

The apparent strike of the vein is N. 60° W. and dip 47 degrees to the north-east. A sample taken across a width of 12 inches at the top of the winze ran: Silver, 52 oz.; lead, 20 per cent.; zinc, 12 per cent. Exceptionally high silver values have been obtained from a few picked samples.

The formation, consisting of limestone, quartzite, and schist, is somewhat complex, and the possibilities of the property can best be ascertained by further development-work.

GOLDEN MINING DIVISION.

This property is situated above the *Monarch* mine, near Field, and is now being operated by the Couverapee Mines, Limited, of Calgary. S. Chapin is general manager; W. Orville Young, mine superintendent; and W. Whittaker, mine foreman. The ore occurs as a bedded vein replacing the limestone in large shoots. A considerable quantity of ore is said to be available for extraction, while the average values are reported to be: Lead, 15 per cent.; silver, 3 oz.; and a small percentage of zinc. The ore is concentrated

in the Monarch mill. During the year 776 tons of ore has been shipped to Trail, which is a considerable increase over last year's shipments.

It is reported that C. J. Lincke has been doing a little work on the *Rainbow Tarheel Group* claim. A small cabin was built near the tunnel-site, and another at Spruce Tree camp, on the Middle fork of the Spillimacheen river. The trail from Carbonates Landing to Spruce Tree camp is reported to be in good condition. This trail also gives access to the *Bobbie Burns* and *International* groups, which are situated near the headwaters of the Middle fork of the Spillimacheen. No work has been done on these properties for a number of years, but they are now evidently attracting attention, as several parties have made examinations during the season.

Among other properties in which some interest has been taken during the season are the *Atlanta*, *Constance*, and *Horseshoe* claims, on Jubilee mountain, near Spillimacheen. H. Moody, of Golden, had the old trail slashed out and the claims surveyed. The ore is said to run high in copper values.

**I.X.L. and
Condor.**

These claims are owned by R. McKeeman and W. Logan, of Castledale, and are situated at an elevation of 1,600 feet above the Columbia river. In order to reach the property the river is crossed at a point near Castledale, and then a trail is followed for a distance of about five miles. With the exception of a short steep grade to the top of the first bench above the river, the trail is of an easy grade, and the trip from Castledale and return can be comfortably made in a day. The claims are located along and near the top of a small isolated ridge which rises abruptly to a height of 600 feet above the surrounding country, and from the top of which an excellent view can be obtained of the Columbia and Spillimacheen valleys. The country which forms the divide between these two large watercourses is not of a rugged nature, and is characterized by rounded knolls and ridges, the gentle slopes of which are thickly wooded with small timber and underbrush, while a few small lakes can be seen lying in the depressions.

The formation consists of beds of argillites and limestone, dipping almost vertically and having a south-easterly strike. The ore, consisting of an intimate mixture of galena and sphalerite, carries low silver values and occurs replacing and impregnating the limestone near the contact with the argillites. In places the ore occurs in bunches and streaks, and in others it appears to be disseminated through the limestone. Where the limestone has been crushed and shattered by pressure the percentage of ore is greater than elsewhere. The workings consist of a shallow shaft sunk to a depth of about 10 feet near the top of the hill. A sample across 5 feet of soft ledge-matter at the bottom of this shaft gave 2.7 oz. silver and 7.8 per cent. lead. On the hillside, immediately below the shaft, galena and some lead carbonates are exposed in a shallow open-cut. A sample of the former gave 8 oz. silver, 10.2 per cent. lead, and 24.5 per cent. zinc; a sample of the carbonates gave 4 oz. silver, 27.5 per cent. lead, and 20 per cent. zinc.

Following around the contour of the hill for about 750 feet, a small open-cut exposes a face of low-grade ore, a sample of which ran 7.6 per cent. lead and 4.5 per cent. zinc. This can be traced up the hill for a considerable distance. Not much importance can be attached to the shallow surface diggings, which at the time of my visit did neither prove the lateral nor longitudinal extent of the ore-body, but the mineralized area apparently covers the wide zone along the contact of the argillites and limestone, and there is a possibility of developing a considerable tonnage of low-grade ore.

Unfortunately there is no water available for mill or power purposes in the immediate vicinity, although a desirable site could probably be located near the Columbia or Spillimacheen rivers. In a direct line the property is only about a mile and a half from the Columbia, and it is possible that a good outlet can be obtained by a short road across the top of the ridge and then by aerial tram down to the river. However, these are matters which can be carefully gone into should the development of the property be under serious consideration. The value of the property depends on the development of sufficient ore of a desirable grade to justify the erection of a concentrator and to enable mining operations to be carried out on a large and economical scale.

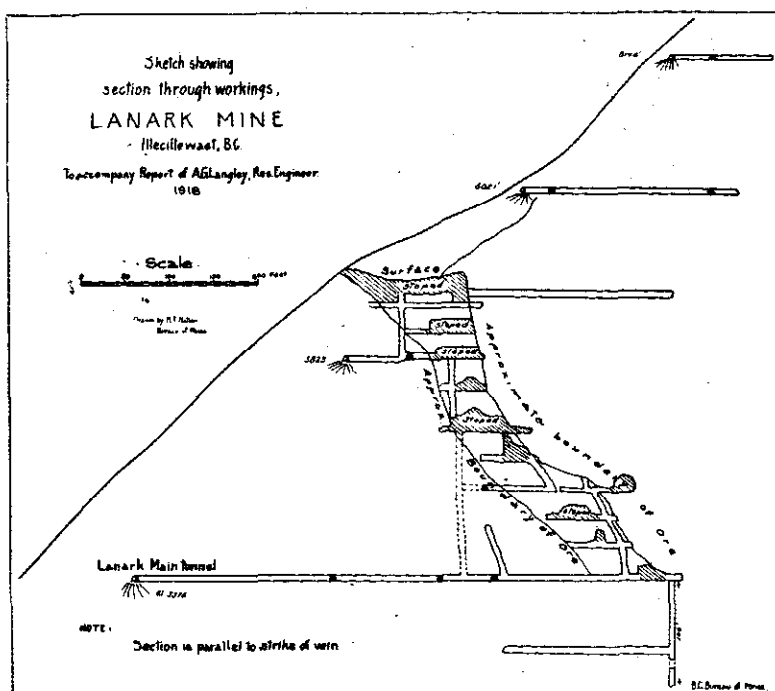
REVELSTOKE MINING DIVISION.

Lanark.

The lower camp, consisting of commodious buildings erected by the previous company which operated the property in 1896, is situated near Laurie Station, on the main line of the Canadian Pacific Railway. The mine camp is situated

on the steep side-hill near the entrance to the main tunnel, and at an elevation of 2,600 feet above the railway. The buildings, which afford good accommodation for a fairly large crew of men, are very substantially built.

The main tunnel or 400-foot level is about 700 feet long, and from this tunnel a large shoot of ore has been stoped to the surface. According to old reports, the width of the ore near the surface was between 20 and 25 feet, which decreases to 4 or 5 feet in the lower workings. From the lower tunnel a shaft has been sunk to a depth of 140 feet, and from which some 180 feet of drifting is reported to have been done. There is said to be a good showing of ore in these



workings. Unfortunately, at the time of examination the shaft was inaccessible on account of water. The deposit occurs in a bedded fissure-vein, which has a dip of 50 degrees to the north-east, and a strike of N. 46° W. The hanging-wall is slate and the foot-wall carbonaceous limestone.

At the present time ore is being extracted from the upper portion of the *Lanark* shoot and from a point higher up the hill, on the *Maple Leaf* claim, but not a great deal of importance can be attached to these workings at present; the future of the property apparently depends greatly on the success obtained in the shaft, and on the development of a promising showing recently discovered higher up the hill, where a quartz vein can be traced for some 200 feet. Good-grade ore shows in lenses at intervals along the outcrop. The walls of this vein are slate. An assay of sorted ore from this showing ran as follows: Gold, trace; silver, 35 oz.; copper, 3.4 per cent.; lead, 51 per cent.; zinc, 12.4 per cent.

In order to carry out his scheme of development, W. Dornberg, the manager, decided that it would be necessary to install a power plant to run the mine compressor, pumps, and a small hoist for the shaft. The installation of this plant was commenced early in the year and was completed in the fall. The plant consists of a Baden-Globe turbine; a C.G.E. alternating-current generator, the full load of which is 2,300 volts 39.7 amperes at a speed of 300 revolutions; an exciter for generator; and a Woodward governor to regulate the speed of the turbine. The water-power is derived from the Illicillewaet river, and is conveyed by a square flume 4 x 4 feet and 700 feet long. The head of water at the turbine is about 25 feet. The power developed will also be used to run the concentrator, which was originally driven by a steam plant.

The concentrating equipment of the mill consists of two double 4-compartment jigs, one single compartment fine jig, one bull-jig, and one Deister-Overstrom table. Connecting the mill with the mine there are two independent 2-bucket trams—the lower one operating from the mill to a central station at the top of an intervening ridge, and the other from this station to the mine. The lower span is 3,400 feet long and the upper 3,600 feet.

This property, consisting of seven claims—the *Alice, Helena, Nellie E., Bee, Woolsey Group. May, Cora, and Joy*—is situated on the East fork of Silver creek, which flows into the Illecillewaet river at a point about two miles west of Albert Canyon Station, on the main line of the Canadian Pacific Railway. The elevation of the camp is 4,200 feet above sea-level, or 2,000 feet above Albert Canyon, from which place a good trail leads to the property, the distance being seven miles. The original group consisted of four claims, which were staked by P. E. Kennedy; the other claims were staked this year.

David Woolsey took a lease and bond on the property in 1917, and built a new trail, which was completed in the early part of 1918. Before this time it was difficult to reach the claims, as there was practically no trail, and in places the hillsides are steep and covered with dense underbrush.

New cabins were built at a convenient distance from the workings this fall. The work which is now being carried on by D. Woolsey consists of driving a tunnel in the foot-wall and in the direction of the strike of the vein. Crosscuts to the vein will be driven at intervals. There is plenty of timber for mining purposes, while a good mill-site is available on Silver creek.

A trip was taken to the property early in July to ascertain whether assistance towards building the trail was justified under the "Mines Development Act," and a cursory examination was made.

The vein, which is composed of massive white quartz, outcrops on the hillside at an elevation of about 1,000 feet above the creek, where an open-cut and a 10-foot tunnel expose a width of about 15 feet, in which is included narrow bands of slate. Farther up the hill clean galena ore is exposed at the surface, but very little work had been done on the vein at the time of examination. The vein, which also can be readily seen cutting the hillside on the opposite side of the creek, has a dip of 40 degrees to the north-east and a strike of N. 42° W. The strike and dip conform to that of the strata; hence it may be classified as a bedded fissure-vein. The formation is composed of a dark carbonaceous slate, probably belonging to the Carboniferous period and correlated to the similar rocks of the Lardeau and Trout Lake Divisions. The strata are not badly folded or faulted, and the vein shows persistency in outcrop.

The principal ore-mineral is argentiferous galena, which occurs replacing the quartz in streaks and bunches. The associated minerals are zinc-blende and iron pyrites, which do not appear to be intimately mixed with the galena; hence the ore is amenable to concentration. A sample of sorted ore for shipment ran: Silver, 80 oz.; lead, 25 per cent.; zinc, 4 per cent.

Although some high-grade ore could be mined for shipment, in order to operate the property to the best advantage the installation of a concentrator would ultimately be necessary when sufficient ore has been developed to justify it. At the present time it is a promising-looking prospect, but the continuity of the ore in commercial quantities has yet to be proven by further development-work.

Other claims have been staked above the *Woolsey* group, and on the same lead, by Gus. Hedstrom and O. Sandberg, of Albert Canyon. There is reported to be a good surface showing on these properties, but the writer has not had an opportunity to examine them yet. It was while examining these properties that A. B. Clabon, president of the Vancouver Chamber of Mines, missed his footing, fell over the edge of a bluff, and lost his life.

The season's work has been principally confined to prospecting the lead on the **Mastodon.** Carnes Creek slope, where the vein is said to be exposed in the face of a bluff.

During the winter months the shaft was sunk to a total depth of about 129 feet. About 20 tons of ore was hauled to the end of the Big Bend road, but unfortunately a heavy mud-slide late in the fall prevented the shipment from being hauled to the railway.

E. McBean, an old-time miner and prospector in the Big Bend district, has been engaged in the development of his property on Carnes creek and in doing further prospecting-work during the year.

Placer-mining is carried on every year on a small scale on the creeks entering the Columbia river, north of Revelstoke, but no information is to hand regarding the results obtained.

TROUT LAKE AND LARDEAU MINING DIVISIONS.

Mining activities have been on a smaller scale than last year in these Divisions, and it is to be hoped that before long the district will attract the attention that it deserves.

Triune.—R. H. Batty resumed work this year, and employed fourteen men during the summer.

Towser.—This property was worked under lease and bond. Eight to ten men were employed.

Nettie L.—Peter Cameron and others had a lease on the property. Five men were working during the season.

Ethel.—A few men were working on this property, and a small shipment was made to Trail.

True Fissure.—Development-work was done under the management of A. C. Houston. Ten men were employed.

Fidelity.—This property, which is situated near Gerrard, was worked during the season by J. C. Rady.

The following is a list of shipments made to Trail: *Towser*, 81 tons; *Triune*, 46 tons; *True Fissure*, 41 tons; *Ethel*, 13 tons; *Nettie L.*, 31 tons; *Foggy Day*, 9 tons; *Fidelity*, 6 tons.

TROUT LAKE MINING DIVISION.

A somewhat hurried trip was taken with Mrs. Jowett, of Trout Lake, to examine some of her prospects and to gain at least an idea of the geology and topography of that part of the country along the southerly slope of the Silver Cup mountain, in which so many claims have been staked, and all of which, with the exception of a few, are now lying idle; the cabins are becoming dilapidated and the workings caving in. Many of the properties in this district are described by Newton W. Emmens in the Annual Report of the Minister of Mines for 1914; reference is also made to them in Annual Report of 1903 and in the Geological Survey Report for 1903.

Generally speaking, the principal values found on the south-westerly slope of Silver Cup mountain are in gold, which occurs in quartz veins, either cutting or following the bedding-planes of the formation. Greenish-grey and brown schists shot with quartz stringers and veinlets are characteristic of the formation in this particular section. Two quartzite dykes which run along the summit of the mountain and having a north-westerly strike, can easily be traced for a considerable distance and form an approximate boundary between the silver-lead properties on the northerly slope and the gold properties on the southerly slope. The formation on the northerly slope consists of carbonaceous shales, slates, and limestones, in which are located the *Cromwell*, *Triune*, *Silver Cup*, *Nettie L.*, and other properties. The country is easy of access by good trails either from Trout Lake or Ferguson, which connect with the summit trail, and from which nearly all the properties are within easy reach.

Taking horses at Trout Lake, an excellent trail was followed along the north-east shore and up Six-mile creek to the summit of Silver Cup mountain to this property, which is owned by Mrs. Jowett, and consists of two claims—the *U & I* and *Hercules*. The formation consists of greenish-grey schists, in which occur numerous quartz inclusions as stringers and gash-veins, having a general tendency to follow the schistosity of the country-rock. Some open-cut work and shallow shaft-sinking has been done on some quartz-showings. A sample from a small pile of sorted ore from a 30-foot shaft ran: Gold, 1.8 oz.; silver, 9 oz. The vein, which is 1 foot wide at this point, has a strike of N. 10° W. and has a dip of 38 degrees to the east. It is a prospect in the initial stage of development, on which further prospecting-work is necessary to prove its value.

This property adjoins the *U & I* higher up the hillside, and is fully described in the Annual Report for 1914, since which time no further work has been done. A quartz vein, which is strong and well defined, cuts the formation, consisting of argillites and schist, and can be traced for a considerable distance on the surface. The strike is N. 25° E. and dip almost vertical. The width of vein exposed at a small open-cut and shaft is 45 inches. The crosscut tunnel driven to tap the vein below the open-cut evidently did not reach its objective, as there is no evidence of vein-matter on the dump. An average sample taken across the vein at the shaft by Newton Emmens, whose report may be seen in the Annual Report of the Minister of Mines for 1914, ran: Gold, 1.9 oz.; silver, 2.9 oz. It would appear to be a prospect upon which further work is justified.

Foggy Day. This property, comprising two claims—the *Foggy Day* and *Bronze*—is situated at the headwaters of Eight-mile creek at an elevation of about 7,300 feet. The property, which belongs to Mrs. Jowett, was being worked by J. Lamphere under a lease and bond. A quartz vein is exposed in the side of a precipitous bluff by a series of open-cuts, while a certain amount of gophering has been done to win the ore, but no systematic development-work has as yet been attempted. The vein varies in width and is irregular in strike and dip. The formation, which is composed of grey talcose schist, is crushed and decomposed in the vicinity of the vein. Good gold values have been found along the foot and hanging walls. The gold-bearing quartz is honeycombed and stained with oxide of iron. A shipment made in 1917 gave the following values: Gold, 4.35 oz.; silver, 13.9 oz.; lead, 4.6 per cent.

On account of the heavy packing charges down Eight-mile creek to the lake, ore for shipment is carefully sorted and screened. There is a requisite amount of water near by for a small mill, and the property is undoubtedly one which has merit and on which further development-work might be done to advantage.

Crescent. This property is being developed by the Mansfield Mining Company, of Mansfield, Wash. M. Leahy, who is in charge of the work, has two or three men working. It is situated at an elevation of about 7,000 feet and at a short distance from the *Foggy Day*. A few open-cuts and an 18-foot shaft expose a small quartz vein cutting a brownish schist formation. At the bottom of the shaft, where the vein shows a width of about 1 foot, there is a small showing of galena which carries fair silver values, while from a narrow streak of soft decomposed iron-stained material good gold values have been obtained. A crosscut which was being driven to tap the vein at a point below the shaft is now reported to have reached its objective, and the vein is being developed at a vertical distance of 75 feet below the surface. The cabin is conveniently situated to the workings and has accommodation for four to six men, while there is plenty of timber available for mining and fuel purposes.

The *I.X.L.* and No. 3 are situated in the same basin as the *Crescent* and have had a considerable amount of work done on them, but have been lying idle for some time and the workings have partly caved in, but no doubt could be cleaned out again at small expense. Reference is made to these properties on page 125 of the Annual Report for 1903. Farther on the *Arrallu*, belonging to Mrs. Jowett, was visited, but unfortunately the lower tunnel had caved and there was nothing of importance to report on.

Mrs. Jowett, who has lived at Trout Lake for the last twenty years or so, is one of the few lady prospectors in the Kootenays. Every year she goes out into the hills with her prospecting-pick, looking for mineral or directing work on her properties, and probably has as good a knowledge of the district as any one.

Trout Lake is one of the most beautifully situated settlements in the Kootenays, and any one desiring information regarding the natural resources of the country, or even a holiday, would do well to stay a few days at this place, and enjoy some excellent trout-fishing. Should trips be contemplated into the mountains, good horses and mules may be obtained locally or from Andy Daney at Ferguson, who has packed and hauled ore out of these hills for many years, and has a reputation as a packer.

LARDEAU MINING DIVISION.

Dunvegan Group. This group is situated on Bain creek near the headwaters of the Incomapleux river. Access is gained to the property by a good trail, which leaves the Canadian Pacific Railway at Flat creek and traverses the summit of the divide between the headwaters of this creek and the Incomapleux river. The distance to the property from the railway is ten miles. The elevation of the camp, which consists of one small cabin, is 3,750 feet. The vein, which has a strike of approximately N. 5° W. and dips at an angle of 50 degrees to the east, has been exploited by two adit-tunnels driven in the steep hillside at a vertical distance of 110 feet apart. At the uppermost or No. 1 tunnel, from which some ore was extracted many years ago, there still remains a small pocket of galena and zinc-blende which could not be considered of any commercial importance. A sample from a small pile of carefully sorted ore from this tunnel ran: Silver, 73 oz.; lead, 65.2 per cent.; zinc, 7.2 per cent. At the lower tunnel the vein has been drifted on for about 200 feet, but no ore is exposed. More recent work consisted of running a drift for 51 feet at a vertical distance of only 15 feet above the lower tunnel. No ore was developed. Other drifts farther down the

hill, and which are now caved in, evidently did not prove the existence of ore in any quantity. The vein, which has been formed along a fault-fissure, shows persistency along the strike, but the ore apparently only occurs at intervals in pockets and small bunches. The formation consists of calcareous shale and slate and is somewhat blocky in character.

R. A. Grimes, who had charge of the recent work on behalf of the Dunvegan Mining Company, ceased work this year, as he realized that in order to win more ore a certain amount of dead-work was necessary, which would involve a considerable expenditure and a proportionate amount of risk, while the inaccessibility of the property to transportation facilities is unfortunately a decided drawback.

This claim is situated at an elevation of 6,900 feet near the head of Lexington creek and at a distance of about twelve miles from Cambourne. The property is owned by Mrs. M. K. Stuart, of Wisconsin. A good cabin was built and a short length of trail was completed this year, but no work was done on the claim. The *Kitsap* and a number of other claims were staked many years ago along the strike of a strong and well-defined iron-stained vein which occurs along or near the contact of a blue limestone and schist. This vein can be traced for thousands of feet on the surface, but numerous open-cuts and shallow workings on the outcrop fail to expose ore of any consequence, and at only a few places is any galena noticeable.

At the *Kitsap* a cut 10 feet deep and 15 feet long shows the width of mineralization to be about 13 feet. The ledge is highly mineralized with iron pyrites, but galena only occurs in occasional blossoms. The gangue is silicified limestone. So far no ore has been developed which might be considered of commercial importance. A sample from a few tons of sorted ore ran: Gold, trace; silver, 5.4 oz.; lead, 40 per cent.; zinc, 1.2 per cent. More exploratory work along the outcrop will probably be done during the coming year.

Multiplex Group.—Development-work was continued during the early part of the year, but the property is now temporarily closed down, pending the securing of more capital.

There have been a number of inquiries about the *Mammoth*, *Scout*, and other properties, which seem to have attracted outside attention; but so far no new developments have taken place, and the Lardeau has suffered from an unusually quiet season.

ARROW LAKE MINING DIVISION.

There has been quite a little activity in the district surrounding Lightning peak, where rich discoveries of high-grade silver ore have been reported. Unfortunately the writer was unable to visit this part of the country on account of other work on hand. However, P. B. Freeland, Resident Engineer for the Southern Mineral Survey District, examined some of the properties in 1917, whose report may be seen in the Annual Report of the Minister of Mines for that year. The properties are situated at a distance of between thirty-six and forty miles from Edgewood, from which place horses may be obtained.

Millie Mack.—The trail has been extended from Blue Grouse creek for a distance of two miles to connect with the terminal of a light tramway recently constructed by H. E. Forster, the owner of the property. A small crew of men is employed at the property. Some 35 tons of sacked high-grade silver-lead ore is now ready for shipment at the mine.

AINSWORTH SECTION.

This property, consisting of eight Crown-granted claims, is owned by the Florence Silver Mining Company, of which F. R. Wolfe is manager and F. Hewer mine superintendent. The mine is developed by means of over 10,000 feet of underground workings. The concentrator, which is situated on the shore of Kootenay lake, is said to have a capacity of 150 tons. Water-power to run the plant is developed on Woodberry creek under a 350-foot head. A large gang of men was employed by the company during the year, and over 2,000 tons of silver-lead-zinc concentrates was shipped to the Trail smelter. The company declared its first dividend of 1½ cents a share, payable on March 20th.

No. 1.—Mining and development work have been actively carried on during the year by the Consolidated Mining and Smelting Company. John Cannon is mine foreman. The ore shipped this year, amounting to over 6,000 tons, shows a considerable increase in production over that of last year.

Highland.—This property is also operated by the Consolidated Mining and Smelting Company. L. W. Oughtred has been in charge of the work. During the year about 800 tons of silver-lead-zinc ore and concentrates has been shipped to the smelter.

Spokane-Trinket.—This property, which is owned by Frank T. McCullough and others, of Spokane, has been operated during the summer under the management of J. McGougall. Shipments for the year total 221 tons.

Other properties which have shipped during the year are as follows: *Little Phil*, 110 tons; *Tariff*, 26 tons; *Tam O'Shanter*, 38 tons; *Silver Hoard*, 37 tons; *Maestro*, 66 tons; *Gallagher*, 56 tons.

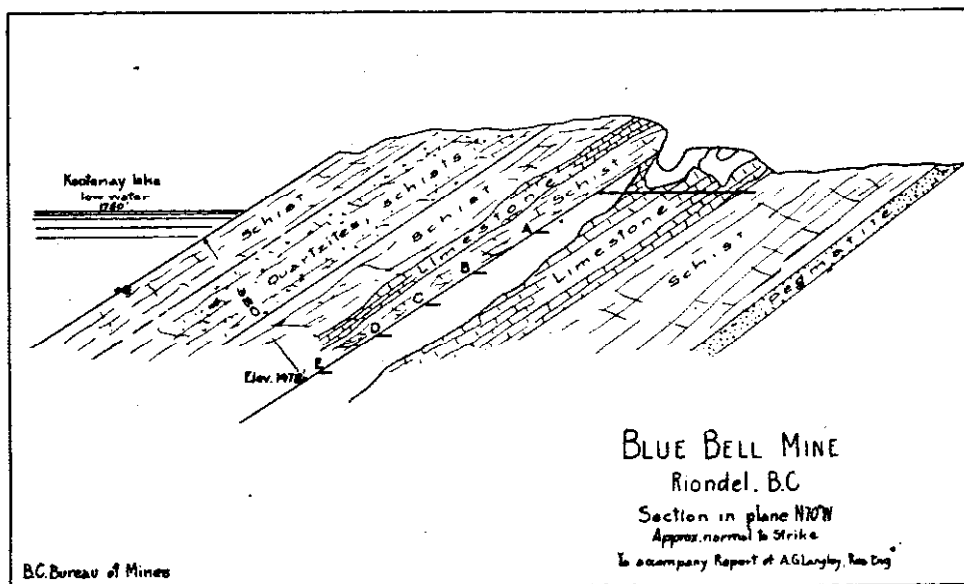
Development-work has been done during the year on the *Crescent*, at Coffee creek, and the *Buckeye*, where considerable work has been done under the supervision of Mr. Dagleish.

Molybdenite was reported to have been discovered near Crawford bay. Two men have put in a season's work on the property. No information is to hand regarding results obtained.

This property, consisting of three claims, is held under lease and bond by John Cannon, of Ainsworth, and is situated at a distance of three miles by trail up Coffee creek. No work has been done on the claims for a number of years.

Fourth of July. Preparatory to the continuance of the development-work the building of a cabin was started last year, but was not completed at the time of examination. The ore-body may be described as a replacement deposit near the contact of schist and limestone; the ore replacing the latter consists of oxides and carbonates of lead and zinc, with occasional nodules of galena, in a soft, decomposed, and oxidized gangue. As may be expected in this class of deposit, the ore is irregular in occurrence, and nowhere is there evidence of a well-defined vein or boundaries. A sample across a width of 4 feet of this brown oxidized material at the bottom of the winze ran: Gold, 0.02 oz.; silver, 10.8 oz.; lead, 3 per cent.; zinc, 24 per cent.; while a grab-sample of about a 15-ton pile of the same material ran: Gold, 0.02 oz.; silver, 13.2 oz.; lead, 6 per cent.; zinc, 32 per cent. Better values are said to have been obtained by the owners. The principal workings consist of 242 feet of tunnelling and crosscutting, near the end of which a considerable amount of gophering has been done and some 50 tons of ore extracted.

Blue Bell. This well-known property is owned and operated by the New Canadian Metal Company, which is financed by French capital. S. S. Fowler has had charge of the mining and milling operations for a number of years. The mine is



situated at Riondel, which might well be considered one of the model mining camps of the Kootenays. The buildings and plant are well designed and laid out. Comfortable quarters are provided for the single men, while for those who are married, small cottages, each with its little

garden, can be had at a nominal rental from the company. The ore occurs as a replacement deposit in the limestone, the deposition having taken place along the lines of transverse fissuring. The limestone, which has a dip of 35 degrees and a strike of N. 70° W., lies between beds of schist. The mine has extensive underground workings which extend for a considerable distance below the level of the lake. The ore consists of galena, zinc-blende, and oxidized ores of lead and zinc. During the year over 5,000 tons of oxidized ore was shipped from surface workings.

This year difficulty was experienced in coping with the increased flow of water, and it was found necessary to install a new pump having a capacity of 1,000 gallons a minute. The pump, which is a Garratt jack-head plunger-pump, is stationed on the adit level and is driven by a Pelton wheel. The total length of the pump-rods will be 660 feet; the length of each rod is 30 feet and is made of 8- x 8-inch fir. The pump is now in operation and satisfactory results are being obtained. The concentrator has a capacity of 200 tons a day. The whole plant, including a Sullivan compressor and lighting generator, is driven by Pelton wheels, the water-power being piped for a distance of about three miles. Through the courtesy of Mr. Fowler a section of the formation is herewith shown.

The *Matchless*, *Exchange*, and *Speculator* group of claims is situated on Lockhart creek at a distance of six miles from Kootenay lake. The property is owned by T. Wall and R. Yuill. Very little work has been done on the property and no ore in commercial quantities has yet been developed. Galena in small quantities is found to occur in a series of small quartz veins, which show conformity to the limestone formation in which they occur. The best showings so far uncovered are near the contact of the limestone and schist. A sample of the ore ran as follows: Gold, 0.02 oz.; silver, 7 oz.; lead, 17.3 per cent.; zinc, 5.4 per cent.

KASLO SECTION.

Mining and development work have been actively carried on during the year under the management of W. E. Zwicky. The production shows a substantial increase over that of last year. A Minerals Separation flotation plant consisting of fourteen 12 x 12 cells, three Wilfey tables, a Dorr classifier, and other equipment was added to the mill during the year. About 752 tons of silver-lead concentrates has been shipped to Trail during the year. Latterly the property has been temporarily closed down.

Index Group.—This property has been bonded by J. C. Roberts, of Portland, and others. A crosscut is being driven to intersect the vein at a point 500 feet below the old workings.

Utica.—This property has been operated by a crew of twelve men since July, during which time six cars of ore has been loaded for shipment.

Montezuma.—One hundred and six tons of zinc concentrates from the old dump was shipped, which had been neglected for fifteen years.

Silver Bell.—This property, situated on the South fork of Kaslo creek, is being operated by Green Bros. under the management of Mr. Newton. There is said to be a good showing of high-grade ore.

Whitewater.—This property has been worked under lease. The property is controlled by J. L. Retallack & Co., of which W. H. Burgess, of Kaslo, is manager. Large tonnages of ore have been shipped during the season, with very satisfactory results for both the leasers and the owners of the property.

Helen.—W. English, of Kaslo, has been doing some development-work on this property.

Bell.—Operated by the Jackson Basin Zinc Company. Shipments to Trail total 255 tons.

Lucky Jim.—The bulk of the shipments from this mine were made during the first six months in the year; for the balance of the year only small shipments were made. Total shipments to Trail, 1,843 tons.

This group, consisting of ten claims, which are located at a distance of seven miles from Kaslo, on the Kaslo & Nakusp Railway, is owned by A. J. Curle and A. G. Larson. Owing to the brisk demand and high prices prevailing for this class of ore during the war, this deposit attracted considerable attention and its development was watched with interest. The owners bonded the property to Colonel F. B. Millard, of Spokane, who erected small camp buildings and started a crew of about seventeen men to work at cleaning the surface and mining the ore. The ore chiefly consists of brown and black oxides of manganese, with occasional bunches of concen-



An Old-timer and Pioneer Prospector, Trout Lake.



Typical Prospector's Cabin, Ainsworth M.D.

tionary psilomelane. The ore occurs over two areas on a bench and adjoining gentle slopes of the hillside at an elevation of about 350 feet above the railway.

Without going into a detailed description of the deposit, it will suffice to say that the distribution of the ore, which forms a layer on the surface of the hillside, is uneven and irregular in occurrence, the thickness of the deposit varying from a few inches to 4 feet. During the latter part of June, 1918, when an examination of the property was made, the writer estimated that there was about 1,400 tons of ore positively in sight; beyond this any estimate of possible ore would at this time have been the wildest kind of a guess.

The primary deposit of manganese probably owed its origin to deep-seated springs arising from a body of intrusive magma. These waters deposited their burden of lime, iron, manganese, and silica in veins and veinlets of the country-rock. During subsequent erosion and oxidation the manganese has been collected by surface waters and redeposited on the benches and gentle slopes of the hillside. The iron, being precipitated first from the solution, forms the lower layer of the deposit, while the lime may have been an important factor in bringing about the precipitation on the manganese. The ore was easily mined by pick and shovel, but a certain amount of sorting was necessary to maintain a grade suitable for shipment. The first shipment contained such a high percentage of moisture that it was found necessary to install a dryer. The results evidently did not meet with much success, and after shipping fifteen cars the project was abandoned. The ore runs from 34.5 to 49 per cent. manganese, is low in silica and iron, and may be classified as a good grade of wad. It is possible that the failure to make a success of the venture may be attributed to unfamiliarity with mining and treatment methods for this class of ore.

This group consists of three claims—*Harp*, *Collingwood*, and *Black Diamond*—owned by W. J. Murphy, of Kaslo. The property is reached by a short trail which leaves the *Cork-Province* road at a distance of about five miles from Kaslo. Prospecting-work chiefly consists of a 33-foot drift along a quartz vein. The vein is 4 feet wide and occurs between a hanging-wall of compact dark argillites and a foot-wall of chloritic schist. The mineralization principally consists of rhodonite with which is associated small quantities of iron pyrites, pyrrhotite, and chalcopyrite. The rhodonite where exposed to the weather has been altered by oxidation from a silicate to an oxide of manganese. No values have been yet obtained which are of commercial importance.

This property consists of three claims—the *Ashnola*, *Peterborough*, and *Comstock*. J. Spiers and J. Moore, of Kaslo, are the owners. The elevation is about 4,200 feet. The claims are situated at a distance of seven miles from Kootenay lake on the southerly side of Campbell creek, which flows into the lake at a point almost opposite Kaslo. The formation belongs to the Shuswap series. The rocks are mostly grey gneisses, mica-schists, crystalline limestones, altered granites, and diorites. At a point where a small creek runs through the claims thin beds of shale and schist overlie a ledge of highly metamorphosed rock resembling gneiss, and which is highly mineralized with pyrrhotite, iron pyrites, and marcasite; a small sample of this material failed to give any gold values. This ledge is 10 to 15 feet thick, and being less easily eroded than the overlying rocks can be traced in a small bluff which it forms higher up the hill. The dip of the strata is 32 degrees to the west and the strike due north and south. In a small digging on this ledge at a point 300 feet above the creek, a sample was taken across 28 inches of oxidized material which gave 1.5 oz. in gold. The hillside is covered with overburden and the network of fallen burnt timber makes prospecting difficult. However, from the values obtained it is evident that it is a property well worthy of further exploitation, which probably could be done to best advantage by further surface work on the ledge. Ample water-power is available in Campbell creek for any possible mining or milling operations.

A hurried visit was paid to this property on the way down from the *Peterborough* group to the lake. Mining operations carried on by the Globe Mining Company in 1901 principally consisted of driving two crosscut tunnels into the contact between a mica-schist and granite. The upper tunnel is in 205 feet, and the lower, which terminates on an incline, is in 124 feet. The incline was full of water. Both tunnels are driven through an altered granite to the schist, and fair values in gold and copper were said to have been obtained, although there was no evidence of ore in the workings or on the dumps, and I am not aware of any shipment ever having been made. However, neither

the condition of the workings nor the time at my disposal allowed the making of a thorough examination.

Lincoln Group. J. H. and J. R. Thompson, of New Denver, worked this property during the season under lease and bond. The three claims comprising the group are located on the east side of Robb creek at a distance of two miles from Blaylock Station, on the Kaslo-Nakusp Railway. The workings are at an elevation of 4,900 feet. The ore, consisting of galena and lead carbonates, carries good silver values, is fairly free from zinc, and occurs in a crushed zone between a hanging-wall of limestone and a foot-wall of crushed slate. The gangue material is decomposed and heavily stained with oxide of iron.

On account of the formation being broken and faulted near the outcrop, the true strike and dip of the vein can only be determined by further development-work on the upper portion of the vein. A considerable amount of work was done in the past by crosscutting to strike the vein at a depth, which proved unsuccessful, and under the conditions was premature. The present work is being confined partly to surface exploration and partly to drifting along the vein at a short distance below the outcrop. Between 30 and 40 tons of clean galena and some carbonate ore was extracted during the summer, while the development-work is reported to have met with satisfactory results.

DUNCAN RIVER SECTION.

Lavina Butte.—Situated on Hamill creek. A few men have been working. Sixty-five tons of ore has been shipped.

St. Patrick Group.—Situated at a distance of six miles from Argenta. The property belongs to the British Alberta Mining Company, of which W. R. Allen, of Nelson, is secretary. A few men have been employed at the mine, and two car-loads of ore has been extracted for shipment.

International Group. This group, consisting of eight claims, is situated at a distance of nine miles north of Howser lake, on the Duncan river, making a total distance of about nineteen miles from Howser, which can be travelled by launch. The property is owned by the Blue Lake Consolidated Mining Company, of which W. J. Milne is manager. The mine-workings are located on the face of a bluff at an elevation of 5,200 feet above sea-level, or 3,100 feet above the Duncan river. The distance from the mine to the lower camp on the bank of the river is three miles by trail and about 7,400 feet by air-line. The lower camp, which is situated near the mouth of McGuire creek, consists of two small cabins, from whence a trail leads up to the mine cabin, which has accommodation for four men. The mountain-side rises abruptly from the river and becomes precipitous in the vicinity of the workings.

The vein, which is a fissure of the bedded variety occurring in a schist formation, has an average width of 2 feet, is composed of crushed and shattered quartz, and dips at an angle of 30 degrees in an easterly direction. The ore occurs in small pockets and lenses at irregular intervals. The predominating ore-mineral is galena, with which is associated tetrahedrite, sphalerite, and iron pyrites. The old workings, which consist of a 25-foot drift and a few open-cuts, do not expose much ore in commercial quantities.

Following around the side of the bluff for a short distance from these workings, the vein is exposed along the trail for a distance of about 50 feet, in which occurs a streak of galena about 4 inches wide and about 15 feet long, a sample across which ran as follows: Silver, 13 oz.; lead, 37.7 per cent.; zinc, 1.2 per cent. Recent work consisted of driving a crosscut to tap the vein at a depth of approximately 50 feet below the old workings. This was in a distance of 65 feet at the time of my visit.

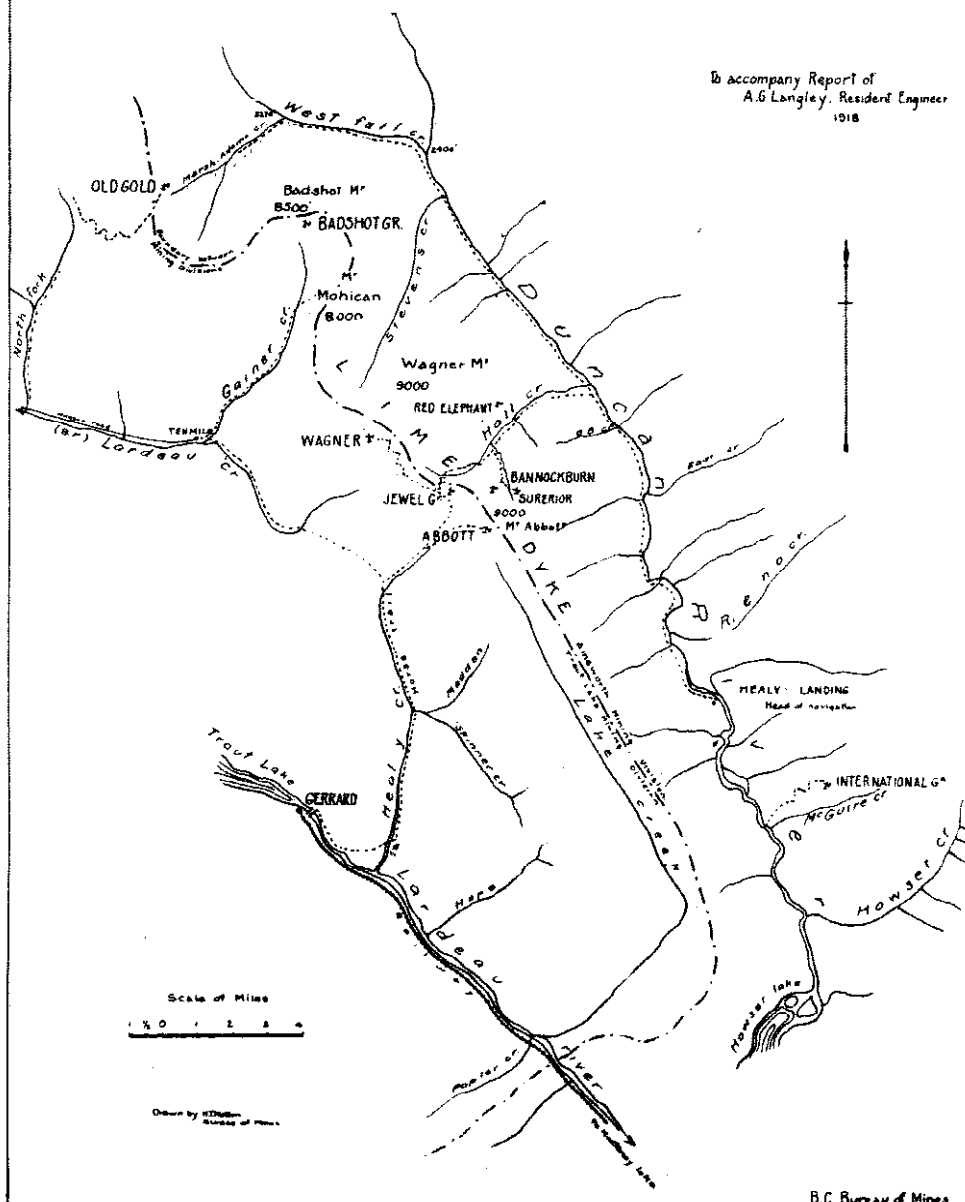
The property is in the prospective stage of development, and should sufficient ore be developed to warrant the erection of any plant, the conditions are admirably suitable for an aerial tramway to the river, while there is reported to be a good mill-site available on McGuire creek.

Hall Creek Properties.

For some years there has been a certain amount of agitation for the Government to build a wagon-road up the Duncan river from Idaho Landing, the head of navigation to Hall creek, in order to give access to mining properties located in this vicinity. Upon request from the Hon. Minister of Mines, a trip was taken into this part of the country to report on the existing conditions, and ascertain, if possible, whether assistance from the Department of Mines under the "Mineral Survey and Development Act" towards building twelve or fourteen miles of road up the Duncan river would be warranted at the present time.

Sketch Map
showing certain properties,
DUNCAN RIVER & HALL CREEK.
Ainsworth, M.D.

To accompany Report of
A.G. Langley, Resident Engineer
1918



Hall creek flows into the Duncan river at a point about twenty-two miles north of Howser lake. There are two routes which give access to the properties on this creek and those situated in the mountainous area of country from which it derives its source. One is by Healy creek from Gerrard and the other by way of the Duncan river from Howser. If the former route is chosen, horses can be taken from Gerrard and headquarters made at the *Jewel* cabin, which is situated on the summit of the divide between Hall and Healy creeks, from which point short trips can be made to the various properties.

The Healy Creek trail leaves Gerrard and follows the Lardeau for about five miles, crosses Healy creek at a point about three miles from its mouth, and then follows up the creek for a distance of fifteen miles to the base of Abbott mountain, from whence it ascends at a steep grade past the old *Abbott* cabins to the *Jewel* cabin, and thence to the *Wagner*, making a total distance of between eighteen and twenty miles from Gerrard.

The Healy Creek trail is not good, but is passable, and horses can be ridden for the whole distance. In order to eliminate a bad part of the trail, which is expensive to maintain, and also in order to shorten the distance to the railway, the Government is building a bridge across the Lardeau river at a point three miles below Gerrard. From the base of Abbott mountain to the bridge crossing on Healy creek a good wagon-road grade not exceeding 4 per cent. is obtainable. A wagon-road, however, would be both expensive to build and costly to maintain on account of a number of slides which would have to be crossed.

To reach the properties by the Duncan River route a launch is taken from Howser to Healy's Landing, a distance of approximately twenty miles; from this point horses may be obtained, and the trail followed for twelve miles up the Duncan and six miles up Hall creek to the *Bannockburn* group, making a total distance from Howser of thirty-eight miles.

The latter route is the easier of the two if one should wish to visit the properties on Hall creek, while the other is better if one should wish to get a general idea of the country at the head of Hall creek, and visit the *Abbott*, *Wagner*, and *Jewel* properties. The natural outlet to the *Bannockburn*, *Superior*, and *Red Elephant* groups is via Hall creek to the Duncan river. Although Hall creek offers an outlet to the *Wagner* and *Jewel* properties, the owners prefer the Healy Creek route, it being shorter and more direct to the railway.

When contemplating a road down the Duncan to the head of navigation, the question of water transportation has got to be taken into consideration, and although no data is available on the navigability of this river, it is probably not navigable for more than four months in the year, and even then a good deal of money might have to be spent in removing log-jams, sand-bars, and snags.

Bannockburn Group.

This property, consisting of seven Crown-granted claims, is situated near the headwaters of a glacial-fed stream known as Bannockburn creek. This creek is a tributary to Hall creek and enters the latter at a point about five miles from the Duncan river. In order to reach the camp, which is situated at an elevation of 5,775 feet, or about 2,000 feet above Hall creek, a fairly steep climb is necessary. The camp consists of a good cabin, having sufficient accommodation for three or four men, and a walled tent. The site is well chosen, as there is plenty of timber available both for mining and domestic purposes, while water is obtainable from a near-by creek. It is possible that sufficient water-power could be developed during the summer months to run a small compressor from Bannockburn creek, which is only a short distance below the cabin.

In the immediate vicinity of the outcrops the formation consists of thin intercalating bands of limestone and light-brown fissile schist. The ore apparently occurs along the contact of the limestone and schist, replacing the limestone. The strike of the formation is N. 38° W. and dips at an angle of 65 degrees to the north-east. The ore on the surface consists of massive galena and a little zinc-blende, mixed with iron-stained ledge-matter.

The deposit has been uncovered at a number of places by shallow surface diggings, which indicate the known length of the deposit to be about 200 feet. The ore shows continuity along the surface, for at each place where the surface soil has been removed ore is exposed in widths varying from 20 inches to 5 feet. A sample across a width of 5 feet at No. 3 open-cut ran as follows: Gold, 0.30 oz.; silver, 27.5 oz.; zinc, 3 per cent. Some years ago a 40-foot shaft was sunk on the strike of the ore, but the development evidently did not come up to expectations, for it was abandoned, and no recent attempt has been made to further exploit the ore-body at this point.

At 100 feet below the No. 1 showing, at the north-western extremity of the deposit, a crosscut has been run for a distance of 107 feet. This has been driven in a white crystalline limestone, and so far has not encountered any ore. At a distance of 90 feet from the portal a quartz-filled fissure was encountered; this was drifted on for 118 feet, but no ore was developed. This fissure occurs vertically below the line of the outcrop.

Two other showings on the property were examined—one in a southerly direction and about 400 feet above the No. 5 open-cut, and the other about 500 feet in a northerly direction from the No. 1 open-cut; but in both cases the showings appeared to be isolated, and the formation being broken and shattered made it impossible to form any idea as to future possibilities or to connect them with any vein system.

With such strong surface showings, it would be reasonable to suppose that ore would be found at a depth, but before doing any extensive crosscutting more work might be done to advantage on the surface, by uncovering more of the ore and sinking shallow shafts to find out definitely the character of the deposit.

These claims are situated on Hall creek and adjoin the *Bannockburn* to the **Superior Group**, south-east and east. Development-work was started on the property in the fall of 1917 by Brown Bros., the original owners, who bonded it to Conaway & Birch, of California. The vein apparently occurs along the contact of schist and limestone, and is completely covered by slide material and glacial talus, through which three crosscut tunnels have been run. The uppermost strikes the vein at a distance of 15 feet, and exposes about 6 feet of ledge-matter in the bottom, the mineralization consisting of galena, zinc-blende, and iron pyrites; the gangue, which is composed of lime and silica, is decomposed and stained with oxide of iron.

The second tunnel strikes the vein at a distance of about 100 feet, and the third had been driven for a distance of 176 feet when work had to be discontinued on account of a heavy flow of water from the glacial ice immediately above the slide. It was the intention of the owners to continue this work as soon as the weather became cooler and the flow of water abated. Prospecting-work by means of open-cuts and short tunnels was being carried on at another showing farther down the hill to the east of the *Bannockburn* cabin. The property is in the prospective stage of development, and until further work has been done it is difficult to form an opinion as to its future possibilities.

This group, comprising four claims, is situated at an elevation of 4,450 feet, or 700 feet above Hall creek, and within four miles of the mouth of the creek.
Red Elephant Group. The property is owned by J. W. Power and Hugh MacKay, of Kaslo. The

development-work principally consists of about 150 feet of tunnelling in decomposed, rusty-coloured schist. A sample taken across a width of 6 feet of this material in the tunnel only ran 0.10 oz. in gold. A sample of decomposed silicified schist and honeycombed quartz exposed in an open-cut near the portal of the tunnel gave 1.24 oz. in gold. On the top of a small ridge, and a height of about 50 feet above the tunnel, there is another exposure of similar material to that found in the open-cut.

The good gold values obtained, its easy accessibility, and proximity to ample water for power and milling purposes make it an attractive prospect well worthy of close investigation. Very little work, if any, has been done on the property since it was examined by the Provincial Mineralogist, whose report may be seen in the Annual Report for 1909, page 112.

This property consists of six claims and two fractions staked in a north-westerly direction and running parallel to the lime dyke-belt. The names of the claims are as follows: *Ella*, *Ould Jim*, *Duncan*, *Lardo*, *Queen Mary*, *Princess Mary*, *Lardo Fraction*, and *McCartney Fraction*. The property is owned by the Wagner Mines, Limited, of which C. T. Porter, of Spokane, is one of the principal parties interested. The location of the mine-workings, which are situated at an elevation of 8,200 feet, is somewhat unique. The vein-outcrops near the top are a small knoll which extrudes through the glacial ice covering the summit of the divide between Hall and Cariboo creeks, and in order to reach the tunnel one has to travel over the glacier for at least a quarter of a mile. The natural conditions only allow accessibility at certain times of the year, but when once at the workings, as Mr. Porter says, there is no danger from snowslides, for you are well above them. No work of any importance has been done since 1897.

The development-work consists of a drift along the vein for 100 feet, at the end of which a crosscut has been driven. These workings are approximately 200 feet below the top of the knoll, where the vein outcrops and exposes a nice surface showing of galena. At 49 feet from the portal of the drift a station has been cut, and, according to information received from C. T. Porter, a 54-foot winze was sunk, at the bottom of which a drift was run for a distance of 15 feet in a north-westerly direction, from the end of which a 20-foot crosscut exposed a 12-foot width of vein-matter. Assays taken from this crosscut gave the following values: Silver, 100 to 170 oz.; lead, 60 to 63 per cent. These workings were full of water and therefore could not be examined.

The crosscut at the end of the main drift has been driven for a distance of 46 feet. This exposes a 10-foot cross-section of the vein near the point of intersection of the main drift. This section shows a 2-foot width of ore, a sample across which ran: Gold, 0.02 oz.; silver, 22 oz.; lead, 21 per cent.; zinc, 17.4 per cent.; the remaining 8 feet of the vein is only slightly mineralized. In view of the high values obtained from the bottom of the winze, this crosscut possibly cuts the vein near the end of the ore-shoot. The vein dips at an angle of 65 degrees to the south-west and has a strike of N. 65° W.

The country-rock consists of dark slates, which in this vicinity are somewhat contorted and faulted. (For further reference to this property see Report of 1909, page 109.) Following the strike of the vein in a south-easterly direction, similar vein-matter and ore are found on the *Lardo* claim, about 1,000 feet below the *Wagner*, in the old *Jewel* workings on the south side of Hall creek, and again on the *Abbott* claim, which would indicate the possibility of all these claims, which cover a distance of about three miles, being located on the same vein, although the heavy overburden of glacial drift, detritus, and ice make tracing of the vein impossible except at a few places. A little work was done on the *Jewel* group some years ago, but these workings are now caved. The vein, which is mostly covered with detritus, consists of broken fragments of slate and occurs in a crushed slate formation similar in character to that of the *Wagner*. A grab sample from a 6-ton pile of ore on the old dump ran as follows: Gold, 0.02 oz.; silver, 34.8 oz.; lead, 40 per cent.; zinc, 4.8 per cent.

In the past only spasmodic attempts have been made to develop ore in any of these properties, which is hardly to be wondered at considering the inaccessibility, which makes the cost of packing prohibitive. However, conditions would appear to warrant some work being done on the vein at the most favourable places, where natural conditions do not too seriously handicap or interfere with mining operations.

In the event of sufficient ore being developed to justify the building of a road down Healy creek, ore could be hauled from the foot of Abbott mountain to the railway at a cost not exceeding \$5 a ton.

SLOCAN MINING DIVISION.

SANDON CAMP.

Conditions in the Sandon camp have been better than for many years past, and the prospects for a large increase in production from the surrounding district is most encouraging, providing market conditions remain favourable.

Clarence Cunningham, who has been carrying on progressive mining and development work at his various properties, has done a lot to stimulate the industry in the Slocan and elsewhere.

Besides the *Queen Bess*, which is proving to be one of the richest mines in the Division, he is operating the following properties, in which, all told, about 250 men are employed: *Idaho-Alamo*, *Sovereign*, *Wonderful*, *Van-Roi*, *Hewitt*, and *Wakefield*.

The Surprise Mining Company has also been very active this year, and recently acquired the *Ivanhoe* group and adjoining claims of the *Adams* group. The company is also operating the *Bosun* mine, where sixty men are being employed. The ore from this mine is concentrated at the Rosebery mill. The entire output from the properties operated by this company is shipped to the United States for reduction, under arrangements of a long-term contract.

Slocan Star.—This mine is now being operated by the Silversmith Mines, Limited, under the management of R. H. Stewart. A large shoot of ore was recently developed on the tenth level, which is the lowest point in elevation in the Sandon camp at which ore has been developed. After nearly a year's idleness the mill was again started in October, and it is to be now hoped that the mine will once more rank among the leading producers of the district.

Noble Five.—Work is progressing satisfactorily on the four-compartment vertical raise, being driven to connect the lower workings and the main adit-tunnel with the upper workings.

Ruth.—Work has been continued on the driving of the long crosscut.

Payne.—Leasers have been on this property, and small shipments have been made to Trail.

Mountain Con.—Development-work has been continued. Unfortunately the principal owner, W. Bennett, and another man lost their lives in a snowslide this fall. Mr. Bennett was an old-timer in the Slocan and his loss will be greatly regretted by the mining community.

Rambler-Cariboo.—This property has been steadily operated under the management of W. A. Cameron, although during the early part of the year the company suffered material loss from a heavy snowslide.

Noonday.—Development-work has been carried on under the direction of Bruce White, who recently died at Nelson from pneumonia, following an attack of influenza. Mr. White was one of the first men to find his way into the Slocan country, and staked the *Slocan Star* in 1891. He was liked and respected by all who knew him, and has done a lot to attract attention to the mineral wealth of the Kootenays.

Carnation.—This property has been steadily developed under the supervision of G. W. Clarke. The amount of tunnelling done since mining operations started in the fall of 1917 is 638 feet; upraising, 190 feet; crosscutting, 105 feet. The results so far obtained are said to be encouraging.

Alamo Concentrator.—Situated at Alamo, on the Kaslo-Nakusp Railway. Built and designed by the General Engineering Company, of Salt Lake, for Clarence Cunningham. The mill was designed for treating ore from the *Wonderful* mine. Ore will also be treated from the *Queen Bess* and *Idaho-Alamo* properties, which will be directly transported by aerial tramway to the mill-bins. Provision is also made for handling ore from the railway-track to the mill-bins, the present capacity of which is 700 tons. The capacity of the plant is 150 tons in 24 hours. Water-power is derived from the North fork of Carpenter creek. The distance from the intake to the mill is approximately two miles. The water is conveyed by a 22-inch diameter steel pipe-line. The head of water obtained at the mill is 210 feet.

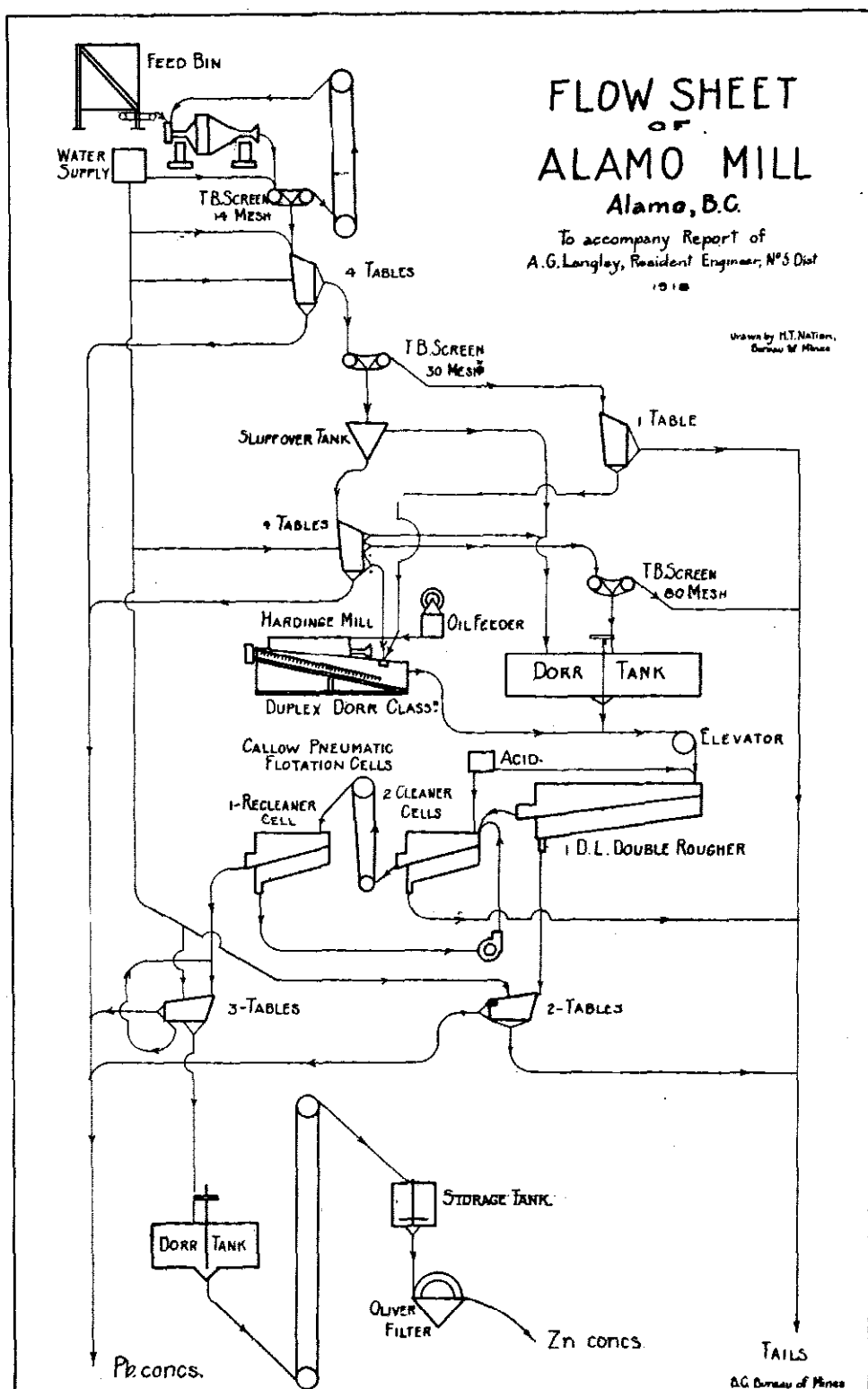
A 225-horse-power Pelton wheel drives the entire mill, including a lighting-generator. A 45-horse-power Pelton wheel is provided as a spare, and in case of a shut-down would be used for operating the lighting plant and the mechanism of the Dorr tanks. As will be noticed by the flow-sheet, jigs have been eliminated and the fine grinding is done entirely by Hardinge mills, while the sizing and classifying is done by three Callow travelling-belt screens and one duplex Dorr classifier. The zinc and lead flotation product is separated on tables; selective flotation is not attempted. The tables used are all Wilfley. About 75 per cent. of the total lead is recovered by water-concentration. The zinc contents of the ore are recovered by Callow pneumatic flotation-cells.

The floor-space of the building is divided as follows: Upper bin, 20 x 28 feet; upper ball-mill floor, 20 x 48 feet; upper Wilfley table floor, 48 x 50 feet; lower ball-mill and Dorr classifier floor, 21 x 48 feet; lower table floor, 24 x 60 feet; flotation floor, 15 x 60 feet; tank building, 63 x 96 feet; concentrate-bins, 12 x 88 feet. The difference in elevation from the bottom of the feed-bin to the railway-track is 56 feet.

NORTH FORK OF CARPENTER CREEK.

Jo-Jo. This property, consisting of two claims, is owned by T. Trenary, who staked it in 1894, and is situated on the North fork of Carpenter creek at a distance of five miles and a half from Three Forks. The elevation of the cabin is

4,850 feet. The vein is developed by two adit-tunnels driven at a vertical distance of 130 feet apart. Ore was first extracted from the upper workings, where a 90-foot crosscut intersected a narrow quartz vein carrying high values in silver; this was drifted on for 112 feet in an easterly direction, and at 67 feet from the crosscut a small shoot of high-grade ore was stoped to within a few feet of the surface, when it had to be abandoned on account of water coming in from the creek-bed. The drift was continued in a westerly direction from the crosscut for a distance of 38 feet, at which point a winze connects with the lower tunnel. The dump from these upper workings, which was said to have contained about 200 tons, was carried away by a snowslide last spring, with the exception of about 15 tons, a grab sample of which ran: Silver, 22.5 oz.; lead, *nil*; zinc, 3.6 per cent.



In the lower workings the vein has been followed for a considerable distance and a little ore stoped at intervals. The vein, consisting of white brittle quartz, occurs in a crushed zone of black slate, which is characteristic of the Slocan series. The walls are not well defined, while the strike and dip are irregular, but lenses of quartz occurring at intervals, and having a maximum width varying from a few inches to about 2 feet, carry high silver values. The ore principally consists of argentite, tetrahedrite, and native silver in a highly siliceous gangue.

On account of the high cost of packing to Three Forks, the ore is carefully sorted and cobbled before shipping, with the result that the product is high grade. Two men who had the property under lease this year shipped 10 tons from the lower tunnel, which ran as follows: Silver, 324 oz.; lead, 4.7 per cent.; zinc, 5 per cent. The second-grade ore or reject from this shipment formed a dump of about 50 tons, a grab sample of which ran: Silver, 22.5 oz.; lead, *nil*.; zinc, 3.6 per cent.

Present development-work is being confined to continuing the lower drift, with the object of getting under the shoot of ore in the upper level. There is sufficient water in a near-by creek for camp requirements and possibly for a small mill, although if any quantity of ore is developed a mill-site could be obtained on the North fork of Carpenter creek. Although there is not much ore in sight at present, it is an attractive property on account of the high silver values, and on which more development-work might be done to advantage.

These claims adjoin the *Jo-Jo* higher up the hillside. The property belongs to R. McPherson and S. McGregor, of Kaslo. Only a cursory examination was made of the somewhat extensive workings. R. McPherson for many years has diligently worked at the development of the claims, and has accomplished a phenomenal amount of work single-handed. Altogether there is about 1,500 feet of tunnelling besides a considerable amount of surface work. The underground workings are in first-class condition, the tunnels have plenty of clearance, and the timbering is well done. There are several quartz veins exposed, one of which is similar in character to the *Jo-Jo* vein. The possibilities of the property can only be determined by a careful examination and sampling, which would have taken more time than the writer had at his disposal on this occasion, but another trip is contemplated.

Black Grouse.—Situated at a distance of two miles from Three Forks. Some work was done by G. Murhard, the owner, during the summer.

The ore from properties on this creek carry high silver values and are low in lead and zinc.

SILVERTON CAMP.

This camp has been a little quieter than usual on account of the temporary close-down of the *Standard* mine, which for many years has been the leading shipper of the Slocan. However, further development-work is being done, and it is to be hoped that before long it will again become one of the large shippers. In the meantime the mine is being partly worked under lease by L. McPhee and partner. Small shipments are now being made to Trail.

Echo.—This mine, situated above the *Standard* and on the same lead, promises to be an important shipper in the near future. Arrangements have been made to lease the *Standard* mill, and a tramway has been built from the mine to connect with the *Standard* tram. J. P. Bonner is mine superintendent.

Galena Farm.—This property was worked during the summer under the supervision of P. Clarke, of Spokane. After a short close-down the mine was leased to the foreman, J. Casey. A new shoot of ore was recently developed.

Van-Roi and Hewitt.—These properties are being systematically mined and developed under the management of C. Cuchin Moore. About 100 men are employed.

Wakefield.—This property was recently acquired by Clarence Cunningham and is now being developed under the supervision of Oscar White. About seven men are employed.

Bosun.—Besides the mining and development work being carried on in the upper levels of the mine, the lower or No. 6 tunnel is now being driven to tap the vein. This tunnel will gain a depth of nearly 800 feet on the vein at a point under the main workings. A 100-horse-power boiler and a 600-foot Ingersoll Rand compressor have been installed near the lake. S. R. Moore is mine superintendent. Sixty men are employed.

Molly Hughes.—Situating on Slocan lake, near New Denver. The property is being mined by the owner, H. Cleaver, of New Denver. A few men are working and a small shipment was made to Trail.

Lucky Thought.—This property has been operated by the Consolidated Mining and Smelting Company and a small shipment was made to Trail.

The following is a list of shippers of the Slocan Mining Division, giving the approximate tonnage shipped or milled by each property during the year:—

	Ore Tons.
Anna group, Sandon	17
Best, Rambler	37
Canadian group, Sandon	11
Echo, Silverton	44
Freddy Lee, Sandon	40
Gem, Sandon	7
Idaho-Alamo, Sandon	184
Ivanhoe, Sandon	53
Jo-Jo, Three Forks	10
Lucky Jim, Zincton	1,724
No. 1, Sandon	111
Payne, Sandon	49
Queen Bess, Sandon	5,314
Rambler-Cariboo, Rambler	7,138
Reco, Sandon	37
Richmond-Eureka, Sandon	66
Ruth	33
Silversmith, Sandon	315
Sovereign, Sandon	240
Surprise, Sandon	13,998
Bosun, Sandon	27,764
Wonderful, Sandon	100
Standard, Silverton	34,727
Galena Farm, Silverton	5,250
Van-Roi, Silverton	25,278
Hewitt, Silverton	19,399
Lucky Thought, Silverton	123
Molly Hughes, New Denver	19
Caledonia	19

L. & H. This property, comprising the following mineral claims: *The L. & H., Summit, Camden, Harlen, St. Joe, Basin Fraction, C.B., and Baby Ruth*, is owned by F. Fingland and C. Brandt, who have worked the property for a number of years. It is situated at a distance of five miles and a half from Silverton and is easily accessible by wagon-road from this place. The elevation of the camp-site is about 5,250 feet above sea-level. J. D. Galloway's report, published in the 1915 Annual Report, fully describes the property, so the matter will only be briefly dealt with.

The claims are located in a greatly disturbed area of sedimentary rocks, cut by dykes and pegmatite veins. This area, which is only a few miles in extent, is surrounded by the granitic rocks of the Nelson batholith. The ore, consisting of an intimate mixture of pyrite, arsenopyrite, and pyrrhotite, carries average values in gold of about \$6 a ton. These sulphides have been deposited in a highly silicified slate, and the mineralization occurs in proximity to intrusive dykes, which apparently bear a close relationship to, and are genetically connected with, the ore-body. The ore outcrops on the side of a steep bluff and is developed by means of two adit-tunnels. The vertical distance between these tunnels is 90 feet. A third tunnel is now being driven which will give an additional depth of 250 feet. This tunnel is now in about 200 feet, and they yet have about 200 feet to drive in order to reach a point below the upper workings, where some 30,000 tons has been developed.

Should the ore-body be developed in the lowest tunnel and its continuity proved to the upper level, there will be sufficient ore available to justify the large expenditure which will be necessary

to erect a power plant, mill, and tramway in order to mine, treat, and handle the ore on a large and economical scale.

The owners have a mill-site near the mouth of Eight-mile creek, where, it is estimated, enough power can be developed for mining and milling purposes. The prospects for the development of a large low-grade ore-body are encouraging, and conditions appear to fully warrant the work which is now being done.

This group is situated to the east of the *Noonday*, which adjoins the *Galena* **Midnight Group.** *Farm* property. The claims are easily accessible, being only a short distance from the road leading to the *L. & H.* mine. R. MacFarland and A. S. Calany, of Silverton, are the owners. A prospect-tunnel has been driven for 160 feet, and a small well-mineralized quartz vein is exposed along the bottom of the drift for about 75 feet. A sample of select specimens from the dump ran: Silver, 137.4 oz.; lead, 2 per cent.; zinc, 24 per cent. The small quantity of ore so far exposed is a mixture of galena and sphalerite, with which is associated small quantities of tetrahedrite.

The tunnel gains very little backs, as the hill slopes at a slight angle. The apparent strike of the vein is N. 83° E. and the dip 70 degrees to the north. Further work might be done to advantage by sinking on the vein and by doing a little crosscut work to determine the true foot-wall.

These claims, owned by W. H. Dawson, of Victoria, are now under bond to **Le Roi,** T. Lloyd and others, of New Denver. The property is situated on Granite **Baltimore, and** creek, the claims being staked along the easterly extension of the *Van-Roi* **Silver Wedge.** veins. In the lower workings a considerable amount of drifting and cross-cutting has been done on what is supposed to be the north vein, while farther up the hill a short tunnel has been driven and a shaft sunk on presumably the south vein. At these latter workings a vein 10 inches wide is exposed in the bottom of a 10-foot shaft; this vein is highly mineralized with zinc-blende. A sample from sorted ore on the dump ran: Silver, 2 oz.; lead, trace; zinc, 44 per cent.

In the lower workings there is a small showing of galena at the intersection of the main drift and a crosscut, but as yet no ore has been developed which might be considered of commercial importance, although the conditions appear favourable for further prospecting. The vein, occurring in a sheared zone of black slates, is brecciated in character and has been subject to faulting.

SLOCAN CITY MINING DIVISION.

There has apparently been more activity in this Division than last year. Generally speaking, the ores are "dry ores" containing high silver values, with small percentages of lead.

Meteor.—J. C. Buchanan, who is also interested in the *Lily B.* mine, recently took an option on this property. The results obtained from preliminary development-work are reported to be of a highly satisfactory nature. Preparations are now being made for the immediate installation of a compressor plant, while it is possible that a mill will be erected at a later date.

Lily B.—This season's work was confined to driving a crosscut to tap the vein at a depth. Work was discontinued this fall.

Arlington.—M. Davys, of Kaslo, who has secured a lease of the mine and ore-dumps, has started to make shipments from the latter to the Trail smelter. It is estimated that there are approximately 10,000 tons in the dumps, and he proposes to erect a concentrator to treat the second-grade ore, which will not stand shipment.

Enterprise.—Situated on Ten-mile creek. Work has recently been started on this property by Earle Hyde, who is confining his attention to the development of a parallel vein to the one which was worked previously. About seven men are employed at the property.

Ottawa.—This property has been mined by the Consolidated Mining and Smelting Company and a small shipment made to Trail.

Black Prince.—F. Tipping put in a season's work on this property, which is a small but steady shipper.

Republic.—G. E. Laird was in charge of the mining operations at this property during the summer.

Westmount.—Situated on Ten-mile creek. Worked under lease by H. Lee.

The following shipments were made: *Arlington*, 375 tons; *Ottawa*, 48 tons; *Black Prince*, 30 tons; *Republic*, 14 tons; *Westmount*, 49 tons; *Lily B.*, 15 tons.

NELSON MINING DIVISION.

This claim was originally staked by C. E. Wilson, of Salmo, in 1895. It is situated on Wilson creek at a distance of twelve miles from Salmo, the nearest shipping point. Recently a company was incorporated at Trail, called the Trail Mining Company, in which Joe Rozeck, Cavin Hicks, and others are interested. This company acquired the property and adjoining claims with the intention of driving a long crosscut to tap the vein at a depth, but beyond building a new cabin near the proposed tunnel-site did not make much progress this year. It is reported that there is some dispute regarding the ownership of one of the claims, and that work has been suspended until settlement is arrived at.

The quartz vein, which occurs in a crushed zone of dark slate and schist probably belonging to the Carboniferous period, is not well defined and is only found in broken segments, none of which yet developed is large enough to demonstrate the existence of an ore-body of commercial importance; hence the property is still in its prospective stage. Geological conditions appear favourable for the existence of ore, or, as the prospector would say, "it is good-looking ground," and further development at a depth may possibly disclose more ore.

Briefly, the principal workings consist of two crosscuts and a little drifting. At the lower workings a crosscut has been driven for a distance of 137 feet. At a distance of 98 feet from the portal, ledge-matter was struck, which was drifted on in a westerly direction for 43 feet. No ore was encountered. At 130 feet from the portal a drift was started in a north-easterly direction and run for a distance of 29 feet. This exposes a short length of a small quartz vein, a sample across 12 inches of which ran: Gold, 0.02 oz.; silver, 4 oz.; lead, 3.5 per cent.; zinc, 1 per cent.

The upper workings are situated at a distance of about 900 feet in a westerly direction from and approximately 150 feet higher than the lower tunnel. Here a crosscut intersects a narrow quartz vein at a distance of 136 feet from the portal, and was drifted on for a distance of 50 feet in a westerly direction; the end of the drift terminates in an inclined winze, which gains a depth of 31 feet on the vein. At the bottom of the winze a small section of the vein has been uncovered, which showed a width of about 20 inches, with a pay-streak of 4 inches of clean galena. Near the intersection of the crosscut and this drift a 20-foot raise exposes a width of 17 inches of vein-matter, a sample across which ran: Gold, trace; silver, 2.4 oz.; lead, 6.5 per cent.; zinc, 1.2 per cent. This drift was also continued for 73 feet in an easterly direction from the crosscut, but no ore was developed. A few tons of sorted ore which was shipped early in the year ran: Silver, 27.3 oz.; lead, 30 per cent.; zinc, 0.8 per cent.

This property, consisting of six claims—the *Jumbo No. 1*, *Jumbo No. 2*, *Climax*, *Nevada Group*, *Gladstone*, *Boulder*, and *Chief*—is owned by D. M. Mowat and W. McIntosh, of Salmo. The claims are situated on the Lost Creek slope of Nevada mountain, at a distance by trail of four miles from the *Emerald* mine. The elevation of the main tunnel is 5,000 feet. At the upper tunnel, which has been driven for a distance of 93 feet, gold and silver values have been found in a quartz vein which occurs in a crushed zone along the contact of the granite and slate. The crushed material and vein-matter is highly mineralized with iron pyrites, which in places has been altered by oxidation to a soft, dark-brown amorphous material. Very little backs are obtained by this tunnel, and not sufficient work has been done to prove the continuity of the vein. A sample of a 6-ton pile of sorted ore from this tunnel ran: Gold, 0.48 oz.; silver, 2.1 oz.; while a sample across a width of 27 inches at the face of the drift ran: Gold, 0.2 oz.; silver, 4.5 oz.

A lower tunnel was driven some years ago along a quartz-filled fissure in the granite. The length of this drift is 75 feet and the vein can be traced for its entire length. A sample across a width of 24 inches ran: Gold, trace; silver, 0.4 oz. There is a good cabin on the property within convenient distance of the workings.

There are six claims in this group; those on which the work has been done belong to Alex. McDonald, while some of the adjoining claims are held by L. Gallagher. The property is situated near the headwaters of 49 creek, at an elevation of 4,960 feet, and at a distance of eight miles and a half from Granite Station, which is the nearest shipping-point. The road leading to the claims passes the *May & Jennie* mill on the way up 49 creek. This mill has recently been dismantled. The workings principally consist of a long crosscut tunnel which strikes the vein at a distance of approximately 500 feet from

the portal. At this point the vein has been stripped on either side, leaving a pillar of ore 12 feet long by 6 feet high and about 12 inches thick. At the northerly end of this showing the ore is exposed in a 17-foot raise, where it shows a width of 15 inches, and across which a sample was taken, which ran as follows: Gold, 8.5 oz.; silver, 4.4 oz.; copper, 4.4 per cent.

Just beyond the raise the vein is cut off by an intrusive dyke, and work has not been continued for any distance in this direction. At a short distance from the raise in a southerly direction a 15-foot winze was sunk on the vein and exposes ore in the bottom, while just south of the winze a small lens of ore having a maximum width of 7 inches gave the following values from a sample taken across same: Gold, 6.88 oz.; silver, 4 oz.; copper, 4.2 per cent. The vein, which has a brecciated structure, occurs in a dark schist and has a strike of N. 10° W. and an almost vertical dip. The mineralization consists of iron pyrites, arsenopyrite, chalcopyrite, and chrysocolla. The gold values are probably associated with the iron pyrites and arsenopyrite. The above-mentioned workings develop the vein at a vertical distance of about 300 feet below the surface.

SHEEP CREEK CAMP.

Emerald.—Mining and development work have been steadily carried on with satisfactory results. This property is the largest producer of lead-silver ore in the district. Between twenty and thirty men were employed. According to information received, the mine closed down temporarily on December 7th.

Ore Hill.—Mining operations have been carried on under the management of W. De Witt. Four or five men were employed.

Aspen.—A few men have been working at this property. A new trail was built between the H.B. camp and the mine.

Reno.—Situated on Fawn creek, above the *Nugget* mill. W. B. Poole put in a season's work on the property and reports the finding of two new veins. The ore is gold quartz.

The Sheep Creek gold camp, in which is located the *Motherlode*, *Nugget*, *Kootenay Belle*, and *Queen* mines, is one of the most important gold-bearing areas in the Kootenays. The gold-bearing quartz veins are of the true fissure type and traverse a quartzite and schist formation. The values occur in well-defined shoots. All the properties have been closed down during recent years, which may be partly accounted for by the increase in the cost of labour and supplies during the war under which conditions the mining of low-grade gold properties could not be carried on to advantage. Recently, however, A. W. McCune, of Salt Lake City, bonded the *Queen* and some of the adjoining properties, and a long crosscut tunnel is now being driven to tap the vein system at a depth.

The *Nugget Gold Mines, Limited*, has been organized to develop the *Motherlode*, *Searchlight*, and *Nugget* properties, and I understand that the preliminary development-work will consist of driving a 1,200-foot crosscut to connect the *Motherlode* and *Nugget* workings. This undoubtedly is the most economic manner in which to develop and operate the *Nugget* mine. Should results come up to expectations, we will shortly see a substantial gold production from this camp, which up to the end of 1915 produced about \$2,500,000 in gold.

Spokane Group.—This property, which is situated on the easterly side of the Sheep Creek divide, has been developed by the Laib Bros., and 20 tons of high-grade ore has been packed out.

Yankee Girl.—Situated near Ymir. This mine has been steadily operated during the year under the management of W. T. McDowell. Shipments have been made to the Greenwood smelter, from which the mine received very favourable smelting rates. Mining operations temporarily ceased early in December, which may partly be attributed to the closing-down of this smelter.

OTHER PROPERTIES.

Relief.—Situated near Erie. The season's work has been principally confined to the building of a new flume. Plans are being prepared for reorganization, with a view to obtaining more capital in order to continue operations on a larger scale. A. D. Westby is manager.

California.—Situated near Nelson. Development-work is being continued. About six men are employed.

Monarch Group.—Situated near Beasley. Development-work has been carried on during the year. Four or five men employed. The principal values are in copper.

Silver King.—The Consolidated Mining and Smelting Company has had a small crew of men employed during the season.

Eureka.—Now being operated by the Inland Mining Company, of Walla Walla, with head office at Nelson. W. M. Myers is mine manager. Work done by the previous owners during the early part of the year consisted of erecting a 1,100-foot 2-bucket tram, new bins, and extending the *Granite-Poorman* tramway for 3,000 feet across Kootenay river to the railway. The ore carries values in gold, silver, and copper. Twelve men are employed.

Molly Gibson.—This mine has been operated by the Consolidated Mining and Smelting Company. Motor-haulage from the mill to Kitto Landing was used for the first time this year, and is reported to be considerably more economical than the use of teams.

Iva Fern.—Situated on Cultus creek. This mine is owned by J. Mullholland and is being developed under a bond by the Consolidated Mining and Smelting Company, who are now driving a crosscut to intersect the vein at a point below the surface showings.

Good Hope and *Nelson* claims, on Bird creek, are reported to have had development-work done on them by J. B. Baxter and associates. The ore is gold quartz, and the season's work is said to have produced satisfactory results.

The following is a list of shipments made from the district: *Emerald*, 3,176 tons; *Aspen*, 7 tons; *Eureka*, 2,092 tons; *Lost Cabin*, 13 tons; *Monarch*, 170 tons; *Ore Hill*, 37 tons; *Queen*, 14 tons; *Spokane*, 20 tons; *Yankee Girl*, 8,847 tons.

TRAIL CREEK MINING DIVISION.

The thirteenth annual report of the Consolidated Mining and Smelting Company of Canada, Limited, for year ending September 30th, 1918, deals fully with the operation of the smelter at Trail, and the various mines throughout the district. The outstanding features of the report are as follows:—

The net profit for the year, after deducting taxes to the amount of \$81,986, writing off \$408,557 for depreciation of plant and equipment, and charging profit and loss account with \$219,203 for the development of mining properties, was \$867,259. The company will continue to pay dividends at the rate of 10 per cent. per annum. The value of the season's metal product exceeded \$10,500,000.

The directors have decided to extend the power-development of the West Kootenay Power and Light Company, and to increase the capacity of the copper-refinery from 20 tons to at least 50 tons a day. It is estimated that these improvements will cost about \$1,500,000. An issue of debenture bonds will be created for \$3,000,000 to bear interest at 7 per cent.

The solving of the *Sullivan* ore problem makes available many million tons of ore which formerly could not be considered of commercial value, and thus greatly enhances the value of the mine, which is now considered to rank among the leading mines of the world. Headway has been made on the concentration of the low-grade sulphide ores of the Rossland camp, while the cost of mining has been greatly reduced.

A few extracts from the report are here reproduced:—

FROM THE PRESIDENT'S REPORT.

"Your directors have pleasure in presenting the thirteenth annual report of the operations of the company, together with the managing director's report, the financial statement, and the auditor's report for the year ending September 30th, 1918.

"The net profit is \$867,259.48 after providing for taxes to the amount of \$81,986 and after writing off \$408,557.22 for depreciation of plant and equipment and charging profit and loss account with \$219,202.33 in development of your properties. Taking into consideration the recent improvements in metallurgical processes, and the enhanced value of the company's mining properties on that account, your directors decided to continue payment of dividends at the rate of 10 per cent. per annum, charging to profit and loss account the deficit of \$180,485.52. The balance at credit of profit and loss account now stands at \$2,148,122.99.

"Your directors have decided that the power-development of the West Kootenay Power and Light Company, Limited, should be extended and that the copper-refinery should be increased from its present capacity of 20 tons per day to at least 50 tons per day. It is estimated that capital expenditures for these purposes will amount to not less than an additional \$1,500,000.

*"Financial Statement."**"Liabilities—"*

Capital authorized, 600,000 shares, \$25 each, \$15,000,000.	
Issued and fully paid: 419,098 shares of \$25 each	\$10,477,450 00
Bank loans and overdrafts	2,809,071 07
Accounts payable	1,386,344 02
Dividends payable October 1st, 1918	261,936 25
Reserves, including provision for claims awaiting adjustment ..	16,998 71
Profit and loss account—Balance at September 30th,	
1917	\$2,360,274 73
Less Provincial income-tax, 1917, paid in 1918	31,666 22
Total	\$2,328,608 51
Profit for year ending September 30th,	
1918	\$949,245 48
Less Dom. income-tax \$27,771 46	
Less Prov. income-tax 22,429 72	
Less mineral-tax 31,784 82	
.....	81,986 00
.....	867,259 48
.....	\$3,195,867 99
Less dividends 27, 28, 29, and 30	1,047,745 00
.....	2,148,122 99
Total	\$17,099,923 04

"Assets—"

Mines, mineral claims, and shares in other companies—Balance, September 30th, 1917	\$7,303,443 60
Expenditure for year to September 30th, 1918	581,120 82
.....	\$ 7,884,564 42
Mining, smelting, concentrating, and refining plants	
—Balance, September 30th, 1917	\$4,867,505 25
Construction for year to September 30th, 1918	130,660 03
.....	\$4,998,165 21
Less depreciation	408,557 22
.....	4,589,608 06
Ores, metals, and smelter product on hand and in transit—Value of metal contents corrected to market quotations	2,828,415 66
Mine and smelter stores and materials	1,183,183 30
Accounts receivable	542,825 89
Insurance and taxes paid in advance	28,192 86
Cash in banks and on hand—Head office, Toronto \$	42,148 72
Sundry cash accounts	984 13
.....	43,132 85
Total	\$17,099,923 04

"Profit and Loss Account."

"To Smelter product on hand and in transit from smelter to refineries, September 30th, 1917	\$	29,242	85
Ores and metals on hand and in transit to the smelter, September 30th, 1917		2,586,421	22
Customs ore, lead, and bullion purchased		4,120,244	06
Freight on ore from company's mines		190,636	58
Mining, smelting, and general expenses—			
Molly Gibson mine	\$	77,890	51
Richmond-Eureka mine		243	30
Highland mine		37,123	34
No. 1 mine		33,608	66
St. Eugene mine		339,601	49
Sullivan mine		339,601	49
Rossland properties		388,701	19
No. 7 mine		861	30
Lucky Thought mine		5,631	22
Emma mine		47,314	02
Ottawa mine		4,508	47
White Bear mine		14,991	11
San Poil mine		12,225	80
Tadanac reduction plant		3,279,826	39
		4,268,219	80
Development expenses—			
Molly Gibson mine	\$	6,348	05
Highland mine		20,068	77
Sullivan mine		14,335	93
Rossland properties		145,744	57
Emma mine		26,093	38
Ottawa mine		6,611	63
		219,202	33
Depreciation		408,557	22
Directors' fees		8,800	00
Sundry items written off, including bad debts		4,415	80
Balance—profit		949,245	48
Total		\$12,784,985	44

"By Sales of smelter product, ore, etc.	\$	9,780,564	64
Ores, metals, and smelter product on hand and in transit—Value of metal contents corrected to market quotations		2,828,415	66
Rents and sundry revenues		16,005	14
West Kootenay Power and Light Company, Limited, dividends		160,000	00
Total		\$12,784,985	44

FROM THE MANAGING DIRECTOR'S REPORT.

"Operations were conducted under very difficult conditions. The first part of the year was unprofitable because of the strike, which not only caused direct loss, but also interrupted production. A strike is always expensive, but weak submission to unreasonable demands is ruinous.

"The latter part of the year produced much better results—largely because of improved metallurgical practice. Materials all tended to appreciate during the year. Labour was more expensive and inefficient. Though at times the metal markets were unstable, all the metals produced were sold.

"Following the armistice, the demand for metals for munitions purposes ceased. It may be worth while to record that from the beginning of the war down to the end of the fiscal year the company supplied the Imperial Ministry with 22,356 tons of zinc, 39,606 tons of lead, and 6,831 tons of copper. The average prices obtained for these metals were:—

Zinc	12.43 cents per pound.
Lead	7.96 cents per pound.
Copper	29.68 cents per pound.

"The saving to the Imperial Ministry through the supplying of high-grade electrolytic zinc at the price named amounts to a very large sum. The average Canadian market price for lead during the period was 8.98 cents per pound.

"The appropriation of nearly all construction material to war purposes affected very seriously the normal commercial demand for lead. The Imperial Munitions Board took the position that they could pay little, if any, more for their lead requirements than these could be secured for from foreigners, although Canadian production costs are necessarily higher because of the heavy duties paid on all equipment and supplies and for other reasons.

"In regard to copper, while the Imperial Ministry made a special allowance to cover the cost of refining copper on a small scale, the price obtained was still below the Canadian market price.

"Shareholders may rest assured, therefore, that the company has made at least a moderate 'money' contribution towards the prosecution of the war, but the greatest and finest gift was that made by the employees. In spite of the fact that a large percentage of the men were married, and many were foreigners, nearly 15 per cent. of the employees enlisted for overseas service. Practically 80 per cent. of the unmarried men of military age in the staff enlisted without waiting for conscription. Many of the finest of these made the supreme sacrifice. Most of them were decorated for deeds of valour, and not one of them has failed to make good in the face of the Hun.

"The company's direct contribution for Red Cross and patriotic purposes was over \$30,000.

"At the same time, it must be realized that war activities have resulted in the establishment on a firm footing in Canada of industries engaged in the production of high-grade zinc and refined copper. The fabrication of these metals is bound to follow in due course.

"Since the cessation of hostilities the normal commercial demand for metals has not asserted itself. There may be a temporary lull in actual consumption, but no apprehension is felt as to markets and prices when usual conditions prevail.

"The Canadian consumption of copper, lead, and zinc prior to the war was in excess of the capacity of the company's plant.

"After all, the mines of the company and their ore reserves constitute the real assets. The control of the West Kootenay Power and Light Company is next in importance, as through it an adequate supply of electrical energy is assured, and at a reasonable cost.

"The *Sullivan* mine has been referred to as the great property of the company, but there are other mineral locations in course of development which promise as well as the *Sullivan* did at the same stage.

"Temporarily, the Rossland mines are unprofitable through high operating costs—the fixed price of gold and its reduced purchasing power. When normal conditions return, as they are bound to do, Rossland will resume its place as one of the foremost metal-producers of the country.

"The \$700,000 advance from the Imperial Munitions Board towards the extension of the zinc plant was repaid in full during the year.

FROM THE ASSISTANT GENERAL MANAGER'S REPORT.

"*The Copper-smelting Plant.*—The year's operations were very expensive owing to intermittent operation, shortage of tonnage caused by the reduced purchasing power of gold, making mining operations impossible, and heavy overhead expenditure. The year's work was conducted with a view to holding the loss down as low as possible. The metallurgical work showed improved gold recoveries.

"*Lead-smelting Plant.*—Operations continued to be unprofitable during the first part of the year. This was owing mainly to the fact that the metal recoveries were not as high as the quantities paid for. The metal losses were smaller than they had been for many years, but the

prices paid for the metal lost were extremely high. In former years each unit of lead cost the company from 40 to 50 cents, while in 1917-18 the same amount of metal cost as much as \$2.20.

"In the latter part of the year much improvement was made in extracting the values from the lead-smoke. The percentage of extraction has already shown a substantial increase, although the installation to take full advantage of the recent discoveries is not yet completed.

"For many years the rates charged for smelting customs lead ores were much too low to cover the metallurgical losses and operating expenses. On February 1st, 1918, these rates were advanced to cover expenses and make a small profit.

"*Lead and Copper Refineries.*—Both of these plants worked on small tonnages most of the year and were handicapped on that account. The lead-refinery showed a very decided reduction in costs, especially in the last months of the year, and proved that for small-tonnage plants the Betts process can compare very favourably with the Parkes process.

"The acquisition of a fluorspar-mine will make a further reduction in cost—fluorspar having formerly been purchased in the east.

"In the copper-refinery the costs have been about as low as could be expected, with the exception of the melting and casting of refined copper.

"The great variety of shapes required by munitions orders for the small tonnage handled, and the difficulty in securing competent labour to do this work, made it advisable to have the copper cast in transit at Great Falls, Montana. In the meantime the melting plant is being enlarged and equipped to handle commercial orders.

"*Acid Plant.*—The sulphuric and hydrofluosilicic acid plants were successfully operated all year. Several improvements were made in the hydrofluosilicic acid plant, and there is now no difficulty in making sufficient acid to operate the entire plant.

"*The Zinc Plant and Concentrator.*—Many very important changes have been made. At the beginning of the year and prior to that date the cost of producing zinc was so high that it would have been impossible to keep the plant running when zinc dropped to its normal price. The plant was thoroughly reorganized and very large reductions made in costs.

"Large-scale experimental work proved that further improvements could be made, more particularly in concentration. These are now being installed in the plant, and when completed will reduce the cost of producing zinc very much further, and will also enable the lead and silver of the *Sullivan* ore to be reclaimed.

"The whole process has been worked out and designed for the complex ores of the *Sullivan* mine. It is possible, though, that other ores may be treated in the same way, but sufficient work has not yet been done to say which ores may and which ores may not be so treated.

"*Sullivan Problem solved.*—The year's developments and improvements have demonstrated that at last the problem of handling the complex *Sullivan* zinc ore has been solved. With a plant operating of from 1,000 to 2,000 tons of this ore per day, there should be no trouble in producing zinc and lead at a profit on any market that has existed in recent years, provided that the cost of labour and supplies falls with the price of these metals. This successful solution of the problem makes available many millions of tons of mixed ore in the *Sullivan* mine which formerly could not be considered commercial ore, although very high in metal content.

"While all of the present plant will be used, quite substantial expenditures on capital account must be made for the necessary extensions to treat the large tonnage above mentioned; besides, it will take considerable time to do this work.

"The research department, which has become a very important part of the organization, worked on the concentration of the ores in our own and other mines; the metallurgical-smoke problem; the manufacture of different chemicals from by-products; and the solution of the various difficulties in our different processes. As already stated, much has been accomplished in connection with the treatment of *Sullivan* ore.

"*Encouraging at Rossland.*—Some headway has also been made on the concentration of the low sulphide ores from Rossland. These results are especially encouraging, as the portion of the Rossland ores most amenable to concentration is that which is the most difficult and expensive to smelt.

"Great strides have also been made in reducing the costs and increasing the efficiency in the mines, though the full force of these will not be felt till working conditions become normal again.

FROM THE MANAGER OF MINES' REPORT.

"I beg to submit the following report on the operations of the various mines of the company, with accompanying tabulated results in development and production:—

<i>" Production—</i>	Sept. 30th, 1917-18.	1894 to Date.
	Tons.	Tons.
Centre Star-War Eagle, gold-copper ore	49,298	2,660,441
Concentrates .....	.....	9
Le Roi, gold-copper ore	54,918	2,062,544
Le Roi, concentrates .....	.....	612
White Bear, gold-copper ore	2,158	2,882
Sullivan, lead ore	22,673	.....
Sullivan, first-class zinc ore	71,048	.....
Sullivan, second-class zinc ore	7,563	.....
Sullivan, pyrites	3,474	595,559
St. Eugene, company lead ore	924	.....
St. Eugene, leasing company lead ore	267	1,022,127
Molly Gibson, silver-lead ore	1,320	.....
*Molly Gibson, silver-lead concentrates	192	7,357
*No. 1, silver ore	5,185	23,312
*Highland, lead-silver ore	283	4,602
Highland, lead-silver concentrates	414	4,727
*Maestro, lead-silver ore .....	.....	463
Maestro, lead-silver concentrates .....	.....	88
*Ottawa, silver ore	48	689
Lucky Thought, lead-silver ore .....	.....	675
Lucky Thought, silver-zinc ore	378	1,141
*Richmond-Eureka, lead-silver ore	37	14,734
*Silver King, silver-copper ore .....	.....	17,238
Emma, copper ore	24,968	201,050
Phoenix Amalgamated, copper ore .....	.....	2,493
No. 7, siliceous gold-silver ore .....	.....	7,388
*Ben Hur, siliceous gold-silver ore .....	.....	12,075
San Poil, siliceous gold-silver ore	1,491	.....
Blue Grouse, copper ore	157	.....

NOTE.—Production given above includes that of previous owners.

<i>" Development—</i>	Total Feet.	Diamond- drilling.
Centre Star-War Eagle	4,274.0	4,833.1
Le Roi	2,645.0	4,641.4
White Bear	634.0	773.5
St. Eugene	61.0	.....
Sullivan	2,539.0	1,774.7
Molly Gibson	366.0	.....
No. 1	553.0	.....
Highland	2,426.3	.....
Ottawa	490.0	.....
Lucky Thought	148.0	.....
Emma	1,817.2	693.4
Richmond-Eureka	128.0	.....
Silver King .....	.....	5,267.6
Coast Copper Co. ....	.....	867.0
San Poil .....	.....	1,831.0
Rock Candy	40.0	492.0
Blue Grouse .....	.....	.....

* Since company acquired property only. Previous records not available.

" Making the total to date as follows:—

	Feet.	Miles.
Centre Star-War Eagle	216,127.5	40.93
Le Roi	92,926.0	17.60
White Bear	8,956.0	1.70
Sullivan	40,202.5	7.65
St. Eugene	105,971.5	20.04
Molly Gibson	11,108.0	2.10
Richmond-Eureka	9,674.0	1.80
No. 7	5,934.0	1.12
Phoenix Amalgamated	2,581.0	.49
No. 1	8,944.7	1.70
Highland	17,069.2	3.23
Ottawa	11,387.0	2.15
Silver King	20,462.0	3.88
Lucky Thought	3,490.0	.66
Emma	5,894.7	1.11
Coast Copper Co.	2,961.7	.56
Rock Candy	55.0	.....

" *Rossland Output irregular.*—About the same tonnage was shipped from the Rossland mines as in the previous year; shipments, however, were very irregular, but attained considerable proportions from January to April, when an unsuccessful attempt was made to cope with steadily increasing operating costs at mines and smelter by handling fairly large but certain definite tonnages with maximum output of ore high in iron from the *Emma*.

" Development was less than that of last year by nearly 4,000 feet, and for the most part was confined to extensions of trunk-line drifts and crosscuts in new territory. Promising veins have been disclosed in the work east from the *Centre Star* sixth and seventh levels and west from the *Le Roi* 1,650 and *White Bear* workings, but insufficient work has been done on them to permit of any estimate of tonnages. A crosscut is being driven to explore ground optioned during the year. Some additional tonnages have been made available by work north on the *Le Roi* tenth level under the *Josie* plane, on the *War Eagle* twelfth and thirteenth and *Centre Star* sixth levels.

" In the *White Bear*, development-work consisted in extensions of drifts from the old workings, in some instances into *Le Roi* ground, and in diamond-drilling. Some new ore was opened up on the eighth level. The stopes on the eighth and tenth levels were extended.

" Steadily increasing smelter costs on Rossland ore have stimulated experiments along other lines of treatment with encouraging results, which, if definitely established, will make available a much larger tonnage than is included in our estimate of present ore reserves."

On January 20th, 1918, the Consolidated Mining and Smelting Company introduced Schedule B of treatment charges for silver-lead-zinc ores, which did not meet with entire satisfaction from the mine-owners, so at the instigation of the associated Boards of Trade of south-eastern British Columbia a committee was appointed to investigate and report on the smelter charges. The committee, composed of S. S. Fowler, Ivan DeLashmutt, and J. Anderson, refused to act until they received the necessary authority from the Federal Government at Ottawa; this was granted and the first meeting was called in October, but on account of the influenza epidemic was postponed until January 21st, 1919. The Resident Engineer for the district was appointed to attend this and subsequent meetings, in order to report all the facts and evidence to the Lieutenant-Governor in Council.

The following is a copy of Schedule B:—

" SCHEDULE B—LEAD ORES.

" Payments.

" *Gold.*—Pay for 95 per cent. of the assay at \$20 per oz. 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:—

"No ore containing more than 25 per cent. zinc will be accepted under this schedule.

"Zinc Contents—

4 per cent. or under		Silver Payment. 95 per cent.	Lead Payment. 90 per cent.
Over 4 per cent. and including	5 per cent..	94½ "	89 "
" 5 "	6 "	94 "	88 "
" 6 "	7 "	93½ "	87 "
" 7 "	8 "	93 "	86 "
" 8 "	9 "	92½ "	85 "
" 9 "	10 "	92 "	84 "
" 10 "	11 "	91½ "	83 "
" 11 "	12 "	91 "	82 "
" 12 "	13 "	90½ "	81 "
" 13 "	14 "	90 "	80 "
" 14 "	15 "	89½ "	79 "
" 15 "	16 "	89 "	78 "
" 16 "	17 "	88½ "	77 "
" 17 "	18 "	88 "	76 "
" 18 "	19 "	87½ "	75 "
" 19 "	20 "	87 "	74 "
" 20 "	21 "	86½ "	73 "
" 21 "	22 "	86 "	72 "
" 22 "	23 "	85½ "	71 "
" 23 "	24 "	85 "	70 "
" 24 "	25 "	84½ "	69 "

"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 dry ton.

"Lead will be determined by the wet method of analysis, from which 1½ units will be deducted to arrive at the dry-lead assay. Lead will be accounted for 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. Settlement for lead will be made on the basis of our circular of November 5th, 1917, as modified by our circular of January 18th, 1918.

"Deductions.

"Smelting.—Per dry ton of material \$7.50 as a base rate, which will be modified in accordance with the following formula:—

"(1.) Add to the base rate per ton 9 times the units of zinc shown by analysis at 9 cents per unit.

"(2.) Deduct from this result the total units of silica, iron, manganese, lime, and magnesia at 9 cents per unit:

"Provided that in no case said base rate be reduced more than \$3.50 per ton as the net result of the additions and deductions:

"Provided also that in making the above computation iron, silica, and lime of 1 per cent. or under and manganese and magnesia if 3 per cent. or under will be disregarded.

"Sulphur.—A charge will be made in addition to the above for all sulphur contained at 50 cents per unit per dry ton of material, provided that such charge shall not exceed \$4 per ton in any case.

"Moisture.—A minimum moisture deduction of ¼ per cent. will be made. The following penalty for moisture will apply to fine concentrates and clayey ore only: If over 5 per cent. charge for contents at 10 cents per dry ton per unit.

"Flotation Concentrates.—Flotation concentrates will be charged \$1 extra per dry ton.

"Size.—Coarse and fine concentrates and ores must be shipped separately; if over 30 per cent. will pass through a ¼-inch screen; otherwise an extra charge of 50 cents per ton will be made.

"Sampling.—If the shipment is less than a car-load or contains more than one lot per car, a deduction will be made for extra sampling, assaying, etc., of \$10 per lot.

" *Weights and Samples* to be used in settlement shall be those made at the smelter.

" *Representation*.—Shippers are expected to notify us as to who will represent them while their shipments are being weighed and sampled. Failure to do so will be construed as meaning that the smelter will have authority to appoint one of the local mine representatives at the shipper's expense, unless the shipper notifies us that a representative is not required. All shipments will be released for smelting as soon as sampled.

" *Assays*.—Shippers will supply the smelter with their assays on smelter pulps shortly after sampling. In case of difference in assays requiring it, the umpire pulp will be referred to an umpire mutually agreeable. The party whose result is farthest from the umpire's result will pay his fee.

" *Settlement*.—Advances on preliminary settlements will be made as set out in our circular of November 5th, 1917, as modified by our circular of January 18th, 1918. The final settlement for the silver will be adjusted between the parties shortly after the close of the second calendar month succeeding the date of sampling when quotations are available. The final settlement for the lead will be adjusted whenever the pooling arrangement will permit.

" If the present price of coke is changed the above rates will be increased or decreased 25 per cent. of whatever price per ton coke costs, more or less.

" If our present price of labour is changed the above rates will be increased or decreased 1½ cents per ton for each 1 cent change per shift for labour.

" The above rates are subject to change without notice."

This is the only producing mine in the Rossland camp which is not operated by the Consolidated Mining and Smelting Company, Limited. The property is owned and operated by the Le Roi No. 2 Company, Limited, of London, England. Ernest Levy is resident manager. The year's shipments show an increase over those of last year of nearly 3,000 tons. The ore is gold-copper and similar in character to that of the *Centre Star-Le Roi* group.

Velvet.—Exploratory work was carried on by the Granby Consolidated Mining, Smelting, and Producing Company during the early part of the year, but, according to reports, was recently discontinued.

This property, consisting of four claims and a fraction—the *Mountain Chief*, *Mountain Chief*, *Morning Glory*, *Calgary*, *Sunset*, and *Morning Glory Fraction*—was operated during the year by M. McDaniels, O. Wheeler, and associates. Early in 1918 the *Mountain Chief* Mining Company was incorporated with a view to acquiring the property and securing the necessary capital to develop and operate the mine on a larger scale than heretofore. The officers of the company are: J. W. Evans, president; A. D. Nash, managing director; Charles F. Blacha, of Walla Walla, director; W. A. Gordon, of Revelstoke, director; J. H. Lawrence, secretary-treasurer; C. R. Hamilton, solicitor.

Surveys are now being made for the right-of-way for a 2-bucket tram-line from the mine to Dog Creek valley, a distance of approximately 2,000 feet, while plans are prepared for the systematic development and mining of the deposit. The property is conveniently situated to transportation facilities, the distance from Renata, on Lower Arrow lake, being about three miles, while the elevation above the lake is 1,100 feet. Ore can be hauled from the lower terminal of the proposed tram to the lake-shore for 50 cents a ton.

Some years ago a 30-foot shaft was sunk and various open-cuts made in an endeavour to locate a commercial body of ore. Unfortunately the results obtained were not very encouraging and the property remained idle until last year, when further work was done. The old workings apparently were too far to the north of the main ore-body, which was developed during the year by M. McDaniels, under whose supervision some 600 tons was shipped to the Trail smelter, and at the time the property was inspected there was about 600 tons of positive ore available.

The development this year consisted of stripping and open-cut work along the trend of the ore-body in a northerly and southerly direction. This disclosed an ore-body having an average width of 5 feet and a length of about 100 feet. The ore as yet developed lies near the surface and resembles a blanket deposit, but no work has been done to disprove this fact, and present geological conditions would indicate that the true foot-wall has not yet been reached.

The ore, which occurs in a highly metamorphosed and siliceous limestone near the contact of an intrusive granitic mass, forms a replacement deposit and probably owes its origin to pneumatolytic conditions due to the adjoining intrusive rocks. The ore-minerals are chalcopyrite,

bornite, melachite, and azurite, with which is associated iron pyrites. The gangue runs high in silica. The average metallic contents of the unsorted ore, according to a previous shipment, is as follows: Gold, trace; silver, 2.5 oz.; copper, 3.5 per cent. I would consider it a prospect which has good possibilities.

Peggy and Rickward.—These two claims adjoin the *Mountain Chief* group to the south, and have had a considerable amount of prospecting done on them, which has been chiefly confined to open-cut work. Although there are copper indications, no ore in commercial quantities has as yet been developed.

NORTH-EAST KOOTENAY DISTRICT.

GOLDEN AND WINDERMERE MINING DIVISIONS.

REPORT BY JOHN BULMAN, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report of the North-east Kootenay District, embracing the Windermere and Golden Mining Divisions.

Although only a very limited number of mines have been shipping during the year, there has been an increase of ore shipped out of the district, principally from the *Couverabee* and *Monarch* claims on Mount Stephen and the *Paradise* mine on Toby creek.

I enclose report from the Mining Recorder at Wilmer, which covers nearly all the principal mines in the Windermere Mining Division. The following is my report on the *Monarch*, *Couverabee*, and the *Giant* mines, which are situated in the Golden Mining Division:—

GOLDEN MINING DIVISION.

Monarch. Situated on Mount Stephen, Field. This mine has the distinction of being one of the first mining claims located in British Columbia and has produced approximately \$1,250,000 in lead and silver. The zinc content, formerly considered an objectionable feature, has been impounded on the banks of the Kicking Horse river, immediately below the company's mill. Assay results from these tailings give 16 per cent. zinc, 3 per cent. lead, and 3 oz. silver to the ton.

The ore-deposits are clearly "bedded veins," but are local fractures traversing the formation some two miles in length. Commercial bodies of ore usually occur along these fractures and into the formation some 300 feet on either side, and to a known length of 400 feet, as demonstrated by the *Monarch* mine.

The metals contained in the ores are lead, zinc, and silver. The content varies from 8 to 65 per cent. lead, 3 to 12 oz. silver, 4 to 22 per cent. zinc, and 0 to 5 per cent. iron. Considerable lead has been shipped in its crude form, but is largely concentrating. Recent sampling of the *Couverabee* mine, immediately adjoining the *Monarch* on the westerly end line, gave 16.8 per cent. lead, 4 oz. silver, and 3 per cent. zinc, with bands of lead varying from 2 to 5 feet of 55-per-cent. lead.

The company has a mill situated 1,600 feet from the mine, connecting the mine with an aerial tramway. This mill is not of the type adopted to treatment of such ores, and in consequence much of the values goes to the "tails."

Couverabee. Situated on Mount Stephen, Field. This mine, a new location, being operated but three years, is giving splendid returns and exhibits permanency of values, with the same conditions for operating as the *Monarch*; in fact, it is operating through the *Monarch* property and mill. This mine was recently taken over by Calgary investors, who expect to install an entire new plant of a much larger and modern type.

The development consists of a chamber 90 x 60 x 20 feet, making an extraction of some 6,000 tons, from which over 600 tons of concentrates has been shipped.

Known ore has been sampled for over 300 feet above the present workings, which should be connected by diamond-drill holes, giving the operators knowledge of ground values and methods for future operations.

The *Monarch* mine has been idle for some time, but is now held by bond and lease. The *Couverabee* mine is in constant operation.

SPILLIMACHEEN DISTRICT.

Giant.—Situated on the Spillimacheen river. There is quite a large body of low-grade ore, but owing to the absence of Captain Armstrong, one of the owners, being away serving his country on the Tigris river, there has been no development since the war broke out.



Looking Across Boulder Cr. from Sitting Bull Cabin, Windermere M.D.



Mount Nelson from Sitting Bull Cabin, Windermere M.D.

OFFICE STATISTICS—GOLDEN MINING DIVISION.

Revenue.

Free miners' certificates (special) (1)	\$ 15 00
Free miners' certificates (ordinary) (114)	608 75
Free miners' certificates (company) (1)	27 50
Mineral claims recorded (27).	
Assessments recorded (36).	
Bills of sale and agreements (16)	321 30
Notices to group (4)	1 00
Lease fees (5)	125 00
Ore-tax	2,950 23
Acreage-tax	1,698 62
Total	\$5,747 40.

WINDERMERE MINING DIVISION.

REPORT BY E. M. SANDILANDS, MINING RECORDER.

I have the honour to submit my mining report for the year 1918 on operations in the Windermere Mining Division.

Paradise. During 1918 active work has been carried on at this property with a monthly average of some thirty to thirty-five men at the mine and from six to ten men employed in the transportation of ore. The new "Cut-off" road from the mine to Invermere has been improved and shortened, so the transportation of ore has been greatly facilitated. The raise from No. 4 tunnel to No. 3 tunnel has been put through, and now all the ore comes out through No. 4 tunnel. Several improvements in the tramway and buildings at the mine have been accomplished this past year. The class of ore shipped is a sand carbonate, and its values run from 30 oz. in silver to 35 per cent. in lead. Over 2,700 tons of ore has been shipped to the Trail smelter. All the ore is now shipped from the bunkers at Invermere.

Mabel R., Relief, and Isaac.—These properties have been idle the past year.

Lead Queen. This property, situated on Frances creek and owned by Thos. Brown and associates, was bonded in the fall to P. Denhart, of Seattle, and work on the property carried on with a force of men varying from eight to ten. Unfortunately snowslides have stopped operations until the spring. Some 80 tons of ore has been hauled to the railway at Brisco. Work will recommence in the spring when the danger of snowslides is over.

These properties are situated up Horse Thief creek, on Boulder creek. The **Sitting Bull** and **Delos.** *Sitting Bull* is owned and operated by Mr. Wonn, of Seattle, with E. D. Smith in charge as superintendent. The *Delos* is also owned by some of the same people, but called the Trojan Mining Company. During the summer considerable work was done on these properties and a new wagon-road commenced from the main road on the Horse Thief, leaving the main road at about the 7- and 8-Mile posts. A wagon-road has been built to the *Delos*, between four and five miles from the main road, and a rawhide trail built to the *Sitting Bull*, a distance of some three miles farther. It is intended to continue the wagon-road from the *Delos* to the *Sitting Bull*. Ore is now being hauled to the railway at Athalmer for shipment to the Trail smelter. The company intends to put in a compressor with which to drive a crosscut tunnel. The ore is a steel galena and of fairly good grade.

Blue Grouse and Bald Eagle.—These claims are situated across the summit from the Paradise basin on Boulder creek and have been worked all summer by Burman and partners. Considerable work has been done and some ore taken out which they expect to ship this winter. The ore is of a very good grade of galena.

Hot Punch.—This property is owned by Stoddart & Parry and is situated on the North fork of Toby creek. Work has been going on during the fall and three or four men working. About 45 tons of ore has been hauled to the railway for shipment. The ore is of a fairly good grade.

During 1918 quite an amount of prospecting-work has been done with fair results, and more assessments recorded than the previous year. Also the number of miners' licences sold and claims recorded exceeded those of 1917.

OFFICE STATISTICS—WINDERMERE MINING DIVISION.

Free miners' certificates sold (ordinary)	86
Free miners' certificates sold (special)	1
Claims recorded (quartz)	54
Claims recorded (placer)	23
Certificates of work issued	61
Certificates of improvements	Nil
Bills of sale, agreements, etc.	28

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 1918.

The following table shows approximately the number of mineral claims held during each year since 1899:—

Year.	Held under Crown Grant or Certificate of Improvement.	Certificate of Work.	New Locations.
1899.....	37	718	729
1900.....	71	704	470
1901.....	104	642	455
1902.....	117	451	253
1903.....	142	335	200
1904.....	167	260	169
1905.....	189	193	181
1906.....	241	235	160
1907.....	254	160	115
1908.....	264	150	100
1909.....	280	154	116
1910.....	294	161	179
1911.....	307	167	96
1912.....	316	143	145
1913.....	319	139	104
1914.....	345	189	179
1915.....	350	203	114
1916.....	353	133	56
1917.....	367	120	105
1918.....	380	122	87

Although the year's results were disappointing in some respects, there is no doubt that the investigations of visiting engineers were favourable, and several bonds are in process of completion, whereby much development is proposed for 1919.

The withdrawal of the Federal Mining and Smelting Company from the district was the chief disappointing feature, presumably due to the failure of the diamond-drilling operations on the North Star hill and *Stemwinder* properties to show up any extension of the known ore-bodies.

After the Federal Mining and Smelting Company had abandoned the option on the *North Star* mine the property was leased by Thompson & Brander, who have shipped over 2,450 tons of ore to Trail, and it is the intention of the lessees under their five-year tenure to operate on a more extensive scale during 1919. Up to the present the main supply of ore shipped has come from the old dumps, from which a very fair profit was made.

Two or three properties in the St. Mary district were under examination, and arrangements have been made whereby the large body of low-grade copper ore on Whitefish creek is to be prospected and developed. This is an important move for the district and much depends on the success. This property, belonging to the Evans Bros., has never been thoroughly prospected, as it is far too extensive for the work of ordinary prospectors.

The properties on Alki creek also came in for examination, and an option was given on the *Blue Peter* group; this property carries copper associated with pyrrhotite and mispickel in a strong, well-defined quartz ledge in the hornblende quartzites of the Aldridge formation. It is owned by Lieut.-Colonel Pollen.

The *Park* group, which had ceased working owing to the increased cost of operation, is to start again immediately the snow is off; what work was done in 1918 was not very satisfactory, but was of too small an amount to determine anything.

Perry creek showed some improvement as far as placer-mining was concerned. The Wild Horse Creek Placer Mining Company, which has bought out the old Perry Creek Hydraulic, did considerable work fixing up the big flume, putting in supplies, lumber, etc., and making ready for an early start this spring.

Placer-mining appears to be coming into some favour again, as, besides Perry creek, Wild Horse is to be tried again by a Seattle company which has taken up six new leases and obtained an option on the existing leases and plant, with the intention of thoroughly exploiting the creek by new methods.

The Moyle placer is also to come in for prospecting at the falls; it is a good many years since anything of any importance was done here, although this locality received a lot of attention from the old placer-miners.

As far as gold-quartz mining was concerned, nothing was done; Perry creek, being essentially a low-grade free-milling gold-quartz camp, does not appeal to capital at present on account of the increased cost of operation.

The Consolidated Mining and Smelting Company is still making records in the ore-extraction from the *Sullivan* mine; the work on the main adit-tunnel was resumed early in November and is being pushed forward with a full force of men, and is now in over 8,000 feet. Pretty nearly 135,000 tons of ore was shipped from this mine last year, the preponderance being zinc ore. It is the intention of the company to make, in the near future, still further improvements and developments for the more economical handling of the ore and the comfort of employees. The extent of the ore reserves fully warrants a large outlay to facilitate the handling of the immense annual tonnage contemplated.

The *St. Eugene* is still shipping a little ore, both by the lessees and also the Consolidated Mining and Smelting Company, but none of the other properties in this camp have broken into the shipping-list, although the *Haws* group, the *Guindon* group, and the *Aurora* have all reported ore in sight.

It is the intention of the local Board of Trade, with the assistance of the Provincial Government, to have a comprehensive collection of ores from this district displayed in a conspicuous place; this collection is to be supplemented with samples of lesser-known ores and minerals for the use and benefit of the prospectors.

The depreciation in the value of lead will necessarily have some effect on the demand for galena properties, but this is practically offset by the increased price of silver; the lead question, however, appears to be somewhat disquieting, as the market value is too fluctuating to establish any confidence.

In conclusion, I would point out that the general interest in mining has been maintained and the receipts in excess of the former year.

OFFICE STATISTICS—FORT STEELE MINING DIVISION.

Mineral claims recorded ("B")	87
Certificates of work ("E")	122
Certificates of improvement issued ("G")	13
Conveyances and other documents of title (bills of sale)	23
Abandonments	..
Partnership agreements	1
Gold Commissioner's permits	5
Documents filed	9
Affidavits filed	159
Mining leases issued	5
Free miners' certificates (ordinary)	208
Free miners' certificates (company)	3
Free miners' certificates (special)	..
Crown grants issued	13

Revenue.

Free miners' certificates	\$1,256 25
Mining receipts	1,209 23

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, 1918.

My forecast, in the Annual Report for 1917, of a year of very promising activity in these Divisions unfortunately did not materialize to the extent that we had anticipated.

BIG BEND DISTRICT.

The Mastodon Mining Company, which is operating on LaForme creek, twenty miles north of Revelstoke, continued the work of developing its properties throughout the season with a crew of twelve men. The properties extend over the summit from LaForme creek to the slope of Carnes creek. The season's work under the direction of the manager of the company, J. W. Evans, proved most encouraging. On the Carnes Creek slope a great deal of open-cut work has been done on the veins, all exposing ore. The company has also drifted 70 feet on one of these. When the snow came this fall the crew moved to the shaft at the lower vein, which has been sunk 110 feet to the 143-foot level. The high-grade zinc is giving way and is now showing galena. On the 110-foot level a drift 80 feet long was made and crosscut at three points, disclosing high-grade zinc ore. Some 20 tons of ore has been moved to the end of the wagon-road, sixteen miles north of Revelstoke, which could have been shipped to the smelter had it not been for slides which occurred on the road this fall. This was the only property working in the Big Bend, although the individual miner and the prospector completed the annual assessments on their claims.

Placer-mining was at a practical standstill. Remillard and associates, who have under lease some placer-ground on French creek, devoted the entire summer in constructing a flume for the purpose of bringing sufficient water from French creek on to the ground. This flume is about completed and the forthcoming season should see active mining. French creek was a big producer in the early sixties.

ALBERT CANYON AND ILLECILLEWAET DISTRICTS.

These districts were the most active during the season just past. A number of men prominent in the mining business made visits to the camps.

The Silver Creek mines, known locally as the *Woolsey* group, is located up Silver creek, about six miles from the Canadian Pacific Railway at Albert Canyon. This property is owned by Calgary capitalists and is managed by David Woolsey. The operations this season were devoted chiefly to the erection of cabins and mine buildings and the construction of a trail from the railroad to the mines. This year plans are out for extensive development of the strong leads that are known to traverse the property.

Adjoining this group, Sandberg & Hedstrom have located two claims that have excellent showings of high-grade ore exposed on the surface. No work has been done on the ground and the permanency of the ore-bodies is not as yet determined.

W. B. Dornberg, manager of the *Lanark* mines, continued extensive improvements to the mine equipment this year. A 250-horse-power hydro-electric plant was constructed to run the concentrator and compressor; the former was installed two years ago, whilst the latter was added to the equipment this season. Development-work consisted chiefly in opening up the new ore-bodies which, by systematic prospecting under the direction of Mr. Dornberg, were recently located and defined. The new lead discovered on the *Lanark* and which was prospected thoroughly has given considerable value to the company's holdings. It has proven to be an entirely new ore-bearing zone and has no connection with the old *Lanark* leads, from which hundreds of tons of high-grade silver-lead ores have been extracted and smelted, and which still hold extensive deposits now being prospected and blocked out for future tonnage. Twelve miners were employed at actual mining, and a big crew of men was engaged in erecting the new equipment during the summer months.

In the Cariboo-Mountain Creek district a number of claims were located and recorded during the summer and fall. This district is just east of the *Lanark* properties above Illecillewaet, about twenty-five miles east of Revelstoke. The leads located are all well defined and the ore samples brought into the city are high-grade silver-lead and copper-gold.

LARDEAU MINING DIVISION.

Mining operations in this Division show a further decrease over that of last year. Like all the mining districts in North Kootenay, it felt the effect of war conditions, which of necessity curtailed expenditure in the exploitation of the less-developed mines; there being practically no capital for the development of prospects.

The Multiplex Mining Company, which has been the largest operator in the Camborne camp during the past few years, ceased active work early in the year owing to conditions which made it impossible to get sufficient help for the economic working of the property. Up to date this company has expended upwards of \$25,000 in actual mine-development, and the property is now in a good position for future operations. It is understood that the finances of the company are in good shape for this year and a vigorous development policy is planned. It is understood it is the company's intention to construct a concentrator this year to handle the output. It is likely to be a customs concentrator, and will be of great benefit to the small mine-owner who desires to concentrate his ore and thus save transportation and procure the maximum of smelter returns.

The *Beatrice* was bonded last fall to a company represented at Vancouver. It is expected that the bondholders will be on the ground as soon as the season opens up, with a view to opening up again this famous old shipper of silver-lead-zinc ores.

The *Berniere*, *Nelson*, and *Goldfinch*, all free-milling gold properties, were inspected late last fall by Mr. Wilde, a mining engineer representing Los Angeles capitalists, accompanied by J. A. Darragh, one of the oldest operators in the Camborne camp. Mr. Wilde will return this spring to the camp for a further examination of these properties, as well as others in the neighbourhood.

A deal is now pending for the purchase of the *Scout* and *Big Showing* groups, which are owned by George Goldsmith and associates, of Cranbrook.

The *Eva* and *Oyster-Criterion* gold properties, which are the most highly developed in the district, have remained idle for some time. These properties were inspected last summer by mining men from Vancouver, but there is no evidence of their intentions in respect to these mines.

There are a number of excellent prospects located in this Division that are well worthy of the inspection and consideration of those seeking a field for future mining enterprise.

REVELSTOKE MINING DIVISION.

REPORT OF JOHN LEE, MINING RECORDER.

I have the honour to submit herewith the annual mining report and office statistics of the Revelstoke Mining Division for the year ending December 31st, 1918.

The past year has been exceptionally quiet in the mining industry of this Division. The scarcity of labour owing to war is responsible for the inactivity affecting mining as well as other lines of industry, and in consequence retarded prospecting. However, with peace conditions, there is no doubt men will again take to the hills and a revival is fully anticipated.

OFFICE STATISTICS—REVELSTOKE MINING DIVISION.

Free miners' certificates	148
Free miners' certificates (company)	1
Locations recorded	67
Certificates of work recorded	81
Bills of sale recorded	16
Transfers recorded	4
Agreements recorded	2
Payments in lieu of work	2
Groupings recorded	11
Placer leases recorded	2

LARDEAU MINING DIVISION.**REPORT OF MRS. F. I. FRASER, MINING RECORDER.**

I have the honour to submit herewith my report of the progress of the mining industry in the Lardeau Mining Division for the year 1918.

Mining operations were very quiet during the year in this district; in fact, the slowest season the camp ever experienced. The Multiplex Mining Company, which for the past three years kept a crew of men at work developing its property, closed down early in the season, thus practically closing the camp. The usual assessments were recorded by individual owners. The old-time miners and prospectors, however, are looking forward to a new era of activity in this district, declaring that a camp so richly endowed will not long remain dormant.

OFFICE STATISTICS—LARDEAU MINING DIVISION.

Free miners' certificates	44
Free miners' certificates (company)	1
Certificates of work	31
Payments in lieu of work	1
Locations recorded	31

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, 1918.

There is very little out of the ordinary to report, with the exception of additions and improvements to mining and milling facilities at the *Gibson*, *Cork-Province*, *Blue Bell*, and *Florence* mines. In all, twenty-three properties shipped, ranging from 3 to 5,700 tons, aggregating 17,000 tons for the district. The principal shippers were the *Blue Bell*, *Florence*, *Highland*, *Cork-Province*, *Whitewater*, *Bell*, *Spokane-Trinket*, *Utica*, *Little Phil*, and *Montezuma*.

Gibson. This claim, situated on the South fork of Kaslo creek and owned by the Gibson Mining Company, has done 700 feet of underground work, consisting of 450 feet of crosscut, 87 feet upraise, and 163 feet of drifts, uncovering new ore-shoots of good-grade mill-feed, with some shipping-ore mixed, from which 21 tons was shipped. A telephone-line has been installed connecting the upper and lower camps; this line connects with the *Cork-Province* line, which extends through to Kaslo. There has also been erected two buildings, one for a laboratory and the other for office and living apartments; the latter is 28 x 40 feet, two stories; a water-power plant; and it is expected the concentrator will be completed next summer and drilling by power started early in March.

Extensive improvements were made to the mill by the installation of a 14-cell **Cork-Province.** Minerals Separation machine, ball-mill, three Wilfley tables, 30-foot Dorr tank, boiler and radiator for heating mill, turbine, and a new bunk-house. With the above improvements to the mill, the company expected to be in a position to produce a selective lead and zinc concentrate; the result, however, was not satisfactory in the early stages of operation. I am informed that before the mine shut down the company succeeded, by experimenting, in producing satisfactory lead and zinc concentrates and expects a good run next year. The production was 642 tons lead-silver concentrates and 110 tons zinc-silver concentrates. An average of forty men was employed.

Silver Bell. Situated on the South fork of Kaslo creek; operated by Green Bros., in charge of W. E. Newton. Work was commenced on August 16th with six men steadily employed; the work accomplished consists of 100 feet of new tunnel, several hundred feet of open-cuts, clearing out and retimbering old tunnels, the erection of new stable, blacksmith-shop, and ore-shed. Thirty-two tons of silver-lead ore was mined.

The *Whitewater* was worked under lease; fifteen men were employed, producing 409 tons silver-lead ore and 135 tons silver-zinc ore. The former was shipped to Midvale, Utah, and the latter to Trail and Sand Springs, Colorado.

Operations at the *Florence* mine, Ainsworth, B.C., for the year 1918, while hampered to some extent by prevalent labour shortage and by delays in securing equipment and supplies, have been on the whole satisfactory, in that they have proven the expectations entertained for the property to have been well founded. Tonnage mined during the year amounted to 24,775 tons, a large portion of which came from development workings, reducing the mill-feed values. High-grade concentrates produced with the mill running one shift of eight hours a day from April to July 1st, and two eight-hour shifts from that date till the end of the year, with an average of twenty running days a month, amounted to 2,118 tons, and crude ore to 284 tons. Total shipments, all of which went to Trail smelter, were 2,402 tons, with a value of \$232,466.07. Ore production was stopped on November 10th, 1917, and was not resumed until April, 1918. This was caused by the shut-down of the smelter at Trail. Completion of development-work and installation of improved equipment in the mill during the year will bring tonnage produced higher and will mean higher values in mill product.

Development-work during the year consisted of the completion of the No. 5 tunnel, 3,000 feet; the completion of the upraise from the No. 5 to the No. 2 tunnel, 365 feet; drifting and

crosscutting on intermediate levels 3 and 4, amounting to 1,000 feet; opening of new stopes on these levels and the running of a second upraise from the No. 5 to No. 2. This last is now under way and will be completed shortly. Development for the year as a whole has kept well ahead of production, and the ore-bodies now blocked out are larger than at the beginning of the year, as well as more accessible.

New equipment and camp buildings costing \$35,000 were installed and completed, as follows: Locomotive and 10-car train for ore-haulage; auxiliary power plant for the mine, consisting of boiler and compressor; modern camp buildings, bunk and cook houses, accommodating 100 men; several cottages for employees. Numerous changes and additions were made in the mill equipment, which have already effected a saving in costs and have greatly increased the concentrate values.

The *Spokane-Trinket* was developed to the extent of 300 feet, consisting of tunnels, drifts, and upraises, and shipped 221 tons of ore. Six men were employed.

The No. 1, operated by the Consolidated Mining and Smelting Company, shipped 5,395 tons of ore. Twenty-two men were employed.

The *Highland*, operated by the same company, shipped 280 tons of crude ore and 505 tons concentrates. Forty men were employed on the property.

The *Utica* worked about three months with a crew of fourteen men, during which time they shipped 222 tons of ore. This property is owned by the Utica Mines, Limited. The above tonnage produced 13,661 oz. silver and 10 tons lead.

The *Bell* and *Sunset*, owned by the Jackson Basin Zinc Company, operated fifty days with eleven men, and produced 473 tons of ore containing 2,731 oz. silver, 16 tons lead, and 183 tons zinc.

AINSWORTH CAMP.

The *Little Phil*, *Maestro*, *Gallagher*, *Sky Line*, *Tariff*, *United*, and *Crow Fledgling* were worked under lease, and shipped respectively 112, 65, 56, 32, 26, 19, and 11 tons.

The *Grant*, near Ainsworth, shipped 4 tons.

The *Tam O'Shanter*, situated near the *Blue Bell*, was operated under lease by C. F. Sherwin, E. Mathews, and D. McLellan. The work consisted of an upraise of 50 feet, clearing out and retimbering 150 feet of tunnel, building wharf and blacksmith-shop. Thirty-eight tons of dry ore carrying silver values was shipped.

The *Montezuma*, on the South fork of Kaslo creek, shipped 204 tons of zinc ore which has been lying in ore-bins for several years.

During January and February no milling operations were carried on because of the conditions resulting from the strike at Trail smelter during November and December, 1917. Development-work was prosecuted on the bottom level during January and February, but at the end of the latter month they penetrated a cavity in the limestone, which resulted in a temporary flow of water beyond the pumping capacity. As a result of this, the lower levels were allowed to fill pending the receipt and installation of other pumping equipment. This equipment arrived during October last, and at the close of the year the installation was nearly complete. This pump is a modified Cornish pump, operated by rod, by means of head-gear and water-wheel located in the adit level, and, so far as they know, is the only installation of its kind in the interior. Whilst this type of apparatus is high in its first cost, the operation and maintenance charges are expected to be very low. During the year there was employed an average of about fifteen men, and these, aside from doing the development and constructional work which was carried out, produced 4,800 tons of oxidized ore and 192 tons of concentrates, all of which was shipped to Trail.

Blue Bell.

The *Lincoln*, under lease to J. H. Thompson, shipped 32 tons.

The *Lavina* was worked for a short time under lease and shipped 34 tons of silver-lead ore.

The *St. Patrick*, on Hamill creek, worked steadily all year with a small crew, and has about one car of ore ready for shipment.

Owned by Curle & Larson; situated about six miles from Kaslo, on the Kaslo & Slocan Railway. The property, consisting of six claims, was leased to B. F. Millard, of Seattle, and work commenced about June 1st and continued until about the middle of October. Ore-chutes about 250 feet long were erected, in which the ore was delivered from the working to a rotary dryer, driven by a 12-horse-power gasoline-engine, and

on to the ore-bins at the spur on the Kaslo & Slocan Railway. Fifteen cars of manganese ore was shipped during operations by Mr. Millard. Later in the season Mr. Curle shipped one car to Seattle with satisfactory results.

In addition to the above, several properties were worked on a small scale and the usual annual assessment-work performed.

OFFICE STATISTICS—AINSWORTH MINING DIVISION.

Free miners' Certificates issued	231
Locations recorded	116
Assessments	299
Bills of sale, etc.	54

Revenue.

Free miners' certificates	\$1,432 25
Mining receipts	1,696 75

SLOCAN MINING DIVISION.

REPORT BY ANGUS MCINNIS, 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, 1918.

I am pleased to report that the year 1918 was the most prosperous year the Slocan has had for some time; not so much on account of the ores shipped or extracted, but mainly because the big mines have been developed and improved to such an extent as to prove beyond a doubt that the ore-bodies in this district continue with depth; also for the reason that the big mines operating in the district have for the last year been spending large sums of money in erecting concentrating plants and other outside equipments. I am quite safe in saying that the fifteen or sixteen mines operating in this district are being operated on a sound and businesslike basis; most of them backed up by capital mostly earned from the properties in which they are concerned.

Clarence Cunningham has about completed his large mill at Alamo, about two miles from New Denver. It is said by expert millmen that it is the most complete plant that ever was built in this Province; it cost about \$250,000 and will be operated in connection with the *Queen Bess*, *Idaho-Alamo*, *Wonderful*, and *Sovereign* mines, all owned and operated by Mr. Cunningham, who is also operating the *Van-Roi* and *Hewitt* mills in connection with the *Van-Roi* and *Hewitt* mines.

The Rosebery Surprise Mining Company, under the management of J. P. McFadden, has taken over the *Bosun*, *Monitor-Ajax*, the *Ivanhoe* group of mines, and also the *Canadian* group, all situated in the divide between Sandon and Four-mile creek, and worked somewhat extensively some years ago by the late Yaukey & Son, of Duluth. Mr. McFadden's company is making very extensive improvements both to the mill and at the mine.

On Slocan lake, where the *Bosun* mine is situated, about one mile from New Denver, they have about sixty-five men employed, and are now running a long tunnel from the lake to get under the old workings of the *Bosun*; this tunnel will be about half a mile long. In connection with the *Bosun* they have a large mill situated at Rosebery, where they take all the feed and produce clear lead and zinc concentrates. F. J. Purphy and J. Moore are the engineers in charge.

The Standard Silver Lead Mining Company has reduced the force at the mine and is only doing development-work for a time. The Echo Mining Company has the *Standard* mill, under lease and is treating its ores there.

All the other large concerns, such as the *Noble Five*, *Slocan Star*, *Rambler-Cariboo*, *Van-Roi*, *Hewitt*, *Galena Farm*, *Wakefield*, *Carnation*, *Ruth & Hope*, as well as a number of smaller concerns, are doing the usual amount of work and improvements. For the last three months miners were rather scarce and hard to get; the epidemic of Spanish influenza has reduced the number at the mines.

I am pleased to say that Mr. Langley, the Government Resident Engineer, has been a great help to many of the prospectors and small operators in this district in advising them what to do and how to do it; he certainly deserves credit for the good work he is doing.

OFFICE STATISTICS—SLOCAN MINING DIVISION.

Free miners' certificates issued	195
Free miners' certificates (company)	2
Locations recorded	32
Assessments recorded	112
Transfers and bills of sale	9
Revenue collected	\$5,551.15

SLOCAN CITY MINING DIVISION.

REPORT OF T. McNEISH, MINING RECORDER.

I have the honour to submit my report for the Slocan City Mining Division for the year ending December 31st, 1918.

Beyond the keeping-up of the yearly assessment-work on all the promising claims, very little has been done in the way of development except in a few cases, but all such work has given very encouraging results.

The *Black Prince*, under lease and bond to J. T. Tipping, has been developing and only shipped 30 tons of ore taken out while doing such work.

The *Meteor* group, which is under lease and bond to Barber & Taylor, has done extensive development-work during the past year and shipped 22 tons of high-grade ore averaging about 400 oz. silver to the ton. A deal has just been completed whereby the property is turned over to J. C. Buchanan, of Spokane, Wash., who is going to carry out extensive development-work, and has already a crew of ten men at work. He has installed a gas-engine and is going to sink on the ore, and is at present shipping the dump, which averages about 60 oz. silver to the ton.

The *Eastmont* group, owned by Ellis Silver Mining Company, has been under lease and bond to H. D. Lea & Co. and has shipped about 50 tons, having another car of ore ready to come out as soon as the roads will permit.

The *Anita* group, which is owned by Kurt Zimmerman, has done extensive development-work during the year, and he has shipped about 17 tons of high-grade ore taken out in such operations.

The *Arlington*, which is under lease to M. S. Davys, has shipped about 400 tons of low-grade ore from the dumps, and I believe that in the spring he intends to put on a crew doing development-work in the mine.

The *Republic* group, under lease and bond to Leard Bros., has been doing extensive development-work and has shipped about 13 tons of gold-silver ore taken out in such development, and has very nearly another car ready to come down.

The *Ottawa* group, owned by the Consolidated Mining and Smelting Company, shipped about 48 tons of high-grade silver ore taken out in developing, but closed down early in the season and removed operations to the *Rock Candy* group (the fluorspar mine) near Grand Forks.

The *Little Tim*, owned by D. B. O'Neal & Co., shipped 20 tons of high-grade silver ore taken out in development-work; this property looks like a steady shipper.

The *Highland Light* group, owned by Swan & Clough, shipped about 2 tons of high-grade ruby-silver ore which averages about 120 oz., and expect this year to carry out considerable development-work.

The *Lily B.* group, which is owned by Geo. Long, *et al.*, has been under lease and bond to W. A. Buchanan, who has done considerable work and has shipped 15 tons of high-grade ore, and expects in the spring to continue extensive development.

The *Evening Star*, owned by Mr. Sutherland, of Winnipeg, Man., shipped about 49 tons, but the buildings were burnt down, so had to cease operations, but I believe that in the spring operations will be continued.

OFFICE STATISTICS—SLOCAN CITY MINING DIVISION.

Free miners' certificates issued	70
Certificates of work issued	82
Locations recorded	38
Transfers recorded	7
Notices to group filed	10

Revenue.

Free miners' certificates	\$ 348 50
Mining receipts, general	320 00
Poll-tax receipts	250
Resident special firearms licences	70 00
Resident general firearms licences	30 00
Ordinary firearms licences	25 00
Total	\$1,043 00

TROUT LAKE MINING DIVISION.**REPORT OF 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 1918.

So far as mining development is concerned, the situation remains practically unchanged from the preceding year. Assessment-work has been kept up, however, on all the well-known mineral claims, but there was a falling-off in locations; a natural thing, as the claim-owners in the camp would rather spend their time in development of their properties than go out to look for new locations. But, the war being at an end, next summer will no doubt bring back some of the soldier-prospectors that are in service now.

D. W. Tomlinson is at present developing the *Crescent* group of claims, and if the results come up to expectations he will install a mill on the property this coming summer.

There is also a good prospect of a mill being installed on the *Foggy Day* property, owned by Mrs. A. C. Jowett, of this place.

OFFICE STATISTICS—TROUT LAKE MINING DIVISION.

Free miners' certificates (ordinary)	54
Free miners' certificates (company)	2
Locations recorded	27
Certificates of work recorded	152
Notices to group	29
Conveyances recorded	5

NELSON DISTRICT.

NELSON MINING DIVISION.

REPORT BY EDWARD FERGUSON, ACTING GOLD COMMISSIONER.

I have the honour to submit the annual report on the Nelson Mining Division for the year ending December 31st, 1918.

NELSON CAMP.

Silver King. This old mining property is being operated by the Silver King Mines, Limited; head office, Trail, B.C. Two men were employed to keep the mine unwatered. Diamond-drilling totalling 6,180 feet was done during the year. No ore was shipped and no additions to plant were made.

California. This mine is operated by John R. Cassin, trustee, Spokane, Wash.; W. H. Turner, superintendent and manager. During the year considerable development-work was done, there being an average of eight men employed. There are 1,300 feet of drifts, crosscuts, and other development-work. The ore is gold-silver, but no shipments were made during 1918. The *Athabasca* air-compressor is used for operating air-drills.

Eureka Group. This group comprises the following claims: *Eureka, Toronto, Champion, Athabasca Frac., Viking Frac., Gold Leaf, and Gold Leaf Frac.* The ore is copper-silver and gold. It is operated by hand-drilling. During the year 930 tons of ore was shipped to the Trail smelter. An average of eleven men was employed. A new road to the mine was built with the assistance of the Public Works Department, giving a very much improved grade. A new aerial tramway to carry ore to the Canadian Pacific Railway track at Granite was constructed at a cost of \$12,340. In October this group was leased to the Inland Mining Company, of Spokane. W. M. Myers is manager and secretary.

Athabasca.—Little work has been done on this property beyond the employment of a couple of men to keep the mine unwatered. Five men were employed for a short time and one small shipment made.

Orinoco Group. This group consists of the *Orinoco, Orinoco Frac., Rio Tinto, and Queen Victoria Fract.* The work during the year consists chiefly of ground-sluicing and open-cuts. A considerable quantity of ore was piled up, two men having been employed about three months. The ore is copper-silver. The group is owned by Mike Egan, Nelson, B.C.

Noonday Group. This group comprises the *Noonday, Climax, Margaret, and Pearl Frac.* It is situated on the head of Nine-mile (from Nelson) or Sictum creek. The work done is principally on the *Noonday* claim and consists of 180 feet of tunnel and surface work. It is a free-milling gold property and is claimed to contain good values. There is a quantity of ore on hand ready to be shipped, and considerable work has been done on trail leading from the North arm of Kootenay lake to the mine. The owners are Jackson Radcliffe and John S. Johnson, of Nelson.

Monarch Group. This group consists of seven claims. Work has been done chiefly on the *Monarch* and *Elk* claims. The property is operated by the Spokane Mining & Development Corporation; Carl M. Mohr, manager and secretary. The ore is copper-gold-silver; the mine is hand-operated. About 170 tons of ore was shipped to the Trail smelter and gave good returns. An average of six men was employed, and the ore shipped was taken wholly from development-work consisting of tunnels, open-cuts, and crosscuts. Frank C. Loring is consulting engineer.

YMBR CAMP.

Yankee Girl. This mine is operated by the Hobson Silver Lead Company, Limited; W. T. McDowell, manager; W. B. Ward, Jr., secretary, Ymb. The group consists of the *Yankee Girl, Canadian Girl, and Yukon Fraction.* The ore is an auriferous sulphide in quartz gangue. During last year 8,847 tons was shipped; 8,260 tons

going to the Canada Copper Corporation and the remainder to Trail and Grand Forks. Average number of men employed was thirty. Development-work consisted of 50 feet of 5- x 7-foot drift and 138 feet of 5- x 16-foot raise. An Anaconda air-hoist and a No. 3 Leyner drill-sharpener were added to the mine's equipment.

Development-work was done on a number of claims by D. E. Grobe and others.

SHEEP CREEK CAMP.

Ore Hill Group. About 1,000 feet of surface work was done, with an average of five men employed. Some 336 tons of ore was treated at mine, and 14 tons of concentrates and 21 tons of crude ore shipped to Trail smelter. The ore carries gold, silver, lead, and zinc. The property consists of five claims and fractions and is considered little more than a surface prospect as yet, but, with proper machinery to treat the ore, it is expected to show good results. C. H. Cassill, Orando, Montana, is operating and W. B. DeWitt is manager.

Aspen.—About \$2,000 of development-work consisting of open-cuts has been done. The ore is high grade. About 7 tons of dry ore was shipped. P. F. Horton, Salmo, is manager.

Emerald and Jersey. This property consists of the *Emerald* and *Jersey* groups and is operated by the Iron Mountain, Limited; John Waldbeser, manager; R. W. Miffin, treasurer; D. E. McLaughlin, secretary. Several hundred feet of development-work was done, employing an average of eighteen men, and 2,092 tons of crude lead ore was shipped to the Trail smelter. An air-compressor and air-drills were used at the *Emerald* mine and hand-work at the *Jersey*. The mines were worked by crosscuts, tunnels, drifts, etc.

H.B. and Zintcon.—No work has been done on this property this season.

Queen. This property has recently been bonded to A. W. McCune, of Salt Lake City and Nelson. Mr. McCune has undertaken a comprehensive exploration and development programme, and in a short time this one-time big producer will probably be again in the list of producers.

Spokane Group. Laib Bros. are continuing development-work on this promising property. Heretofore the lack of roads to furnish outlet for the ore has hindered development. This year a road was commenced up Cultus creek, which will serve a number of promising properties in the Bayonne district when completed.

The *Molybdenite* group, on Lost creek, is operated by Bennett, Ross & Benson.

Ivy Fern Group. This group, situated on Cultus creek, seven miles from Kootenay lake, was staked by T. W. Mulholland. It consists of fifteen claims. Considerable stripping was done by the locators, discovering large bodies of silver-lead ore, and a bond was taken on November 10th, 1917, by the Consolidated Mining and Smelting Company, of Trail, for a considerable sum. This company has done several thousand feet of stripping with good results and is at present driving a long crosscut tunnel to tap the veins at depth. It gives promise of being one of our large shippers. Mr. Mulholland has other claims in the vicinity that show good values.

LOST CREEK AND PEND D'OREILLE.

The *Southern Belle* group (C. E. Wilson, manager), situated on the South fork of Lost creek, has interested Rossland and Trail capital in development programme this past summer, with reported encouraging results.

The *Lost Cabin* group, owned by Ballinger & Smith, of Salmo, is under bond to F. Shoemaker, who kept two to four men at work for several months exploring for vertical extension of rich shoot of ore exposed in surface workings.

Pend d'Oreille. Waldbeser & Reeves are reported to have opened a large low-grade lead-silver vein on the low divide between the lower Salmo river and the Pend d'Oreille, on the apparent northern extension of the silver-lead belt developed by the *Electric Point* mine, which is situated a few miles south of the International Boundary.

ERIE CAMP.

This mine is operated by the Relief Mining Company; A. D. Westby, manager. **Second Relief.** The ore is a gold-bearing quartz, the gold being recovered by amalgamation and concentration. Eighty-five tons of concentrates was shipped to Greenwood smelter from 1,241 tons of ore treated at mine. On the average eleven men were employed and

development-work consists of 50 feet blind drift and stoping. A total expenditure for new plant of \$13,700 was incurred. A 4-foot Senn pan-amalgamator and a Senn concentrator were installed and 8,000 feet of new flume constructed.

OFFICE STATISTICS—NELSON MINING DIVISION.

Free miners' certificates (individual)	543
Free miners' certificates (company)	4
Free miners' certificates (special)	4
Claims recorded (mineral)	277
Certificates of work recorded	446
Agreements, transfers, etc.	92

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, 1918.

This mine is being operated by H. E. Forster, of Wilmer, B.C., who has had **Millie Mack.** a force of four men at work all summer. Thirty-five tons of sorted ore was sacked waiting sleigh transportation. The mine is developed by tunnels and the work thus far is by hand.

Big Ledge.—Nothing more than ordinary assessment-work has been done on the property this season.

OFFICE STATISTICS—ARROW LAKE MINING DIVISION.

Free miners' certificates issued	41
Certificates of work recorded	11
Mineral claims recorded	21

NOTE.—Owing to so many free miners being on active service there were not so many certificates of work recorded as usual.

ROSSLAND DISTRICT.

TRAIL CREEK MINING DIVISION.

REPORT BY H. R. TOWNSEND, GOLD COMMISSIONER.

The mining operations in this district have been confined to some development-work in the mines of the Consolidated Mining and Smelting Company of Canada and the Le Roi No. 2 Company.

A number of claims were staked and other reverted claims leased between Rossland and the *Velvet* mines on Sophia mountain, on what is locally known as Ivanhoe ridge, owing to strong indications of chrome-iron ore; in fact, the presence of the chrome iron was proven, but whether the quality and quantity is sufficient to warrant the installation of machinery, etc., has not been determined.

Angus Cameron and associates have one large group of claims and J. H. MacDonald and his associates another.

OFFICE STATISTICS—TRAIL CREEK MINING DIVISION.

Free miners' certificates (individual)	115
Free miners' certificates (company)	5
Mineral claims located	51
Certificates of work recorded	84
Certificates of improvements	2
Bills of sale, agreements, etc.	5
Leases of reverted mineral claims	10

SOUTHERN DISTRICT (No. 4).

REPORT BY PHILIP B. FREELAND, RESIDENT ENGINEER.

INTRODUCTORY.

The Southern Mineral District embraces what is locally known as the western portion of the Boundary District, including four Mining Divisions—i.e., the Grand Forks, Greenwood, Osoyoos, and Similkameen. The boundaries of these Divisions are shown on the accompanying map, and follow, as nearly as possible, the watersheds of the different areas. The district is exceedingly well traversed with railways and wagon-roads, which add greatly to transportation facilities, while a high-power electric line passes through the southern portion of the Grand Forks and Greenwood Mining Divisions, and is being built through the Osoyoos and Similkameen Divisions, supplying a cheap means of power to any mining industry.

For the past twenty years the Greenwood Division has been the largest copper-producer of the district. During 1918 the Canada Copper Corporation closed its smelter and its properties near Greenwood, and is now confining its energies towards the development and construction of the Copper Mountain property and mill near Princeton.

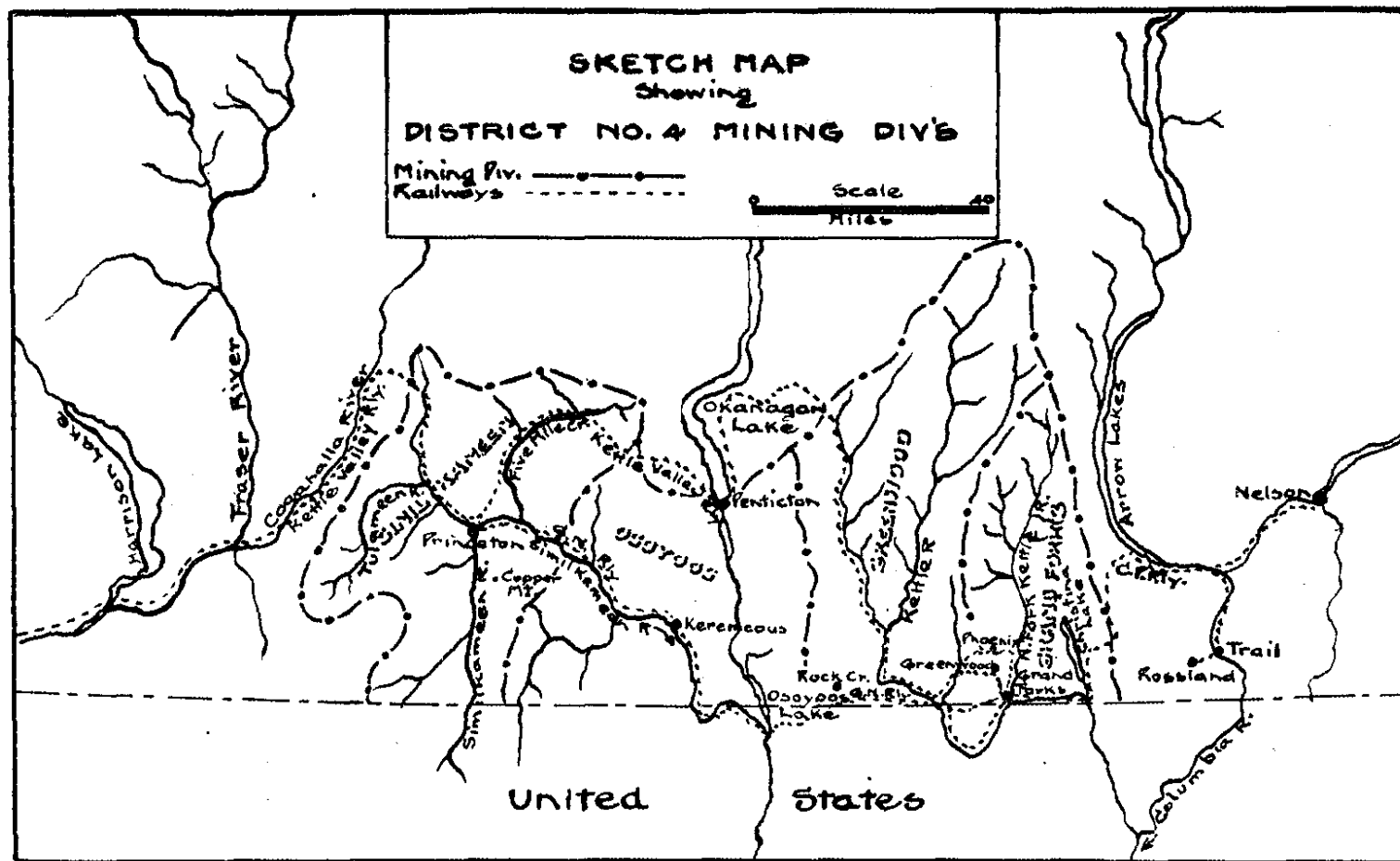
The Granby Mining and Smelting Company shipped 443,134 tons of ore to the smelter at Grand Forks during the calendar year 1918. Should the price of copper drop below 20 cents a pound and at the same time the cost of labour and supplies maintain their present prices, it will probably be difficult for this company to continue operations. It is sincerely to be hoped that this will not be the case, because the closing of the smelter will be a severe blow to the interests in the West Boundary District.

Although the above companies were unable to find any new large copper properties in the immediate vicinity of their smelters, there still remain large areas that have not been thoroughly prospected. These areas, commencing between the Canadian Pacific Railway and the Granby river (North fork of the Kettle river) at Christina lake and extending north and west, cover practically all the northern part of the Greenwood and Grand Forks Mining Divisions.

The formation is generally supposed to be granite throughout the northern and eastern portion of the district. Samples brought in from time to time by prospectors tend to show that there are well-mineralized areas, and also localities showing evidence of highly altered sedimentaries, which are the chief copper-bearing rocks of the Boundary District.

The construction of the West Kootenay power-line from Greenwood to Copper Mountain (Princeton), a distance of 100 miles, is in progress at the present time. With its completion, which is expected some time during the early summer of 1919, several comparatively old mining centres will have the advantage of obtaining electric power. As one of the chief detriments to mining in these districts in the past was the high cost of fuel, this power-line should be an incentive to more intensive prospecting over the route followed.

Commencing at Greenwood, the line passes through Rock Creek, Camp McKinney, Fairview, Keremeos, Hedley, and following the Similkameen river to Wolf creek, crosses Darcy Mountain to the Canada Copper Corporation's mill at Allenby, where the main distributing-station will be built.



LIST OF SHIPPING PROPERTIES AND TONNAGE PRODUCED.

Division.	Mine.	Tonnage.	Character of Ore.
Grand Forks	Rock Candy	170	Fluorite.
"	Waterloo	5	Silver-lead.
"	Berlin	142	Gold-silver-copper.
"	Emma	20,613	Copper.
"	Union	153	Silver-gold.
"	Fife Quarries	41,105	Limestone.
"	Mastodon	670	Chromite.
"	B.C.	861	Copper.
Greenwood	Bell	192	Silver-lead.
"	Big Copper	409	Copper-silver.
"	Surprise No. 3	89	Copper-silver.
"	Cariboo	9	Gold-silver.
"	Rambler	6	Silver-lead.
"	Standard Fraction	51	Silver-lead.
"	Sunnyside	5	Gold-silver-lead.
"	Sudbury	3	Gold-silver-copper.
"	Providence	235	Gold-silver-lead.
"	Mother Lode	154,332	Copper.
"	Sunset	2,673	Copper.
"	Black Diamond	2	Silver.
"	Bounty Fraction	36	Silver-lead.
"	Kokomo	21	Silver.
"	Aftermath	83	Gold-silver-copper.
"	Sally	72	Silver-lead.
"	Sappho	20	Copper-silver.
"	Lakevale	5	Silver-lead.
"	Granby Co., Phoenix	443,134	Copper-silver-gold.
Osoyoos	Spotted Lake	.....	Magnesium sulphate.
"	Torpedo	135	Gold-silver-copper.
"	Horn Silver	916	Silver-gold.
"	Dolphin	46	Copper-silver.
"	Hedley Gold Mining Co.	67,313	Gold.
"	Golconda	10	Copper-silver.
Similkameen	Princeton Coal Co.	38,673	Coal.
"	Coalmont Collieries	5,744	Coal.

GRAND FORKS MINING DIVISION.

LIGHTNING PEAK.

Lightning peak is approximately thirty-three miles by road and trail from Edgewood, on the Arrow lakes, over the divide.

A good deal of excitement was created in the vicinity of Lightning peak during the year owing to the discovery of some high-grade silver ores. The country-rock surrounding Lightning peak is generally a granite. In the immediate vicinity to the west of the peak are evidences of the sedimentaries much disturbed and altered. In these sedimentaries, chiefly limestone, occur the ore-bodies of high-grade silver.

To the north of Lightning peak the *Equinox* group is situated, consisting of four claims—*West Fork*, *First Chance*, *Jim Hill*, and *St. Paul*. The ore here occurs in a fissure-vein 18 inches wide in the granite; the gangue being chiefly quartz with disintegrated pieces of the wall-rock. Samples of ore shipped assayed as high as 180 oz. silver and 18 per cent. lead.

To the south and west of the *Equinox* group other discoveries of high-grade silver ore were made during 1918, the extent of which is not known.

This claim has developed slowly, chiefly owing to the difficulties in transportation of material necessary for opening up a mine. During the summer months the efforts of the owners were directed towards building a sleigh-road to join the wagon-road already built out of Edgewood for twelve miles. The Provincial Government has given very material assistance towards helping the owners of this camp to build the road. The shortage of labour and weather conditions have delayed construction considerably, but it is hoped that the road will be completed in 1919.

During the summer 5 tons of high-grade silver ore was transported by pack-horses to the end of the wagon-road, and thence by wagon, steamer, and rail to Trail smelter. Some of this ore assayed over 700 oz. in silver. The lead, averaging 4 feet in width, is striking in a northerly direction and occurs in a crystalline limestone close to its contact with the granite, and can be traced for several hundred feet. There has been no work done to prove the continuity of the lead at any great depth, but the owners hope to develop some tonnage during 1919.

PAULSON SECTION.

A considerable amount of work was done upon this property by the **Molly Gibson**. Gibson Mining Company, of Rossland, B.C., during the year. The group consists of the *Molly Gibson*, *Grey Eagle*, *Manchuria*, *Irish Nelly*, and *Molly Gibson Fraction*, situated in Burnt basin and approximately four miles in a south-western direction from Paulson Station, on the Canadian Pacific Railway. These claims are all surveyed. Three other claims, covering an area on the western slope of the mountain to the railroad, are named the *Golden West*, *El Vago*, and *Steel*.

Development-work to date is as follows: Shallow pits and surface trenching sufficient to show a mineralized area about 1,500 feet in length. An inclined shaft 40 feet deep opened up a lead about 8 feet wide carrying values up to \$14 a ton in gold and 2 oz. in silver. An open-cut and tunnel 72 feet in length also showed the continuity of the mineral-deposit. A crosscut tunnel approximately 200 feet long was driven to tap the ore 80 feet below the incline shaft. Some ore, it is understood, was developed by this tunnel, the value of which is not known.

From 1908 to 1911 six car-loads of ore was rawhided to Coryell Station, on the Canadian Pacific Railway, and transported to the Trail smelter. This ore, taken from near the surface, averaged \$17.50 a ton in gold.

On the *Golden West*, *El Vago*, and *Steel* claims some evidence of the mineralized zone is apparent, although practically no work has been done to prove its extent. Should development on this side of the mountain uncover the ore-body, the expense of operation would be greatly lessened and a depth of 2,000 feet be obtained. The older rocks in this vicinity are limestones, argillites, and greenstones, the latter having the greatest areal distribution. A large part of the district is composed of later igneous rocks. The limestones in the vicinity of the ore-bodies are generally replaced by silica carrying small cubes of pyrite. These rocks have practically formed a jasperoid wall. The veins occur in the disturbed areas close to the contact of the pulaskite porphyry dykes with the limestones, and contain values in gold and silver.

Berlin. This property is part of the Inland Mining Company's holdings and adjoins the *Inland* mine, situated approximately four miles east of Paulson, on the Canadian Pacific Railway. Some years ago this company built a 4-stamp mill and installed concentrating-tables to treat the ore from the *Inland* mine. It was found that, in spite of the persistence of the lead and fair mineralization, the ore did not contain sufficient values to cover the expenses of operation.

Since the closing down of the mill this company continued its efforts in developing the *Berlin* claim, where some high-grade pockets of ore carrying gold and silver were encountered. Besides several hundred feet of drifting, a shaft was sunk 100 feet and a crosscut driven at the 40-foot level; a car-load of ore was broken and shipped to the Grand Forks smelter.

In October the property was leased to the Griswold-Billingsley Company, contractors. Two car-loads of ore has been shipped to the Trail smelter by the lessees. Total number of tons shipped for the year, 142, averaging about 3 oz. in gold, 15 oz. in silver, and 0.60 per cent. copper.

CASCADE SECTION.

Mastodon Group. This group, including the *Mastodon*, *Black Tail Fraction*, *Pan*, *Dominion Canyon*, and *Mammoth*, is situated on Castle mountain at an elevation of 3,500 feet above sea-level and approximately 4,000 feet from the Canadian Pacific Railway bridge which crosses the Kettle river at Cascade. The out-

crops of chromite were first located many years ago, but the low price of the mineral prohibited operations at that time. In 1917 the Stewart-Calvert Company, of Oroville, Wash., obtained a lease and bond for \$5,000 on the property from Angus Cameron *et al.*, of Laurier, Wash., and commenced development by stripping and sinking shallow shafts on the *Mastodon* claim, with the result that small lenses of chromite were uncovered, carrying from 30 to 50 per cent. Cr₂O₃. In 1918 the Stewart-Calvert Company graded half a mile of road from the claims to the end

of a branch of the Deep Creek wagon-road, and commenced hauling chromite with teams to the Canadian Pacific Railway at Cascade, a distance of eight miles. From thence the ore was shipped to the Central States. The haulage costs were \$7 a ton and railway freight approximately \$17 a ton, with an excavation cost of \$4.25 a ton. A total of 670 tons of chromite was shipped, averaging 38.5 per cent. Cr_2O_3 .

The smallness of the lenses of ore encountered added considerably to the expense of excavation, necessitating a lot of development-work. However, the amount of work done has not proved the size of the lenses or the fact, conclusively, that they are all of a small tonnage variety. The ore-bodies have a general strike to the north-west and south-east and dip nearly perpendicularly, having an average width of about 6 feet at the thickest part, and varying in length from 10 to 20 feet and in height 10 feet.

The rocks constituting Castle mountain are broadly classed by R. A. Daly, Geological Survey, Ottawa, as being part of the Rossland volcanic formation, constituting flows and pyroclastic deposits of latites, andesites, and basalt, with small inclusions of dunite. Closer observation has shown the dunite rocks to be far more extensive than hitherto supposed, and constitute the greater part of the southern and western slope of Castle mountain.

The serpentine appears in a number of places, but is nowhere of great areal extent, the largest mass lying near the summit of the southern peak of the mountain. These masses vary from olive-green to a light greenish-grey in colour. The slickensided surfaces are much lighter, green colour, and generally highly polished. This serpentine has resulted from the alteration of a pure dunite. The alteration from olivine to serpentine entails a considerable increase in volume, which probably accounts for the shattered, sheared, and slickensided serpentine. Although specks and very small lenses of chromite appeared in the serpentinized area, yet no commercial amount of chromite was found. The pure dunite masses outcrop chiefly at the southern end of Castle mountain, and in these masses are found commercial lenses of chromite. Only a slight serpentinization has taken place.

The ideal location of these claims, close to railway transportation and electric power, made them worthy of consideration, and should the demand for chromite again arise, the cost of mining these deposits could be greatly lessened by the construction of an aerial tramway approximately 4,000 feet long from the claims to the railroad.

These limestone-quarries, situated on the Canadian Pacific Railway, closely adjoin Christina lake on the east side. The Consolidated Mining and Smelting Company, of Trail, B.C., is the owner and operator of the property, and has quarried 41,105 tons of limestone, used as a flux in the Trail smelters.

GRAND FORKS SMELTER.

The recovery of 15.36 lb. of copper a ton out of a total of 19.2 lb. or a loss of 3.57, which was the average of the Phoenix ores for the year ending July 1st, 1918, was creditable from a metallurgical standpoint. A very siliceous slag was handled, with a coke-consumption of 13.98 per cent. Owing to strikes in the Crowsnest coalfield the plant was idle during a part of July, September, October, and November, 1917. During the first six months of the year an attempt was made to run six furnaces, but, the grade of ore being low, it was decided at the beginning of 1918 to reduce the tonnage and raise the grade. Copper-recovery during the first six months was 14.44 lb. a ton of Phoenix ore, and the last six months was 16.84 lb. Furnace operation for the year averaged 3.62 per cent. out of a total of eight.

The following table gives the increased costs per ton of ore treated:—

Coke	\$0.326
Wages	0.098
Electric power	0.0303
Supplies	0.026
Decreased tonnage	0.106
Workmen's compensation	0.0115

* Ore treated was as follows:—

Granby	549,632 tons.
Foreign	13,202 "
Converter slag and matte	26,802 "
Flue-dust	1,531 "

* These figures are for the fiscal year ended June 30th, 1918.

The converter department produced 8,951,892 lb. of copper from the Phoenix ores, 481,965 lb. from foreign ores, and 448,690 lb. from by-products produced whilst handling Anyox matte, being a total of 9,522,347 lb. This copper was obtained from 15,700 tons of 30.4-per-cent. matte.

FRANKLIN CAMP.

This camp, situated forty-one miles from Grand Forks, on the North fork of the Kettle river, was the centre of interest for some time owing to the discovery of platinum in some of the ores. The high price of the metal, \$108 an ounce (refined), was caused by its demand for munition-making during the war.

The Munition Resources Commission, then in search of platinum, sent in their representative, Wm. Thomlinson, to overlook the camp. The results of his research are given below:—

"Early in the month of August, 1918, under instructions from Geo. Mackenzie, I visited Franklin camp and took samples from the various workings on the *Maple Leaf* mineral claim, and sent the samples to the Dominion Assay Office at Vancouver, to be assayed for platinum. Two of the samples from the *Maple Leaf* claim, taken from an open-cut from which two cars of copper ore had been shipped, were found to contain, respectively, 0.15 and 0.17 oz. of platinum a ton, and the results appeared to me to indicate that the platinum content of the ore was roughly proportionate to the amount of the primary copper minerals, especially chalcocopyrite, showing in the ore.

"Later, J. J. O'Neill, of the Dominion Geological Survey, visited the *Maple Leaf* claim with me, and being much interested in the mode of occurrence of the platinum, he took a sample of almost pure chalcocopyrite, occurring as a small lens in the pyroxenite, and had the sample assayed for platinum at the Dominion Assay Office at Vancouver. This sample showed a content of 0.38 oz. platinum a ton.

"The mineral-bearing gangue on the *Maple Leaf* claim is mainly pyroxenite, with some inclusions of augite-syenite on the hanging-wall side of the lode, and the copper minerals, principally chalcocopyrite, occur in bunches and veinlets and as disseminated specks throughout the pyroxenite and syenite.

"Owing to the good results from the *Maple Leaf* samples, and noting that the pyroxenite zone, or so-called *Black Lead*, extends almost entirely across the Franklin camp, I obtained permission from Mr. Mackenzie to remain in the camp until I had visited and sampled all of the principal properties situate on the pyroxenite-syenite contact zone.

"On most of the claims situated on the pyroxenite forming the *Black Lead* the lode material appeared to be barren of economic minerals, but on several of the claims there could be seen, at or near contacts, a tendency for the copper and iron sulphides to form mineralized belts or masses.

"Most of my samples were taken from places where such segregations of copper and iron sulphides occurred, and especially from where copper-bearing minerals were evidence; although the oxides and sulphides of iron were also included in the samples.

"Although most of the samples taken, on being assayed, showed appreciable amounts of platinum, it cannot yet be stated with certainty that more than very small portions of the *Black Lead* or pyroxenite belt can be mined on a commercial basis.

"In the samples assayed there appeared to be certain proportions between the copper-bearing minerals present and the platinum contents; but at the *Mountain Lion* claim the platinum appears to be entirely associated with sulphides and oxides of iron.

"Whether the platinum occurs in the ore as native platinum or as sperrylite, the arsenide of platinum, has not yet been determined; but I presume it may be in the latter form, and associated with the sulphides and oxides of copper and iron where they are found segregated in the pyroxenite zone.

"On several properties, such as the *Gloucester* mineral claim, situated near to and on the dip side of the pyroxenite zone, platinum may also be found to be associated with the sulphide ores; and perhaps it may be advisable to have all of the ores of the entire camp tested for the metals of the Platinum group.

"There is, however, much still to be learned regarding the mode of occurrence of the platinum, and as to the average values of the material forming the so-called *Black Lead*.

"It is probable that only certain portions of the pyroxenite zone contain platinum, copper, or other metals in economic amounts; therefore much further investigation may be required; but I certainly consider the matter worthy of detailed research on the part of the Government or of the large mining corporations.

"Samples from the under-named properties contained platinum as follows:—

	Oz. Platinum to the Ton.
Maple Leaf	3 samples—0.15, 0.17, and 0.38.
Lucky Jack	3 samples—0.04, 0.06, and 0.08.
Mountain Lion	2 samples—0.02 and 0.09.
Golden Age	1 sample —0.06.
Averill group	2 samples—0.09 and 0.09.
Buffalo	2 samples—0.08 and 0.19.
Ottawa	1 sample —0.06.
Columbia	1 sample —0.04."

Union. L. Johnson, part owner in this property, employed four men for a short period during the year, resulting in the shipment to the Grand Forks smelter, by motor-truck and rail, of 153 tons of ore, carrying values from 0.31 to 0.64 oz. in gold a ton, and from 31.4 to 50.50 oz. in silver a ton. The bonding of this property was considered by Eastern American capital and by a local mining engineer representing capital. Neither of these organizations was able to come to terms with the owners of the property.

KENNEDY CREEK.

Rock Candy Group. The most interesting development in this Division during the year took place on the *Rock Candy* group of claims, situated on Kennedy creek, a tributary of the Granby river (North fork of the Kettle). This group is owned and being operated by the Consolidated Mining and Smelting Company, of Trail, B.C. One hundred and seventy-seven tons of ore carrying 80 per cent. CaF₂ (fluorspar) was shipped by pack-horse and sleighs over trail and road a distance of approximately ten miles. Development-work consisted of diamond-drilling the deposit, which was unsatisfactory owing to the difficulty of retaining the broken pieces of the core in the barrel. A tunnel was also driven across the lead and a considerable amount of stripping done. An aerial tramway is in course of construction over a distance of about two miles. The lower terminal will be situated about one mile and a half north of Lynch Creek Station, on the Kettle Valley Railway.

The ore-body, from surface indications, appears to be about 500 feet long and 25 feet wide. A hurried examination of this deposit showed the surrounding rocks to be mainly of a granitic nature, cut by alkali syenite dykes. The deposit appears to be associated with calcite.

EHOLT SECTION.

Emma. Approximately 20,530 tons of low-grade copper ore was shipped from this property during the year. Development-work consisted of 170 feet of shaft-sinking, 50 feet of pockets and stations, 1,220 feet of drifting and crosscutting, and 363 feet of raising. This mine is owned by the Consolidated Mining and Smelting Company, of Trail. About thirty-five men have been employed in the underground workings and on the surface.

B.C. In 1898 this mine was considered to have a fair chance of developing into one of the large producers of the district. From that time until 1906 about 100,000 tons of copper ore was shipped by the British Columbia Chartered Company, Limited, Montreal. In 1907 the British Columbia Copper Company took hold of the property and shipped 1,712 tons of ore. Since that time the old workings, consisting of a shaft about 200 feet deep and about 2,000 feet of levels, have been allowed to fill up with water and nothing but leasing done in and around the old "glory-hole." During the year the property was leased to J. St. Claire, of Eholt, by the Canada Copper Corporation, and 861 tons of copper ore was shipped to the Greenwood smelter. The ore-bodies occur as a replacement in the limestone, lying between lateral porphyry dykes.

GREENWOOD MINING DIVISION.

GRANBY CONSOLIDATED MINING, SMELTING, AND POWER COMPANY.

The following constitutes the report of the operations at the Granby mines at Phoenix for the fiscal year ended June 30th, 1918, by C. M. Campbell, superintendent:—

"The coke shortage referred to in last year's report continued intermittently until December, resulting in a total of two months' shut-down. Since that time there has been no trouble from this source and operations have been continuous.

"*Victoria Shaft*.—Due to the working-out of large areas of the reserves and the fact that no new ore has been opened up, this outlet is now being operated to a little better than half its capacity. Shipments for the year amounted to 317,763 tons, or 58.4 per cent. of the total. The *Victoria* ore for the year averaged 0.98 per cent. copper, 0.24 oz. in silver, 0.042 oz. in gold, 45.5 per cent. insoluble matter, 10 per cent. iron, 15.3 per cent. lime, and 3 per cent. sulphur.

"*Electric Shovel*.—Ore from this source amounted to 95,824 tons and made up 17.8 per cent. of the total shipments. This ore contained 0.95 per cent. copper, 0.20 oz. silver, 0.028 oz. gold, 40 per cent. insoluble, 14 per cent. iron, 16.7 per cent. lime, and 2.4 per cent. sulphur. At the shovel during the year 194,477 tons of waste was sorted out and a large quantity used for stope-filling.

"*Gold Drop*.—The ore from this mine totalled 128,945 tons, or 23.8 per cent. of the total. This ore averaged 0.92 per cent. copper, 0.25 oz. silver, 0.024 oz. gold, 41.6 per cent. insoluble, 13.3 per cent. iron, 16.9 per cent. lime, and 2.6 per cent. sulphur. During the year all the older portions of the mine were almost entirely cleaned up.

"*Shipments*.—Total shipments from all sources amounted to 542,532 tons. The following table shows the distribution of this tonnage and the ore shipments to date:—

	Tunnel Ore (Elec. Shovel).	Shaft Ore.	Gold Drop Ore.	Totals.
	Tons.	Tons.	Tons.	Tons.
Prior to July 1st, 1917	6,150,039	5,039,633	1,635,754	12,825,426
Year ended July 1st, 1918	95,824	317,763	128,945	542,532
Totals	6,245,863	5,357,396	1,764,699	13,367,958

"The total waste handled for the year amounted to 257,295 tons.

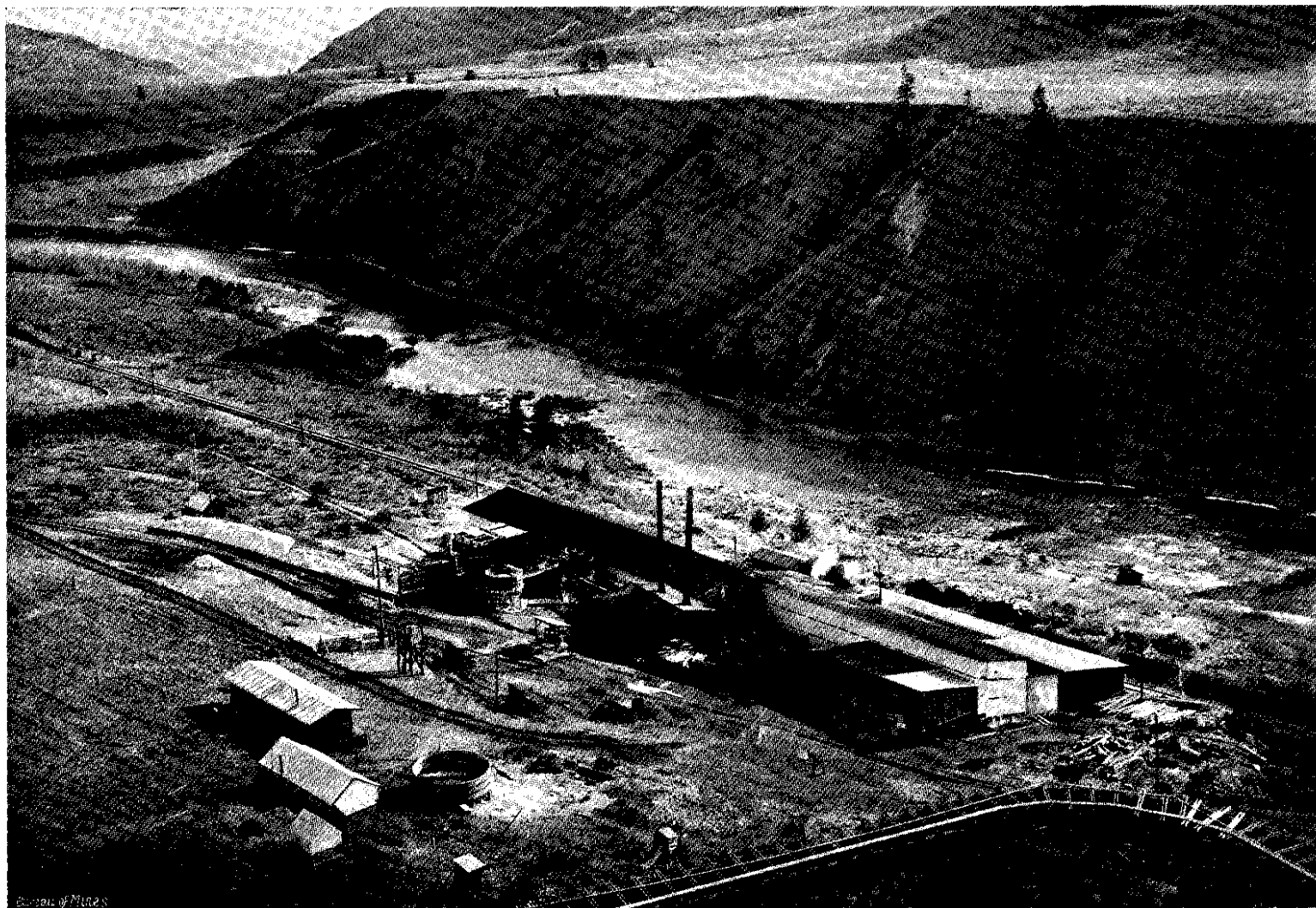
"The average assay per ton amounted to 0.954 per cent. copper, 0.227 oz. silver, and 0.0351 oz. gold.

"Total development to July 1st, 1918, amounted to 161,091 feet; development for the year, 7,667 feet; total diamond-drilling to July 1st, 1918, 123,019 feet; diamond-drilling for the year, 3,897 feet."

The recent exhaustion of this property has terminated mining operations which have been in progress in the eastern section of the Phoenix camp for twenty years, and which have added to the world's supply of metals about 70,000,000 lb. of copper and \$3,500,000 in gold and silver. Slightly over half this was produced by the *Gold Drop* mine, the other producers being the *Snowshoe* and the *Rawhide* mines.

In 1905 the Granby Company took an option on the *Gold Drop* mine, owned by the Gold Drop Mining Company, of Montreal, Que. The only ore encountered at that time was of an indifferent character. The price asked was \$250,000, and during the summer the claim was diamond-drilled and 250,000 tons of ore blocked out. It was estimated that this would yield a profit of \$1 a ton, and as there were prospects of additional tonnage the purchase was made. This claim shipped 750,000 tons of ore before being exhausted, and, though a profit of a \$1 a ton was not maintained, still the ore was of such uniformly good grade and had such good smelting qualities that it paid to ship.

Other properties adjoining the *Gold Drop*—i.e., *Gold Drop Frac.*, *Phillipsburg Frac.*, *Nugget*, *Snowshoe*, *Curlew*, *Monarch*, *Tamarack*, *Tamarack Fraction*, *Toboggan*, and *Missing Link*—were purchased. These claims comprise what was known as the *Gold Drop* mine and represented an investment of about \$500,000. The total shipments amounted to 1,764,699 tons. In the



Plant for evaporating and refining Epsom Salts, Stewart & Calvert Co., Oroville, Wash.

underground working square sets were originally used, but this method proved to be not only prohibitive in cost, but also unsatisfactory from a safety standpoint, and was discarded sixteen years ago. The square sets did not prevent masses of rock crushing through, while in the open slopes the ground can be examined to better advantage and dangerous pieces of rock removed.

Development-work at the *Gold Drop* mine amounted to 17,330 feet of drifting, 16,696 feet of upraising, and 39,406 feet of diamond-drilling. This amounted to approximately 1 foot of upraising, 1 foot of drifting, and 2 feet of diamond-drilling to each 100 tons of ore shipped, which is a heavy development charge. The cost of the *Gold Drop* ore on cars averaged \$1.05 a ton. This figure includes all charges against the ore, except the purchase price of the property. The best costs were obtained in 1913, when ore was shipped for 77 cents a ton. Latterly, on account of frequent handling, shortage of working-places, and the war, the cost rose, and for the last year amounted to \$1.54 a ton.

The *Gold Drop* mine develops only part of an extensive and practically continuous ore-body which outcrops on the *Gold Drop* claim, swings down across the *Rawhide* and *Curlew*, and terminates on the *Snowshoe* claim. The whole, when broadly viewed, has on a horizontal plan the form of a compressed crescent with northward-trending horns, broken by the occurrence of the detached ore-body of *Gold Drop No. 1* and the north body of the *Snowshoe*. The ore-body rests on a floor of jasperoids, and in the *Gold Drop* proper there is an entire absence of Tertiary intrusions, or remnants of the Brooklyn limestone.

The ore consists of chalcopyrite, which with pyrite and hæmatite in grains is finely and uniformly distributed through the gangue, composed of garnet, epidote, calcite, quartz, and chlorite. The values as determined from assays of drill-cores give from 0.90 to 3.2 per cent. copper, 0.02 to 0.07 oz. gold, and 0.20 to 0.60 oz. silver a ton. Acknowledgment is due to Chas. Campbell, superintendent of mines at Phoenix, for information connected with this mine.

THE CANADA COPPER CORPORATION (GREENWOOD).

The smelter and properties owned by this company in the Greenwood Mining Division ceased operations on November, 1918. The town of Greenwood has for the past twenty years been the centre of various mining operations, and the closing of the smelter will work a hardship on a good many citizens in Greenwood and its vicinity, who relied on the company's operations for a livelihood.

As soon as the people of Greenwood were sure of the cessation of work, a committee was formed to investigate the possibilities of continuing smelting, with the result that the heads of the Canada Copper Corporation were requested to put a price on their holdings in and around Greenwood. Up to this time no definite answer has been received by the citizens' committee.

Oscar Lachmund, consulting engineer, of Spokane, and former manager of the company, was employed to investigate the possibilities of resuming operations. He suggested the possibilities of building a lead-furnace on the old smelter-site to treat such lead ores as might be available in the district until sufficient tonnage of copper ores could be developed. This possibility has not materialized at present.

For the past year only one of the furnaces was in operation, under the superintendence of Oscar Lachmund and Mr. Bidder. Over 168,800 tons of ore was treated during the year, not including customs ore from the United States.

The chief producing mine, owned and operated by the Canada Copper Corporation, was the *Mother Lode*, situated four miles from Greenwood. The shipments from this mine amounted to 154,332 tons of low-grade copper ore. Toward the end of the year the company experienced some difficulty in finding suitable fluxes for this ore, and had to resort to purchasing some of the output from the *Emma* mine, Coltern.

Another property closely adjoining the *Mother Lode*, named the *Sunset*, has produced 2,697 tons of copper ore. The company pumped out and exploited the *Brooklyn* mine, Phoenix, and it is understood that some good ore was exposed. Before any of this ore was broken it was decided to discontinue operations.

It is understood that the difficulty of obtaining proper fluxing-ores, together with the probability of a drop in the price of copper and the extra expense of operating mines necessitating shaft-work, caused the Canada Copper Corporation to cease operations. This company's holdings at Princeton will be dealt with under the heading of the Similkameen Mining Division.

GREENWOOD SECTION.

Providence. This property was leased to A. J. Morrison during the year. An air-compressor, hoist, etc., were installed and considerable work done in sinking and drifting. A lead in the old workings was uncovered and approximately 235 tons of ore shipped to the Greenwood and Trail smelters. This ore carries good values in gold, with a little silver, lead, and zinc.

This mine has been under lease and bond to J. E. Thompson *et al.*, of Phoenix. **Surprise No. 3.** Intermittent development-work has been carried on during the year, with the result that the shaft has been sunk 25 feet farther, making a total depth of 75 feet, and a tunnel driven from the bottom of the shaft for 60 feet. The mineralized part of the lead in this drift is about 4 feet wide, with a perpendicular dip striking east and west, and is siliceous replacement in the sedimentaries, containing pyrite and chalcopyrite, with traces of molybdenite. Eighty-nine dry tons of ore was shipped from the shaft and tunnel to the Grand Forks smelter, having a total content of 7,450 lb. copper and 70 oz. silver. With proper equipment this property would become one of the small shippers in the district.

Big Copper.—This claim is under lease to J. Foggi, of Greenwood. During the year 409 dry tons of ore carrying copper and silver was shipped to the Grand Forks smelter.

Sudbury.—This claim is owned by Jas. D. Graham, of Deadwood, B.C., and was worked for one month during the year, with the result that 3 tons of ore was shipped to the Greenwood smelter, carrying 0.25 oz. in gold, 12.04 oz. in silver, and 8.54 per cent. copper.

Aftermath.—This claim was operated by L. Richards and 83 tons of ore shipped to the Greenwood smelter. This ore carried values in gold, silver, and copper.

WALLACE MOUNTAIN.

Sally. This mine was leased by Jas. Drum and worked until the end of September. About 70 tons of ore was shipped to the Grand Forks smelter, carrying from 8 to 211 oz. in silver and 9 per cent. lead. A greater part of this ore was taken from the old *Sally* stopes and hauled to Beaverdell Station, on the Kettle Valley Railway, a distance of approximately two miles. From September on, Robert Wood, of Penticton, worked for two months and a half driving a tunnel below the old *Sally* workings. It is understood that when work ceased no ore had been struck.

Bell. This mine was leased and bonded to Duncan McIntosh and Chas. Oliver, of Greenwood, by Robt. Parry in 1916 for \$26,000. Since then the lessees have worked continuously, doing several hundred feet of development-work, and during 1918 shipped, according to official returns, 192 dry tons of ore to the Trail and Grand Forks smelters, averaging about 150 oz. of silver to the ton, with a trace of gold. The ore occurs in a mineralized shear-zone in a quartz diorite which has been slightly metamorphosed. In some cases in and near the shear-zones the rock has been altered to a greenish-white mass. Along this altered zone occur the silver ores, including galena, sphalerite, pyrite, and native silver. A large number of faults offset the ore-bearing shear-zones, and as there seems to be no general relation between the direction of the fault-planes and the amount of displacement they have occasioned, development-work is carried on with difficulty. A good deal of credit is due Mr. McIntosh for the way he has developed the ore-bodies.

Black Diamond.—This claim is situated on Wallace mountain near Beaverdell, on the West fork of the Kettle river. The owner, Pat Kennedy, worked the property during the early part of the year and shipped 2 tons of silver ore to the Trail smelter.

Bounty Fraction and Duncan.—These claims, also situated on Wallace mountain, were leased to John McKellar, James Dale, and Pat Crane. During the summer four men were employed and 36 dry tons of ore shipped to the Trail smelter, carrying values up to 47 oz. in silver and 3.4 per cent. lead.

Kokomo.—This property is owned by G. Barrett, of Carmi. Twenty-one dry tons of ore was shipped to the Grand Forks smelter, carrying good values in silver.

Rambler.—Only one car-load of ore was shipped from this property during the year by W. Rambo, owner. Good values were obtained in silver and lead.

Standard Fraction.—This property adjoins the *Rambler* mine and is under lease to E. Nordman & Sons, of Coltern, B.C. Fifty-one tons of ore was shipped to the Trail and Grand Forks smelters, carrying between 50 and 90 oz. in silver and 2.5 per cent. lead.

KETTLE VALLEY.

Lakevale.—A lease was taken on this claim by M. Shannier, who shipped 5 tons of silver-lead ore to the Trail smelter.

Sunnyside.—This mine is situated about one mile and a half west of the Kettle Valley Railway and about five miles north of Rock Creek. About 5 tons of ore was shipped to the Trail smelter, carrying 0.24 oz. in gold, 80 oz. in silver, and 10 per cent. lead.

Sappho.—This claim was leased to Ol. Lofstad *et al.*, of Greenwood, and 20 tons of ore was shipped to the Greenwood smelter, carrying 1.84 oz. in silver and 6.73 per cent. copper a ton.

CAMP MCKINNEY.

In 1903 the Cariboo McKinney Company mined and milled about 15,000 tons of ore, quartz carrying free gold, having a gross value of \$5.50 a ton. The development of this property did not give much encouragement; consequently the company suspended operations in December of that year. Since that time practically no development was done until the Consolidated Mining and Smelting Company, of Trail, took over most of the old holdings of the company in 1917. During the year 1918 a good deal of assessment-work was done, amounting to open-cuts and shallow shafts. This work showed a continuance of the lead with some mineralization, the values of which are not to hand.

The old Cariboo McKinney Company was surrounded by difficulties, the chief of which were fuel and a long transportation haul to the nearest railroad. Future operations will be facilitated, the Great Northern Railway running to within eight miles of the properties, and a high-power electric line is being built from Greenwood to Copper mountain, at Princeton; the line running directly through the Camp McKinney properties. Future development in this area is looked forward to with interest.

The dump from the old Cariboo mill has been subleased to Leo. Mader and Ab. Savage, of Grand Forks. Under great difficulties, they erected two concentrators brought from the old mill, also a Pelton wheel. The early drought so diminished the supply of water that they were obliged to install a gasoline-engine to run the concentrators. About 9 tons of concentrates was shipped to Grand Forks smelter.

OSOYOOS MINING DIVISION.

Torpedo. This mine is situated on the shore of Okanagan lake, approximately one mile from Penticton. The property has been leased by the Penticton Development Company, Penticton, B.C. The old shaft and lower tunnel, 90 feet below the level of the lake, were unwatered and the mine generally put in shape for operation. Approximately 135 tons of gold, silver, copper, and lead ore was shipped to the Greenwood and Trail smelters. Values averaging 0.35 oz. in gold, 2 oz. in silver, and 0.60 per cent. copper were extracted. The ore is a quartz carrying a variable amount of gold, silver, lead, zinc, copper, and iron.

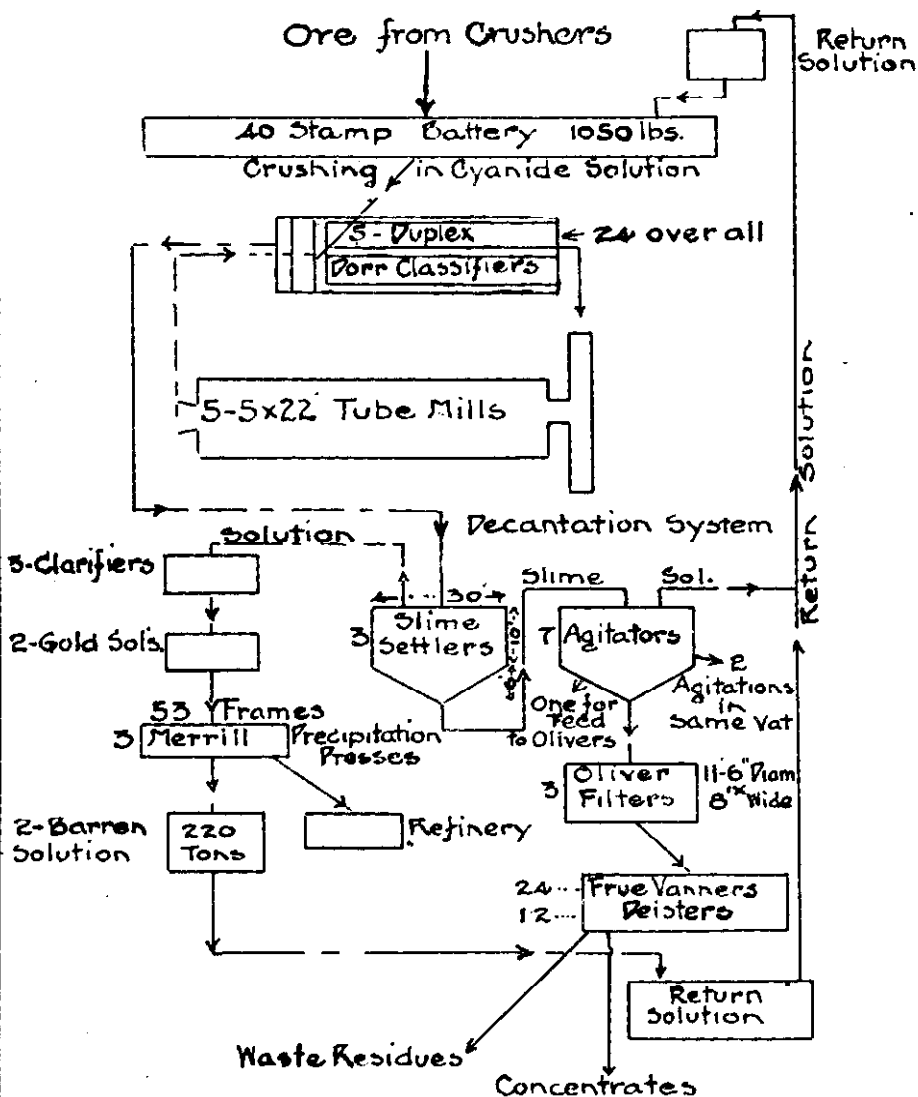
The lead lies between two nearly perpendicular walls of granite, the gangue being mainly silica, with some disintegrated particles of wall-rock. Development has shown the lead to be persistent, though varying in size from 2 feet to 1 inch for 90 feet. At this point on the lake-level a crushed zone was encountered, and some crosscutting done to the north and south without finding a continuance of the ore-body. In the writer's opinion it would be better to drift on the strike of the lead until the crushed zone was passed before crosscutting to the north and south in search of it. The character of this ore makes it a more desirable milling project.

Work has been carried on continuously during the year, despite the handicaps due to the shortage of skilled labour. Development for the year consisted of drifting on the lead and a lower crosscut tunnel, driven with the intention of tapping the lead at a lower elevation. This tunnel was not driven far enough to encounter the ore-body. Nineteen cars of ore was shipped to Grand Forks smelter via the Great Northern Railway, carrying a gross content of 99 oz. gold and 42,661 oz. silver.

Dolphin and Spar Fraction.—This property, owned by C. W. Jordan, of Olalla, was worked for twenty-six days during the year, and 46 tons of ore shipped, carrying 1.50 oz. in silver and 6.2 per cent. copper.

Copper King.—This group is again leased by R. W. Northey, of Olalla, to A. Hagelberg, who is endeavouring to develop the property at depth.

FLOW SHEET
of
HEDLEY GOLD MINING CO.
Hedley B.C.
R.Wheeler Mill Supt.
1918



Golconda. In 1917 3,390 lb. of molybdenite was shipped to Ottawa, carrying approximately 17.1 per cent. MoS_2 . On driving the main tunnel ahead on the lead the molybdenite to a great extent disappeared and a good grade of chalcopyrite was encountered. About 10 tons of this ore, carrying 18.6 per cent. copper and 1.7 oz. silver, was shipped to Trail smelter. This is a good prospect.

Hedley Gold Mining Co. This company has operated the *Nickel Plate* and *Sunnyside* groups, under the management of Gomer P. Jones, steadily throughout the year, in spite of increased costs in labour, supplies, etc. The total number of tons of ore milled during the year amounted to 67,313. The recovery from this tonnage was: By cyanidation, 24,337 oz. gold; by concentration, 7,608 oz. gold; making a total of 31,945 oz. gold. The total dividends for the year amounted to \$144,000.

Spotted Lake. Operations were carried on intermittently throughout the year and a number of tons of magnesium salts was hauled by motor-truck to the Stewart-Calvert plant at Oroville, Wash., for treatment.

The process for treating the salts is as follows: First the raw product, a crystalline salts dug from the lake, is dissolved in tanks by means of steam; from thence the liquid salts pass through launders into the evaporating-tanks, where it is brought to a certain density; then run off into other tanks lined with cement (magnesite), where it is cooled and recrystallized; the liquid remaining being drawn off and pumped back into the boiling tank for further treatment. The crystals are then put through a Watson Laidlaw dryer with a 2-inch basket having a capacity of 15 tons every ten hours. After this preliminary drying the crystals pass through a chute into a rotary circular dryer, 25 feet long by 4 feet in width, which revolves from eight to ten times a minute. The screens at the discharge end have meshes varying from $\frac{1}{2} \times \frac{1}{16}$ to $\frac{2}{3} \times \frac{1}{2}$ inch. Directly outside the discharge end of the screen are a set of steam-coils so placed that the fan draws the hot air over the revolving salts. The temperature is kept below 80 degrees, so that the salts will not melt.

Two grades of these salts are shipped, the finer crystals being used for medicinal purposes, whilst the coarser ones are used for tanning leather. Some of these salts are sold in the drug-stores in Vancouver.

SIMILKAMEEN MINING DIVISION.

TULAMEEN RIVER.

The great demand for platinum for war purposes caused considerable activity in the vicinity of the Tulameen river. In August Chas. Camsell and Geo. A. MacKenzie, of the Geological Survey and Munitions Board Commission, Ottawa, accompanied by an expert panner, made a preliminary inspection of the Tulameen river, resulting in a decision to undertake boring operations, which were commenced in September and ceased on account of weather conditions on December 4th.

During that time ten holes were bored, of varying depths, most of which reached bed-rock, and while complete assays of the borings are not yet finished (February 1st, 1919), it is hoped that the final report of the Munitions Board will indicate the desirability of the ground.

The principal work was undertaken on what is known as Rabbit's ranch, immediately below the mouth of Slate creek. A complete survey of the Tulameen river between Slate creek and the town of Tulameen was made, and the river-bed blocked off into rectangles 200 x 500 feet, so that if at any future time the work should be continued the survey will be of material assistance to others. Details of the work undertaken will appear in the spring of 1919 in the report of the Mineral Resources Commission.

Between Bear creek and Kelly creek, on the Tulameen river, several small placer leases have been worked for platinum and gold, with varying results.

Placer Development Co. of America, Ltd.—This company operated from July 4th to December 1st under a sublease from the Efanjay Gold Mining Company, located on the Tulameen river near its junction with Bear creek. About \$25,000 was spent on building a dam across the Tulameen river, also a spillway and flumes. A deep excavation was made near the dam and the gravels hoisted on an incline tramway and dumped in the sluice-boxes. Owing to trouble with freshets in the river and the depth of gravel, it is understood that bed-rock was not reached. It is expected that work will continue next season.

OLIVINE MOUNTAIN.

A good deal of interest was centered on Olivine mountain, chiefly owing to the fact that the occurrence of platinum and chromite had been reported by the Geological Survey in 1911. The high price of these metals during the war incited certain interests in British Columbia to make further investigations into the possibilities of finding platinum and chromite in commercial quantities in the olivine rocks, which make up the greater part of Olivine mountain.

A proposal that some assistance be given these interests by the Government, in an examination of the locality with the idea of putting a diamond-drill to thoroughly prospect the ground at depth, led to the writer's visit to Olivine mountain in June. Ten days were spent traversing different localities on Olivine mountain in search of any ore-bodies large enough to be of commercial value, with the result that nothing was found that contained enough platinum or chromite to warrant the expenditure necessary for diamond-drilling.

The best showings are on the *Quartz, Copper Queen No. 1*, and *Copper Queen No. 2*, situated on the north-west slope of Olivine mountain and owned by Andy Jensen, of Tulameen. Two open-cuts on the *Copper Queen No. 1* show a fair mineralization of pyrite and chalcopyrite. These open-cuts lie about 200 feet apart and the ore seems to be disseminated through the pyroxenite in small and separated areas. General samples taken along the open-cuts assayed 1 per cent. copper, with a trace of gold and no platinum or chromite. Picked samples assayed as high as 3 per cent. copper.

In localities nearer the summit of Olivine mountain some magnetite, as an original constituent, occurs in the pyroxenite. At Courteney's cabin there is a shaft about 8 feet deep in the magnetite. This appears to be a good grade of iron ore, but the deposit is too small to be of commercial value. Samples were taken along the face of the bluff which lies to the north of Olivine mountain, with negative results.

In the fall of the year a new discovery was made by Andy Jensen, of Tulameen, on the south-east side of Olivine mountain, near Slate creek. Some stripping was done at intervals over an area of several hundred feet, with the result that carbonates and sulphides were uncovered, carrying values up to 4 per cent. copper. The extent of this deposit is not known, but the copper-carbonate stain is traceable over several claims. This occurrence is probably worth further investigation.

PRINCETON SECTION.

Copper Farm Group.

This group consists of three claims—*Copper Farm, Copper Farm No. 2*, and *Copper Farm No. 4*. The original owner of this group, Colonel Robert Stevenson, of Princeton, sold to the Princeton Mining and Development Company, Limited, in 1917. Since that time the property has been managed by Fred Foster, with the result that a considerable amount of development-work has been done on the lower level, also the building of bunkers, office building, and the grading of a spur from the Great Northern tracks.

The lead in the upper levels is about 6 inches wide and carries values in copper up to 16 per cent. and 2 oz. in silver. This lead, striking north and south, can be traced for several hundred feet. On the lower level considerable crosscutting has been done, with the result that the lead, though somewhat shattered and displaced, gives promise of a larger ore-body.

Regal Group.

This group consists of ten claims—*Regal, Rose, Lark, Hit or Miss, Rose Fraction, Regal No. 1, Regal No. 2, Regal No. 3*, and *Regal No. 4*—and is situated two miles and a half north-east of Princeton. The owners, a general mining syndicate, are developing this group under the superintendency of W. C. McDougall, of Princeton. Development-work done consists of an open-cut 150 feet in length by 25 feet in depth, this cut being continued as a tunnel for 50 feet, also extensive stripping.

The surface in the region of this work shows a strong strain of copper carbonates. Assays of samples taken on the surface give from 1.15 to 5 per cent. copper. The sulphides in the tunnel assay from 1.87 to 2.8 per cent. copper and \$1.50 in gold and silver. Future development of this property will be looked forward to with interest.

Princeton Coal and Land Co.—This company's property, situated about half a mile from the centre of Princeton in an easterly direction, was operated steadily up to November 23rd, 1918, and producing about 150 tons a day. Since that time work was spasmodic on account of a fire breaking out from the old workings. The main seam, 24 feet thick, pitches 11 degrees to the

north and south, the top 7 feet of which was worked during the year. The main slope, sunk a distance of 2,323 feet, was abandoned on account of the fire, and a new slope commenced 740 feet down and 1,640 feet distant from the main workings. The area of the property is two square miles. Shipments amounted to 38,673 tons.

Coalmont Collieries, Ltd.—This property is situated between the Tulameen river and Granite creek and is under the management of Donald McLean, Coalmont. Shipments for the year amounted to 5,744 tons.

THE CANADA COPPER CORPORATION, LIMITED.

The constructional and development programme of the Canada Copper Corporation, Limited, at Copper mountain has caused a great deal of interest in this Division during the past few years. With the completion of the plant of 2,000-ton capacity, this company's mine will stand well to the front as one of the large producers in the country. The development of the mine and building of the mill has had a wonderfully stimulating effect upon the prospecting and general mining throughout the district. A résumé of work done by this company on the *Copper Mountain* and surrounding claims during the past few years will be found below.

In 1905 the British Columbia Copper Company, since absorbed by the Canada Copper Corporation, secured a bond on the *Sunset* claim, on Copper mountain, and carried out some development-work, made a small payment, and then allowed the bond to lapse. The reason for this was probably due to the then complex problem of treating the ore, which carries about 50 per cent. silica and 20 per cent. alumina.

In 1911 the same company took options on a number of claims in Voigt camp, also on Copper mountain, and developed the property by means of diamond-drilling, open-cuts, trenches, tunnels, and shallow shafts. The result of this work has not been published and nothing further was done.

In 1912 the British Columbia Copper Company obtained another option on the *Copper Mountain* group, including the *Sunset* and ten other claims. A considerable amount of development-work was carried out upon these claims, including surface-trenching and diamond-drilling.

In 1913, 1914, and 1915 the exploration-work continued, and several thousand feet of diamond-drilling was done and some large ore-bodies developed.

In 1916 a temporary power plant was built, including one 1,100-foot and one 500-foot air-compressor; one Connorsville blower, with a capacity of 3,000 feet a minute for ventilation. Besides these, machine, carpenter, and blacksmith shops were erected, also a store, bunk-house, office, and eight six-room and four two-room houses built. A power-line fourteen miles long was put in between the mine and the 500-horse-power steam electric plant at Princeton. This plant generated enough power to run the compressors, blowers, underground motors, etc., at the mine. A pumping plant for water-supply, etc., was installed on the Similkameen river, which has a head of 1,450 feet.

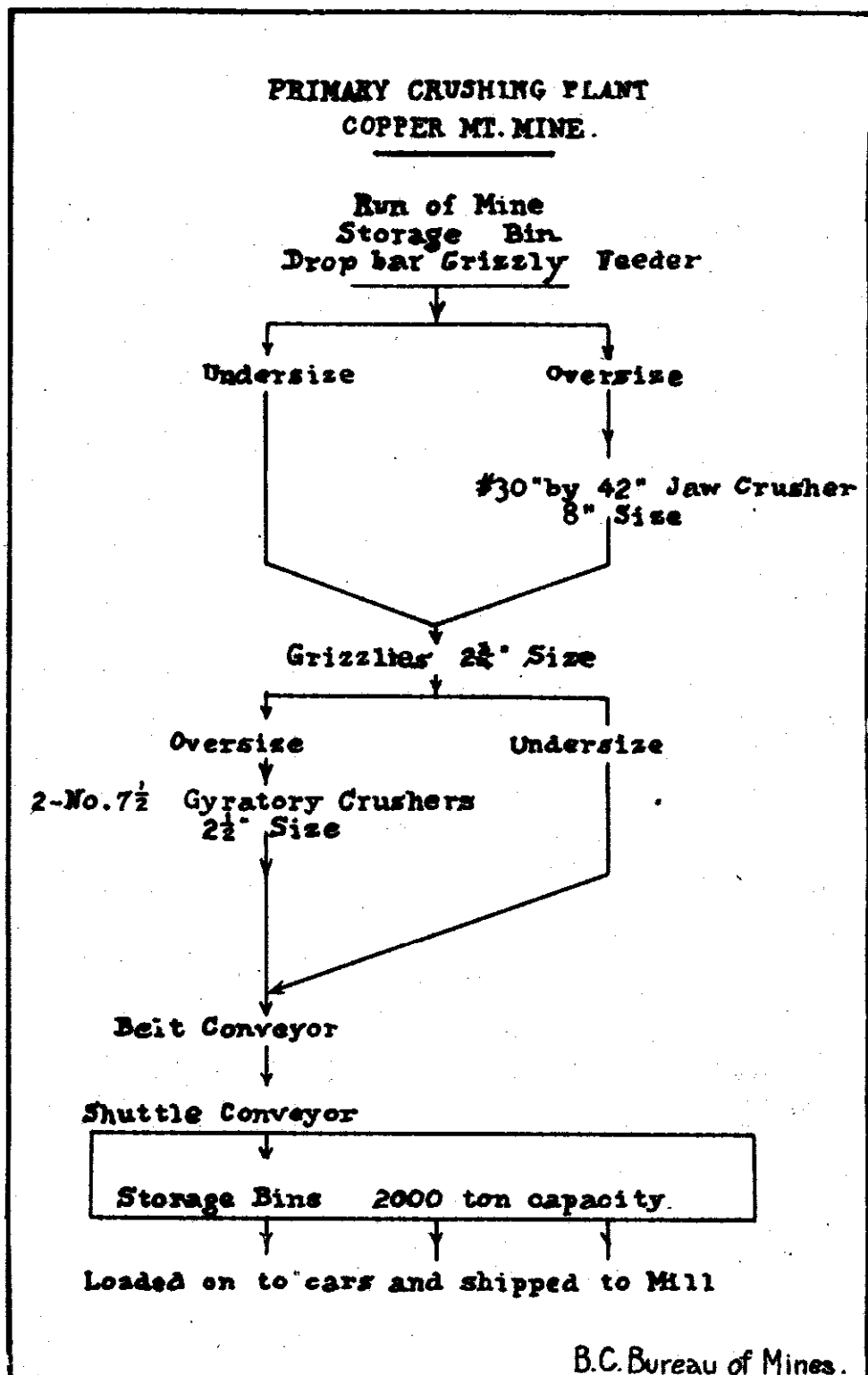
During the year 5,400 feet of drifting was done. Exploration-work was also started on Kennedy mountain, about two miles in a westerly direction across the Similkameen river, and 823 feet of drifting and 709 feet of diamond-drilling done. The results of this are not forthcoming.

Up to the end of 1917, 114,819 feet of diamond-drilling, 14,798 feet of tunnelling, 90 per cent. of which was 9- x 10-foot tunnels, 6,056 feet of upraising, 641 feet of sinking, and 25,084 feet of surface-trenching was done on the *Copper Mountain* property, with a total expenditure of about \$1,250,000. All this development-work was done to ascertain as nearly as possible the size of the ore-bodies, the average grade of the ore, and the best possible means of handling a large tonnage in the cheapest possible manner. It is seldom that any property receives such a thorough prospecting before operations are commenced.

Besides analyses on all the diamond-drill holes in the ore-bodies, test-holes every few feet were driven in the tunnels with stopers and the cuttings analysed. New bunk-houses with steam-heat and shower-baths were erected for the men during 1917.

In connection with this company, the old cement plant two miles from Princeton was put into use for experimental purposes in ascertaining the possibilities of nodulizing the concentrates from the company's flotation plant. Satisfactory results were obtained from these experiments, coal-dust being used instead of oil for fuel.

During the period between 1912 and 1918 F. R. Norcross, Jr., superintended all the development-work, afterwards resigning his post to take a commission in the American Engineers.





Copper Mountain Mine Buildings.



Copper Mountain Mine, 3,945-foot Level.

Oscar Lachmund was general manager for the company until the fall of 1918, when he resigned. Since that time H. van Wagenen has been made general manager, P Crane mine superintendent, and Van H. Smith superintendent of the mill. The writer's thanks are due to the last three gentlemen for their kindness in furnishing the data in this report.

Copper Mountain Mines.—The Canada Copper Corporation's holdings on this mountain and its vicinity are as follows: Copper mountain, 96 claims, 3,192.97 acres; Kennedy mountain, 6 claims, 165.10 acres; Mill-site, 1 claim, 868.60 acres.

The mine on Copper mountain is approximately ten miles in a direct line in a southerly direction from Princeton, B.C. The ore-bodies diamond-drilled vary in size between an elevation of 3,236 to 4,220 feet, a distance of 984 feet. It may be added that most of the drill-holes stopped in ore at an elevation of 3,236 feet. The character of these ore-bodies will be dealt with later.

At the present time three tunnels have been driven into the mountain—No. 1, at an elevation of 4,073 feet, will handle all the ores from the glory-holes; No. 2, at an elevation of 3,945 feet, will handle all intermediate ores; No. 3, at an elevation of 3,170 feet, will be the main haulage-tunnel for all ores broken above. For this purpose an upraise 8 x 15 feet and 804 feet long was put in between the 3,170- and 3,945-foot levels. This upraise was driven in a zigzag manner, the corners of which will act as a buffer to the momentum of the rock dumped from the upper levels. At the bottom of raise just above the 3,170-foot level a storage-pocket was cut out. Chute-gates from this pocket will be operated by compressed air.

A vertical manway from the surface to the 3,170-foot level was also driven, work being carried on simultaneously by sinking and raising. From this manway four short drifts were driven to tap the ore-pass at different points. These drifts will be used only in case the ore-pass gets blocked and will afford a safe means of relieving the trouble.

The ores broken in the glory-holes will run down through ore-passes to the 3,945-foot level, where it will be hauled by 7-ton cars (Granby self-dumping type) attached to an electric motor and dumped into the main ore-pass running to the pocket above the 3,170-foot level. From thence 10-ton cars attached to an electric motor will haul the material to a crushing plant (not yet installed) situated close to the mouth of the tunnel. This plant will crush rock to a 4-inch size and dump it into bins above the railway.

The idea of the company when driving the different levels and upraises was to perfect, as nearly as possible, a gravity system of handling the ore. The loose nature of the ground presented difficulties, especially where the porphyry dykes cut the formation. To locate the most suitable ground for an ore-pass from the 3,945-foot level a diamond-drill was used.

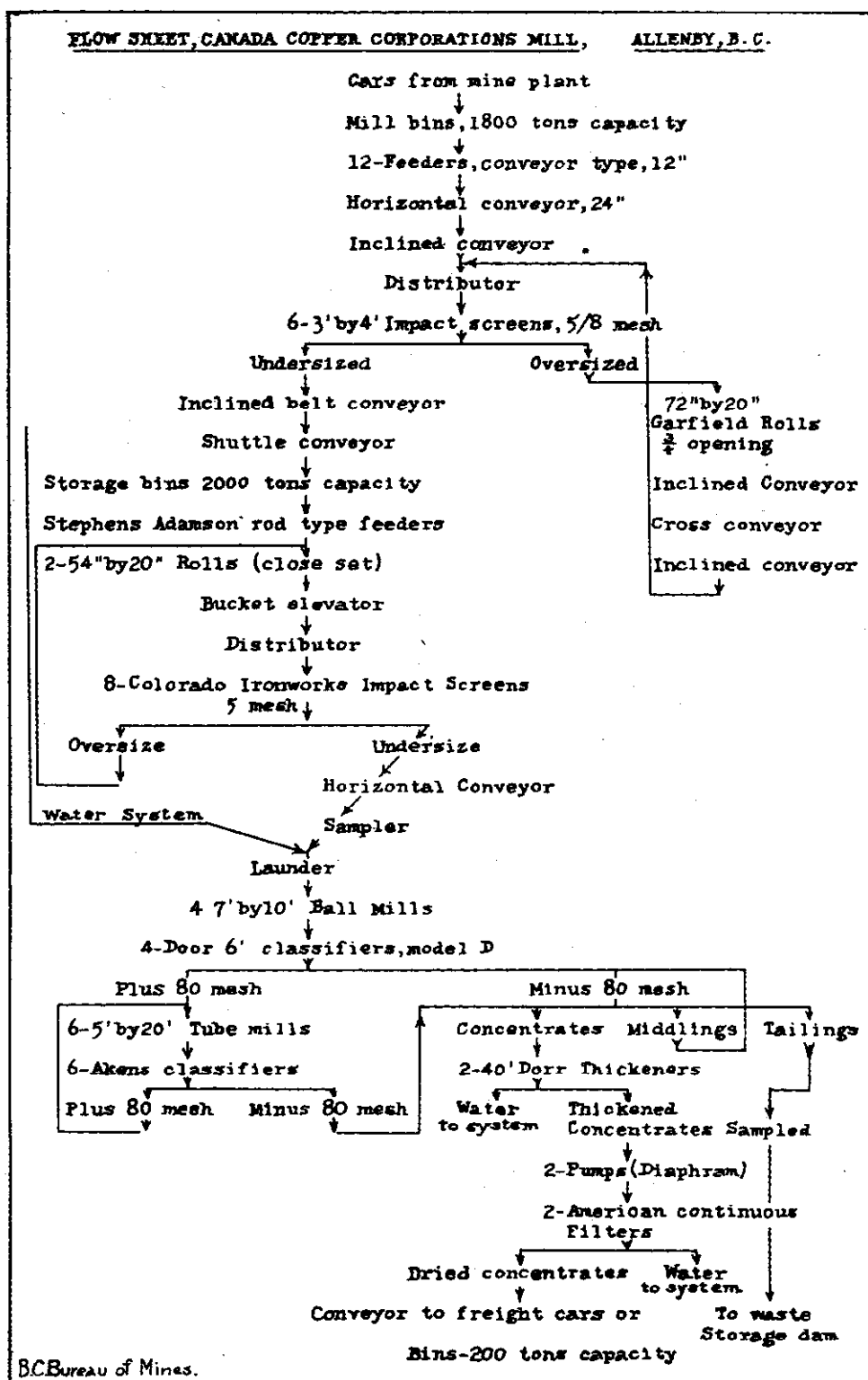
During 1918 the following development-work was done: Tunnelling, 1,720 feet; drifting, 146 feet; upraising, 2,390 feet; ore-passes, 1,017 feet; by-passes, 255 feet; total, 5,528 feet.

Geology.—The country as a whole is a mosaic of various dark-coloured granite-like rocks, which are presumably of Jurassic age. Of these rocks the augite-monzonite-porphyry is the oldest, and this in places is gneissic. The next younger rock is a granodiorite, and younger than this are intrusions of pegmatite and quartz-porphyry granites, into which the pegmatite grades. These granular rocks have by the mineralizing waters been altered to dense, fine-grained cherty rocks consisting of fine aggregates of epidote, calcite, quartz, sericite, chlorite, and metallic sulphides. Within these granular rocks it is probable that there are some small masses of Palaeozoic rocks of sedimentary origin. This older complex of rocks has been intricately cut by a system of north-to-south porphyry dykes which in composition are, for the most part, the porphyritic equivalents of granites and monzonites. These rocks are of Miocene age.

The granite rocks of Jurassic age carry the ore, which consists of chalcopyrite, bornite, and pyrite, occupying the numerous fractures and also occurring in disseminated grains. The deposition of the ore took place in Jurassic times and is in part an original constituent of the granite-like rocks, and in part was deposited in the fractures by hot solutions or vapours given off by these rocks when they cooled. The associations of the ore-bodies and the porphyry dykes is wholly a physical one and relates to a single zone of structural weakness.

Chalcopyrite and bornite are the primary copper minerals present, associated more or less with hematite, magnetite, and iron pyrites. Along certain zones, notably in a shaft on the *Helen H. Gardner*, secondary action has taken place, giving rise to chalcocite, native copper, malachite, azurite, and cuprite.

An average of the general analyses of the ores taken from the mines is as follows: Cu, 1.77; SiO₂, 50; Fe, 5.8; CaO, 9.1; S, 1.1; Al₂O₃, 19.9; Au, 0.005; Ag, 0.20.



The company hopes that the construction of the railway, high-power line, crushing plant at the mine, and installation of the machinery to run the mill will be completed during 1919 and the mine put on a producing basis.

Whether the produce from the mill is to be nodulized or shipped as a concentrate has not been definitely decided by the company. A conservative estimate of ore blocked out amounts to 10,000,000 tons, whilst there is 2,000,000 tons of semi-proven ore.

The Mill.—The location for a mill-site was chosen by the Canada Copper Corporation at a point 5.5 miles from Princeton by railroad, close to the Similkameen river, on a slope so characterized that a gravity system could be used as much as possible and the least amount of excavation undertaken. The location of the railroad was also taken into consideration, it being necessary to hold a nearly uniform gradient from Princeton to Copper mountain and at the same time pass through the company's holdings at the mill-site.

Excavating for the foundations was commenced in August, 1918, and preliminary structures erected to facilitate the handling of concrete for the foundations and the timber for the mill. Excellent material for making the concrete was excavated from a cut-bank close to the mill-site, filled into cars, and dumped into a mixing-bin above the works.

Two timber towers 440 feet apart on parallel rails, with a steel cable strung between, were erected. By this means the frame-timbers were easily swung into place. At present no machinery has been installed, and will not be until the completion of the railway to the mill-site.

A pumping system has been installed on the Similkameen river 600 feet below the mill, with a capacity of 850 gallons a minute. This will supply the mill and town. A sawmill has been erected with a capacity of 30,000 board-feet a day. Practically all the lumber for constructional purposes, except the larger sizes, was the direct output of this mill. All timber to be used in and around the mine will be sawn and framed at the mill, then shipped by rail 7.7 miles.

Half a mile on the north side of the mill the company has erected cottages for fifty-five employees, also a school to accommodate forty children, a store, bunk-houses, and dining-room. On the north side houses will be erected for the staff.

The Kettle Valley Railway is constructing a branch line from Princeton to Copper mountain, a distance of 13.2 miles, which will handle all the tonnage from the mine to the mill. Power will be supplied by the West Kootenay Power Company on the completion of their line from Greenwood to Copper mountain. The present proposed plan of the mill flow-sheet accompanies this report.

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 1918.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.—Tonnage shipped, 448,134. Development: Drifting, 3,618 feet; raising, 4,107 feet; sinking, 15 feet; diamond-drilling, 5,544 feet; average number of men employed, 230; amount expended in wages, \$410,000. There were no new additions to mine plant.

The *Gold Drop* mine of the Granby Phoenix group was permanently closed down on July 15th, the ore-body being worked out. The crushing and generation plant formerly at the Curlew tunnel entry to the *Gold Drop* mine has been moved to the mouth of No. 3 tunnel. The mine enjoyed an uninterrupted run during the entire year.

Consolidated Mining and Smelting Co. of Canada, Ltd.—The *Emma* mine produced 26,261 tons of ore and shipped 20,613 tons. The average number of men employed during the year was thirty-five; wages paid, \$56,801. The advance for the fiscal year ending September 30th, 1918, totalled 1,817 feet. Total diamond-drill footage for the year amounted to 1,346 feet.

WALLACE MOUNTAIN, NEAR BEAVERDELL.

The *Bell* mine, leased to Charles Oliver and Duncan McIntosh, made shipments to the Granby Company's smelter, Grand Forks, and to the Consolidated Mining and Smelting Company at Trail. Total wages paid out to miners, not including management, \$7,654; average number of miners employed, 6. The work consisted of drifting 350 feet and raising 35 feet.

Sally.—The following is the result of the operations on this mine from January 1st to September 30th, when the lessee, James Drum, discontinued working the property:—Shipped to Trail smelter: Lot 50, 7,935 lb., 586 oz. silver, 532 lb. lead; Lot 51, 11,899 lb., 1,170 oz. silver; 1,021 lb. lead. Shipped to Grand Forks smelter: Lot 20, 50,934 lb., 590 oz. silver; Lot 21, 70,234 lb., 280 oz. silver. The Wallace Mountain Mining Company, of Penticton, is now developing this mine.

Buster and Alaska.—J. Kelly *et al.* are working on these claims. The *Buster* adjoins the *Standard*. About 7 tons of ore is ready for shipment. Development consisted of a tunnel 75 feet on the *Buster* and open-cut and surface work. From two to three men have been employed from July 1st last. The ore is silver-lead.

Castor Fractional.—This claim is under bond to Robert Perry, George Hambly, and R. D. McKenzie. I am informed there are good prospects of ore being shipped this winter.

Bounty Fractional and Duncan.—Under bond to McKellar, Dale & Crane. Thirty-six tons of ore was shipped from the *Bounty Fraction*. Approximately 40 feet of drifts were driven and four men employed during the year.

Ramblér.—W. H. Rambo shipped 8 tons of ore from this property in 1918. A 30-foot shaft was sunk and a tunnel 25 feet long driven.

Standard Fractional.—This claim is under bond to Nordman & Sons. The work done consisted of drifting 170 feet, raising 84 feet, and considerable stoping. They shipped 9 tons of ore to the Trail smelter, which carried 850 oz. in silver, 783 lb. of lead, and 4.3 per cent. zinc. Forty-nine dry tons was shipped to the Granby smelter at Grand Forks and 2,481 oz. of silver realized. Three men employed.

Revenge Group.—G. M. Barrett, who is working this group, has about 9 tons of ore sacked and ready for shipment. Development was 90 feet of drifting and open-cut work and a car-load of ore is blocked out ready for stoping. The lead looks very promising.

Napanee Group.—Owned by E. G. Cummings and M. D. Schenck. A 50-foot tunnel was driven and 150 feet of trench and open-cut work.

Scandia.—Ninety feet of drifting and considerable open-cut work was done.

Carmi Camp.

Carmi.—This mine was pumped out and sampled by the owners, but no further work was done.

Arlington Camp.

The necessary yearly assessment-work was kept up on the claims in this camp.

Providence.—This mine is situated near Greenwood and is leased to J. A. Morrison *et al.* During the year 235 tons of ore was shipped from this property; the values extracted were: Gold, 155 oz.; silver, 22,474 oz. Average number of men employed, 6.

Surprise No. 3.—Situated near the town of Phoenix. About 150 tons of ore was taken out, which averaged 5 per cent. copper, 75 cents in gold, and \$1 in silver a ton. A shaft 75 feet deep was sunk and two drifts run from this shaft—one 60 feet and one 30 feet long. The ore occurs in a fissure-vein. Average number of men employed, 3. This is considered to be a good property and the ground is closely staked round it.

Fidelity, Don, General Haig, Millington, and Viny Ridge Group.—Owned by George White *et al.* and situated on Floyd's ranch, near Greenwood. The ore is silver-copper. Development-work consisted of a tunnel 60 feet long and an open-cut 200 feet long and 4 feet deep.

Smith's Camp.

General Joffre Group.—This group consists of some fifteen claims owned by Claude Gidon *et al.* The ore is copper and the owners have great faith in their venture.

Don Pedro.—This mine, situated in Greenwood camp, is being worked by Charles Johnson *et al.* The ore contains gold and silver. About 20 tons of ore is ready for shipment.

Camp McKinney.

According to the preliminary report of Philip B. Freeland, Resident Engineer, the Consolidated Mining and Smelting Company did a considerable amount of work upon its holdings in this camp during the summer. A continuance of some of the quartz leads were uncovered, showing a fair amount of mineralization.

In the fall the West Kootenay Power Company established two camps near the old *Cariboo* mine and commenced cutting a right-of-way for the high-power electric line, which, it is understood, will pass through the Camp McKinney on its way from Greenwood to Copper mountain.

Cariboo.—A. Savage and Leo. Mader, of Grand Forks, obtained a sublease on the tailings from the old mill. Under great difficulties they erected two concentrators below the dump, also a small Pelton wheel. The early drought so diminished the supply of water that they were obliged to install a gasoline-engine to run the concentrators in place of the Pelton wheel. Notwithstanding these difficulties, about 9 tons of concentrates was shipped to the Grand Forks smelter.

Lightning Peak Camp.

Waterloo.—Situated on the headwaters of Kettle river, about thirty miles in a north-westerly direction from Edgewood, on the Arrow lakes. The lessees, George Boug and Charles Hammarstadt, packed on horses 9,381 lb. of high-grade ore to Edgewood to be forwarded from that point to the Trail smelter for treatment. The shipment netted \$3,244.53. The ore contained silver almost entirely, but 375 lb. of lead was extracted.

Lumpy Group.—Owned by W. B. Johnstone *et al.* They are endeavouring to ship some ore to the Trail smelter, providing transportation difficulties can be overcome.

Lightning Peak.—This mine is under lease to W. A. Calder. I am informed 2 tons of ore was shipped to the smelter at Trail last fall.

Many prospectors will visit this locality in the spring. Several promising claims were staked last fall. If sufficient ore is discovered to warrant the expenditure, a wagon-road should be built from the camp to connect with the road which runs ten miles in a north-westerly direction from Edgewood.

Canada Copper Corporation, Ltd.—Tons of ore treated at smelter from all sources, 177,307. Production: Blister-copper, 2,841,378 lb.; gold, 12,662 oz.; silver, 60,495 oz. Average number employed for year: Smelter, 51; *Mother Lode*, 61; *Lone Star*, 8. Wages paid: Smelter,

\$53,054.80; *Mother Lode*, \$103,537.10; *Lone Star*, \$8,669.15. Principal ores treated: *Mother Lode*, 154,332 tons; *Lone Star*, 3,057 tons; *Sunset*, 2,674 tons; *B.C.*, 861 tons; all others, 16,383 tons.

The Greenwood smelter of the Canada Copper Corporation closed down about the middle of November.

OFFICE STATISTICS—GREENWOOD MINING DIVISION.

Free miners' certificates issued	202
Locations (quartz)	115
Locations (placer)	1
Rerecords (placer)	4
Certificates of work	173
Permits to search for lode	2
Bills of sale	10
Agreement	1
Assignment	1
Filings	25

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 1918.

With the exception of the opening of the fluorite properties on Kennedy creek, on the North fork of the Kettle river, by the Consolidated Mining and Smelting Company of Canada, there was not any advance in mining operations over the preceding year. The fluorite properties include the following mining claims: *Rock Candy No. 1*, *Portal No. 1*, *Rabbit*, *Tadanac*, *Fluorspar*, and *Decimal Fractional*. At the present time from 90 to 100 men are employed on these properties.

The *Emma* mine, situated at Coltern, belonging to the same company as the fluorite properties, has been worked continuously throughout the year.

The Inland Empire Company and the Molly Gibson Company did some work on their properties during the year; the properties are situated near Paulson. The *Union* mine, in Franklin camp, on the Granby river (North fork of the Kettle), also did some work.

I understand that P. B. Freeland, the District Engineer for District No. 4, will give a report covering the Grand Forks Mining Division, so I have refrained from giving any details or extending this report, as he is in a far better position to give the details, being conversant with everything pertaining to mining in this district.

OFFICE STATISTICS—GRAND FORKS MINING DIVISION.

Free miners' certificates	149
Records of locations	103
Certificates of work	113
Bills of sale, agreements, etc.	27
Filings	16

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 1918.

I regret to say that as a whole this year very little new work was done, owing partly to the scarcity of labour, many men having been called to the war, and also the lack of capital for investment in mining properties.

The old producing mines, such as the *Nickle Plate* at Hedley, *Horn Silver*, near Cawston, and the *Spotted Lake* group produced about the same quantities. No new properties of any consequence were shown up.

The Power Company's line has not yet reached Camp Fairview, though it shortly will do so.

OFFICE STATISTICS—OSOYOOS MINING DIVISION.

Locations	101
Certificates of work	23
Bills of sale, etc.	34
Leases of mineral claims	4
Free miners' certificates	201

SIMILKAMEEN MINING DIVISION.

REPORT BY HUGH HUNTER, GOLD COMMISSIONER.

I have the honour to state that I have not had an opportunity of visiting any of the mining camps during the past season, and am not in a position to give any information concerning the work. Mr. Freeland's (District Engineer) report will cover the district generally.

OFFICE STATISTICS—SIMILKAMEEN MINING DIVISION.

Free miners' certificates	198
Free miners' certificates (special)	5
Location records	268
Certificates of work	320
Conveyances	26
Powers of attorney	17
Certificates of improvements (mineral claims)	16
Records (placer)	10
Leases	15

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, aggregating in superficial area approximately 45,000 square miles.

PHYSIOGRAPHY.

The major portion of this district is included in the Fraser plateau of the Interior system. The western boundary, however, merges into and includes the easterly spurs of the Coast range and a small part of the Cascade mountains. The physical features along with the geology of the district have been described by several distinguished authorities engaged at different times carrying out investigations for the Geological Survey of Canada.

GEOLOGICAL BIBLIOGRAPHY.

For the benefit of those who may desire a more detailed knowledge of the geology of the district than it is possible to give in this brief report, the following works which have come under the perusal of the writer are mentioned:—

Bateman, A. M. Geology of Fraser Canyon and Vicinity, B.C. Siwash Creek Area. Summary Report, C.G.S., 1911, pp. 125-129.

Exploration between Lillooet and Chilko Lake, British Columbia. Summary Report, C.G.S., 1912, pp. 177-187.

Lillooet Map-area, British Columbia. Summary Report, C.G.S., 1912, pp. 188-210.

Camsell, Charles. Fraser Canyon and Vicinity. Geology of a Portion of Lillooet Mining Division, Yale District, B.C.

Geology of Skagit Valley, Yale District, B.C. Note on the Occurrence of Diamonds at Tulameen and Scottie Creek near Ashcroft, B.C. Summary Report, C.G.S., 1911, pp. 108-124.

The Geology of certain Portions of Yale District, B.C. Summary Report, C.G.S., 1912, pp. 211-220.

Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet. Summary Report, C.G.S., 1917, Part B, pp. 12B-23B.

Daly, R. A. Reconnaissance of the Shuswap Lakes and Vicinity (South Central British Columbia). C.G.S., 1911, pp. 165-174.

A Geological Reconnaissance between Golden and Kamloops, B.C., along the Canadian Pacific Railway. C.G.S., Memoir 68 (No. 59, Geological Series), 260 pp.

Dawson, G. M. Preliminary Report on the Physical and Geological Features of the Southern Portion of the Interior of British Columbia. G.S.C., Report of Progress, 1877-78, pp. 1B-187B.

Report on the Area of the Kamloops Map-sheet. G.S.C. Annual Report, 1894, Vol. VII., N.S.

This report on the "Area of the Kamloops Map-sheet" by Dr. Dawson, who had as his assistant in the work J. McEvoy, takes in a large part of the area in District No. 3, and is looked upon as the standard of reference by all succeeding investigators of geological phenomena in this particular area. It covers a space of 427 pages, in which is included an appendix of fifty-two pages giving the petrographical character of some of the rocks from the same area, as determined by Dr. W. F. Ferrier, F.G.S., at that time lithologist to the Geological Survey of Canada. More recent investigations have modified somewhat the classification of the geological formations as presented in Dr. Dawson's report. The most important modifications are in regard to the Kamloops Volcanic group and the Adams Lake series. The Kamloops Volcanic group is discussed by Dr. Drysdale* as follows:—

"The former classification and correlation of the formations by Dr. G. M. Dawson have been followed in general, with, however, the two following notable exceptions: It has been found necessary to replace the name Lower Volcanic group used for the extensive development

* Geology of the Thompson River Valley below Kamloops Lake, B.C., G.S.C., 1912.



Sodium Carbonate Lake (Red Rock), near 70-Mile House, Cariboo Road.



Epsom Salts Lake, near Clifton, B.C.

of Jura-Cretaceous rock (mapped as Tertiary on the Kamloops map) in the western portion of the section by the new term *Spence Bridge Volcanic group*. Again, it has been thought advisable to include the Lower Volcanic group and Tranquille beds in the vicinity of Kamloops lake, which are undoubtedly Post-Eocene in age, with the conformably overlying Upper Volcanic group, and call the whole by the new term *Kamloops Volcanic group*."

Of the Adams Lake series Daly* writes: "The writer follows Dawson's own suggestion and designates the sediments and associated volcanics of the complex under the name 'Shuswap series,' which excludes the plainly intrusive granites, pegmatites, and orthogneisses. The whole assemblage of sedimentary volcanic and plutonic rocks is here for convenience called the 'Shuswap terrane.'

"During the field season it became convincingly clear that the Shuswap series includes also two great formations which had been referred by Dawson to the Cambrian; these are the 'Nisconlith' limestone with the associated rocks and the Adams Lake series. The evidences that these rocks are not only Pre-Cambrian but also Pre-Beltian were given in the Summary Report for 1911.

"The distribution of the Shuswap rocks as shown in Map No. 1458 was chiefly determined by Dawson, who states that they extend northward to the Finlay river, between the 56th and 57th parallels of latitude. They do not appear anywhere in the Rocky Mountain system, nor are they known in the Coast range."

Drysdale, C. W. Geology of Thompson River Valley below Kamloops Lake, B.C. Summary Report, C.G.S., 1912, pp. 115-150.

Bridge River Map-area, Lillooet Mining Division; Highland Valley Copper Camp, Ashcroft Mining Division; Human Skeleton from Silt-bed near Savona, B.C. Summary Report, C.G.S., 1915, pp. 75-92.

STRUCTURAL GEOLOGY.

TABLE OF FORMATIONS.†

			Approx. Thickness in Feet.
Quaternary	Recent	Soil and subsoil .....	.....
	Pleistocene	Fluvio-glacial deposits .....	.....
Tertiary	Lower Miocene	Kamloops Volcanic group, basalt, andesite, agglomerate, breccia, and tuff (Tranquille beds)	3,000
	Oligocene (?)	Ashcroft rhyolite porphyry	1,000
		Coldwater group, conglomerate, sandstone, and shale	5,000
Mesozoic	Lower Cretaceous	Queen Charlotte Islands formation (?), chiefly shale, conglomerate, and sandstone	5,000
	Jura-Cretaceous	Spence Bridge Volcanic group, lipartic and andesitic lava, tuff, arkose, and conglomerate	5,000
	Upper Jurassic (?) ..	Granitic intrusives	
	Jura-Triassic	Nicola group, greenstone (porphyrites), impure quartzite, argillite, limestone, agglomerate, and tuff	10,000
Palæozoic	Carboniferous	Cache Creek group, cherty quartzite, argillite, greenstone, and limestone (Marble Canyon limestone)	9,500

EROSION UNCONFORMITY.

Pre-Cambrian (Pre-Beltian)	Shuswap terrane	Intrusive granites, Shuswap series:	
		Adams Lake Volcanic	10,000
		Tshinaklin limestone-metargillite ...	3,900
		Bastion schists (phyllites, etc.) ...	5,000
		Sicamous limestone	3,200
		Salmon Arm mica-schists	1,800
		Chase quartzite	3,000
		Tonkawatla paragneiss (?)	1,500

* Memoir 68, C.G.S., 1915.

† Pre-Cambrian after Daly; Palæozoic up after Drysdale.

GEOLOGICAL HISTORY.

In order to present an idea of the sequence and nature of the geological events in this district, the following synopsis by Drysdale* is given:—

"SUMMARIZED GEOLOGICAL HISTORY OF THE REGION.

"The geological history of this region may be presented for the sake of conciseness in the following tabular scheme:—

"(1.) Downwarp of a mid-Palaeozoic peneplain with the transgression of a Devonian-Carboniferous epicontinental sea. Probably warm tropical climate. General marine sedimentation with local vulcanism (Cache Creek group).

"(2.) Uplift and local deformation of coastal plain deposits toward the close of the Palaeozoic; followed by cycle of erosion. Humid cool climate (?). Moderate relief. Organized drainage. Continuous sedimentation in some coastal regions.

"(3.) Transgression of Jura-Triassic sea. Probably semi-arid climate. Marine sedimentation in shallow seas accompanied by pronounced igneous activity (Nicola group).

"(4.) Orogenic uplift—'Jurassic revolution.' Birth of Sierra Nevadas and Coast range and batholithic intrusions of the Pacific coast (granitic intrusives). Youthful topography. Rapid sub-aerial erosion. Chiefly consequent drainage followed by subsequent, etc.

"(5.) Jura-Cretaceous continental sedimentation and widespread volcanic activity. (Spence Bridge Volcanic group.) Semi-arid climate. Rugged probably fine textured topography with many volcanic peaks. Disorganized drainage.

"(6.) Lower Cretaceous sedimentation in brackish waters and in part marine. (Queen Charlotte formation.) Cool humid climate (?). Mature topography.

"(7.) Epeirogenic uplift and local deformation with possibly granitic intrusions. Followed by Cretaceous cycle of erosion during long period of crustal stability in which the land surface was brought down to a peneplain. Coarse-textured topography. Transverse courses of Thompson and Fraser rivers inherited from this Cretaceous peneplain.

"(8.) Laramide revolution. Epeirogenic upwarp of Cretaceous peneplain with maximum uplift along the axes of present mountain ranges. Probably humid, cool climate. Continuous sedimentation into the Tertiary in some coastal regions.

"(9.) Early Tertiary continental erosion and sedimentation (Coldwater group) with local rhyolitic eruptions (Ashcroft rhyolite porphyry). Moist semi-tropical climate (?). Major streams antecedent with slightly different courses than at present. Drainage rejuvenated and much of it disorganized with many local lake-basins. Development of topography from state of youth through adolescence to post-maturity.

"(10.) Oligocene diastrophism. Widespread elevation with intense local deformation (possibly birth of Rocky Mountain system proper). Followed by Oligocene erosion cycle which removed much of the early Tertiary rock record and paved the way for later planation. Semi-tropical climate.

"(11.) Lower Miocene volcanic activity. (Kamloops Volcanic group.) Slight topographic relief. Drainage locally disorganized by lava-flows.

"(12.) Mid-Miocene crustal warping with local buckling and faulting of Lower Miocene volcanics. Probably intrusion and extrusion of alkalic rocks to the south and east in the Boundary and West Kootenay districts.

"(13.) Late Miocene and Pliocene cycle of erosion during long period of crustal stability. Production of peneplain in the Interior plateau and mature to post-mature erosion surface in bordering mountain ranges (old upland erosion surface). Coarse-textured topography in Interior plateau and finer-textured in Coast range. Climate becoming cooler. Drainage well organized.

"(14.) Differential uplift of epeirogenic character in late Pliocene or early Pleistocene. Uplift slow enough for antecedent streams, some of whose courses were inherited from a Cretaceous peneplain to maintain their general courses. Pre-glacial erosion with deep incision of Pliocene drainage within the upland surface (youthful valleys). Drainage, therefore, antecedent from Pliocene and rejuvenated.

"(15.) Pleistocene glaciation. Arctic climate with milder interglacial period. Cordilleran ice-cap softened the contours of the old upland topography; steepened the slopes of the youthful

* C.G.S., 1912, page 149.

valleys and left on its retreat much morainic and outwash material. (Admiralty period of Pacific coast.) Followed by slight subsidence with deposition of clay-silts in lakes.

"A recent advance of valley glaciers (Vashon period of Pacific coast) is recorded which further modified the youthful valleys and supplied considerable till and outwash material. Followed by alluviation and deposition of much gravel, sand, and silt.

"(16.) Post-glacial erosion cycle. Uplift. Excavation of valley-fill by meandering river into river terraces. Incision of canyons, gorges, and ravines.

"(17.) Recent river deposits, landslides, and mud-creeps. The Interior Plateau climate is dry with extremes in temperature; while in the Coast range it is humid and temperate."

OPERATIONS.

In reviewing the operations carried out in District No. 3 during the past year under the heads of the different Mining Divisions, it may not be out of place to state the fact that this district at the present time stands lowest in the output of metalliferous products. This has no doubt been due, to some extent, to difficult transportation conditions. These have been ameliorated to a considerable degree by the building of the Canadian Northern Railway, the Pacific Great Eastern Railway, and the Kettle Valley Railway, but development-work in connection with the mineral resources of the district is still in its embryonic stage, although distinctly encouraging.

The duties of the Resident Engineer have consisted to a large extent in investigating whether conditions in new prospecting areas warranted Government assistance in the matter of trails and roads for the purpose of encouraging development-work wherever indications were promising. In this connection a considerable amount of work has been done, the results of which were not considered sufficiently interesting to incorporate in this report.

In the following notes in some cases advantage has been taken of information furnished by the Mining Recorders of the district, and also of reports by other authorities.

CLINTON MINING DIVISION.

The area covered by this Division consists largely of Tertiary volcanics underlain on the west by highly tilted Cretaceous rocks which themselves overlie the granitic intrusives of the Coast Range mountains. The metalliferous production to date has been very limited, but reliable reports of promising copper discoveries west of Chilko lake have recently come in.

The results of prospecting-work in this Division generally point to a future in products which are probably due to the alteration of the basic volcanic rocks which predominate in this area—chromite, epsomite, magnesite, and sodium carbonate.

SCOTTIE CREEK.

Chrome-Iron Deposits. These comprise two claims—the *Iron King* and *Iron Queen*—which are being operated under bond by Stewart & Calvert, of Oroville, Wash., who also hold other claims adjoining under locator's licence. The property is situated on the west bank of Chrome creek, about half a mile from its junction with Scottie creek, a tributary of the Bonaparte river. The distance from Ashcroft is approximately twenty-one miles, seventeen of this being on the Cariboo road, running from Ashcroft to Clinton. At the time the mine was visited (April, 1918) it was reached by a trail four miles in length, running up Scottie creek from the 17-Mile on the Cariboo road; during the past summer, however, the operators have completed the construction of a wagon-road to take the place of the trail.

The chromite occurs, associated with serpentine, in a peridotitic belt apparently about a quarter of a mile in width, striking north-easterly and running along the west bank of Chrome creek. In going up the trail along Scottie creek from the Bonaparte river wide belts of limestone and argillite are passed. These probably belong to the Cache Creek group, so that the peridotitic belt in which the chromite occurs apparently lies between Tertiary volcanics on the east and the Cache Creek formation on the west.

On page 285, Minister of Mines' Report for 1915, there is a report on this property by W. M. Brewer, from which the following extract referring to the *Iron King* claim is taken:—

"The most important of these outcroppings shows on a point between two gulches, and a crosscut trench 20 feet long and about 6 feet deep has been made across a bed of fairly solid

ore about 3 feet thick, dipping to the north; but sufficient work has not been done to permit of any estimate being made as to extent of the deposit. A sample was taken by the writer of selected ore from the dump of several tons at the entrance to the open-cut. This assayed as follows: Chromium, 22.6 per cent., equivalent to 33 per cent. chromic oxide."

From the date of Mr. Brewer's report the property remained idle until early in 1918, when the present operators started development-work, employing a small staff of men during the year.

At the time of my visit in April the ore-dump at the open-cut referred to in Mr. Brewer's report had been increased to approximately 100 tons, and from a new open-cut about a quarter of a mile farther to the east, on the *Iron Queen* claim, approximately 150 tons of ore had been extracted. This was sampled, and gave on assay at the Provincial Assay Office: Chromic oxide (Cr_2O_3), 22.50 per cent.; silica, 27.2 per cent. The owners claim much higher values than the above figures would indicate. The workings are at an altitude of about 2,900 feet.

Since the above-mentioned examination was made a tunnel 40 feet in length has been driven in the *Iron Queen* claim, and it was stated by the management that a total of 500 tons of shipping-ore has been mined, but no shipments have yet been made.

About a quarter of a mile to the north-east of the working last mentioned there is an occurrence of chromite ore, of which a sample was taken across 13 inches, and which gave on assay: Chromic oxide, 24 per cent.; silica, 35 per cent.

MAGNESIUM SULPHATE (EPSOM SALTS).

One mile and a half south of Clinton, on the east side of the Cariboo road, is a small lake, area not calculated, but in the neighbourhood of 12 acres. In the summer-time this evaporates to dryness, leaving a crust of practically pure magnesium sulphate 4 to 6 inches thick; this is underlain by a quantity of less pure material several feet in thickness.

During the past year Stewart & Calvert, of Oroville, Wash., have been operating the property, and up to the end of the year had shipped 150 tons of the purer surface crust over the Pacific Great Eastern to different points in the United States, leaving about 2,000 tons in storage at the lake. Since the beginning of the present year, 1919, shipments have been continuous, including a considerable amount of the more impure material which was sent to their refining-works at Oroville for treatment. The material is removed from the lake by the use of picks or bars, shovels, and barrows.

SODA LAKE OR RED ROCK LAKE.

Situated about three miles west of the 70-Mile House on the Cariboo road. This lake, which has an area of 100 acres, contains in solution sodium carbonate to the amount of 6 per cent. by weight. The total amount of solution has not been estimated, but the lake appears to be rather shallow in depth. Its altitude is 3,700 feet. There are other smaller lakes in the vicinity of a like nature.

The owners of the mineral rights are the Pacific Coast Contractors, Limited, Vancouver. During the past year this company installed an evaporating plant having a capacity of 2 to 3 tons of crystal soda in ten hours. This was operated during the latter part of the season and 20 tons of crystal soda was shipped. The plant has been closed down for the winter. This property is only three miles from the Pacific Great Eastern Railway.

MAGNESITE.

During the past year considerable interest has been manifested in the magnesite-deposits of this Division, for the reason, no doubt, that the early completion of the Pacific Great Eastern Railway will bring occurrences of this nature within the category of commercial possibilities. Although the writer has had no opportunity of making an examination of any of the occurrences mentioned, there is no doubt of the existence of very promising prospects of this material, as evidenced by the standing of those interested in their development.

Near the 105-Mile House on the Cariboo Road is a hydromagnesite-deposit within three-quarters of a mile of the line of the Pacific Great Eastern Railway. This is referred to by Dr. Dawson in the C.G.S. Report for 1898. The present owner is E. A. Carew-Gibson, Vancouver.

Near the town of Clinton C. E. Cartwright, of No. 445 Granville street, Vancouver, is developing a magnesite prospect, of which he writes under date of October 25th as follows:—

"Our progress has been much slower than expected, due to the depth of drift covering and the fact that for the greater portion of the time we have only employed one man. The indications

are good and have improved greatly during the last two weeks. We are now getting plenty of small angular pieces of white and grey crystalline magnesite in a tunnel being driven on the *Anzac* claim, half a mile south-east of the town of Clinton. I hope to be able to prove that there is a bed of solid magnesite several hundred feet wide in the mountain-side above the snow-white deposit in the valley bottom."

About fourteen miles west of the 59-Mile on the Cariboo Road is a large deposit favourably reported on by Dr. Hodge, of the University of British Columbia. L. Reinecke, of the Geological Survey of Canada, has examined these occurrences during the past summer, and will no doubt have something interesting to say of them in the C.G.S. Summary Report for 1918.

LILLOOET MINING DIVISION.

CADWALLADER CREEK AREA.

The most important producing area at the present time in this Division is the Cadwallader Creek gold-bearing zone. W. M. Brewer, in his report on the Lillooet Mining Division, appearing in the Minister of Mines' Report for 1913, devotes fourteen pages (253-266) to this particular district, giving comprehensive reports on all the properties working at that time, which were considerably more in number than have been in operation during the past two years.

In the 1915 C.G.S. Summary, page 75, there is a report by C. W. Drysdale on the Bridge River map-area, discussing the geology of the district and giving reports on the *Coronation* and *Pioneer* mines. In the "economic geology" section of this report and referring to the Cadwallader gold occurrences, Dr. Drysdale states:—

"The main mineralized belt was found to occupy the western flank of the Ben d'Oro mountains, forming an arc concave toward the centre of the mass. This arc corresponds to a part of the western limb of the Bridge River anticlinal dome which is compressed against the Coast Range batholith and intruded by steeply dipping cupola stocks and tongues of granodioritic rocks. The ore-deposits appear to be genetically related to these younger intrusives and are found in the cover-rocks of the underlying batholith. The gold-quartz deposits are confined mainly to the Cadwallader diorite, which has proved, because of its hard, compact, homogeneous nature, to be physically a good formation to preserve regular and persistent fault-fissures. The fissures have served as channels for the heated alkaline carbonate solutions containing gold, which were given off during the later stages of batholithic invasion and consolidation. At certain localities in the fault-fissures where temperature, pressure, and other physico-chemical conditions were favourable, free gold was deposited from solution to form ore-shoots."

In the 1916 C.G.S. Summary, page 47, further references are made by the same authority to the *Pioneer*, *Coronation*, and *Lorne* mines.

This district was visited during the latter part of November, 1918. There was a considerable amount of snow in the neighbourhood of the working mine, the altitude being about 3,900 feet.

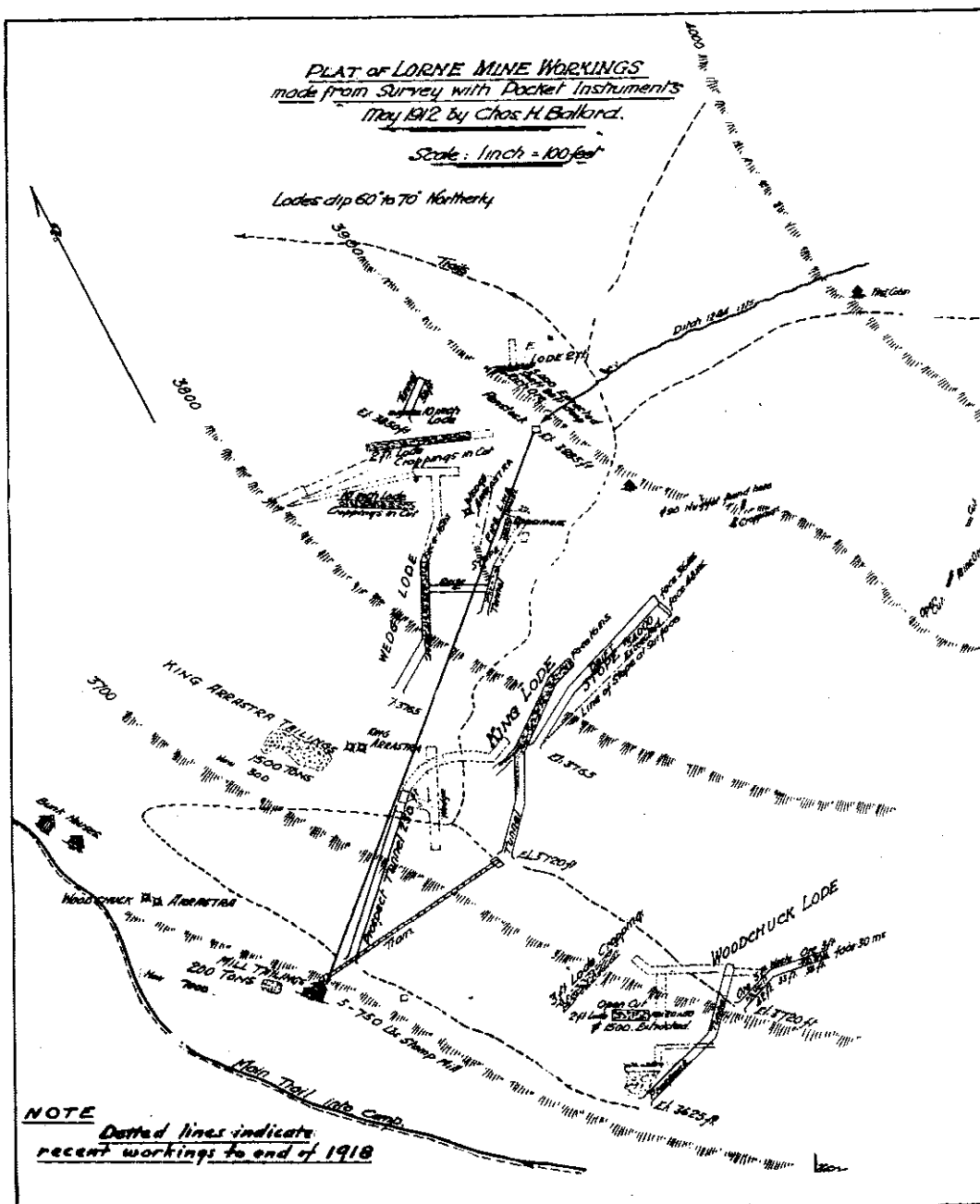
This mine is situated on the north side of Cadwallader creek, camp on south side, fifty-four miles by wagon-road from Mission Station, on the Pacific Great

Pioneer. Eastern Railway, on Seton lake. The registered office of this company is at No. 432 Richards street, Vancouver. The mine superintendent is J. F. Widen, Lorne Mine Post-office. The general equipment consists of: One 6- x 8-inch Jenkins double-cylinder hoist, good for 400 feet depth, working a 1-ton automatic-dumping-skip; one 8- x 10-inch jaw-crusher, No. 5 Brandt mill (Chilian type), capacity 1 ton an hour through 40-mesh screen, with Challenge feeder; one double-deck Deister concentrating-table for tailings from amalgamating-table; two compressors, Ingersoll-Rand, 3-drill capacity each. The reduction plant is operated by a 190-horse-power turbine-wheel supplied by water from a flume which taps Cadwallader creek about a quarter of a mile above the mill. This wheel also supplies power for running a sawmill and a dynamo for lighting purposes around mill and camp.

During the year 1918 the main shaft was continued to a depth of 208 feet from the collar, being 80 feet below the previous lowest workings. A short crosscut to the north was run in to catch the vein and drifts started east and west; at the date of examination (November 19th) the east drift had reached a distance of 40 feet from the shaft and the west drift a distance of 80 feet from the shaft, the vein showing strong throughout, and the values said to be as good as any previously encountered in the mine. This vein is really composed of two veins, Nos. 1 and 2, which run together, forming one vein, as shown on the 200-foot level for a distance of 60 feet to the west and 40 feet to the east of the shaft, separating on the east side at an angle of 10 degrees

and crossing on the west side and diverging at an angle of 8 degrees; both are of pay value. No. 2 is supposed to be older geologically and of somewhat higher value than No. 1. Milling was suspended from July 21st to October 13th to allow shaft-sinking operations to be carried on.

On November 17th fire destroyed the hoist-house and blacksmith-shop, which again stopped production for some little time. Gold produced during the year to November 16th amounted to 1,925 oz. It was estimated another 500 oz. would be produced by the end of the year.



Lorne. Owner, Arthur Noel, Lorne Mine Post-office. This mine is situated three miles north-west of the *Pioneer* mine, in the widest part of the Cadwallader diorite-belt, on the north side of Cadwallader creek and about fifty-one miles by wagon-road from Mission Station. The property is fully described in the report by Mr. Brewer previously referred to, and in which nine distinct ore-bodies are mentioned as occurring on this property. The deposit might be classified, not improperly, as a *stockwork* system, as other veins have been opened up since Mr. Brewer's examination was made. The reduction equipment is very simple, consisting of a 5-stamp (750-lb.) sectional battery, small crusher, and amalgamating-table. Power is supplied by a 30-horse-power Pelton wheel. There is also about 500 feet of tram-track laid for conveying ore to mill-bunkers.

During the past year, on account of the scarcity of labour, operations were confined to development-work only, and 380 tons of ore was milled from this source, yielding 192 oz. of gold and 37 oz. of silver. The results from this development were very promising, some of the faces where the veins had pinched opening up again into pay-ore, surface-trenching also uncovering new leads. In the face of a crosscut from the drift on what is called the Wedge lode a lead was struck carrying strong mineralization having a grey metallic appearance. A sample of this was taken and sent to the Provincial Mineralogist for assay; the grey mineral was classified as arsenical pyrite, the sample going 1.16 oz. of gold to the ton. This occurrence is different from the free-milling ore of the district and is deserving of further investigation.

Coronation.—(See report by Provincial Mineralogist, 1910; also Mr. Brewer's report, 1913.) This property has not been operating since the summer of 1917.

Ida May. This property lies to the west of and adjoins the *Coronation* mine. In Mr. Brewer's report of 1913 he states that no work had been done since his examination in 1901, when there was a total of 278 feet of development done on two distinct veins. Samples taken by Mr. Brewer in 1901 gave: From upper vein across 2 feet, \$23.20 in gold a ton; a grab sample from dump, \$6 a ton; a sample from lower vein across 3 feet 6 inches, \$3.20 in gold a ton.

Recently F. A. Brewer, of Vancouver (not the Mr. Brewer whose reports are quoted), acquired the property, and during the past summer installed a small reduction plant consisting of a jaw-crusher, a Huntington mill of 10 tons per 24 hours capacity, and amalgamating-table, the power being furnished by a 10-horse-power gasoline-engine. A trial run was made and the work closed down for the winter. It is the intention to resume operations in the spring. The development-work now stands as follows: Upper workings, 500 feet incline and drifts; lower tunnel crosscut, 100 feet; drifts 80 feet east and 30 feet west. Ore will be taken from lower tunnel.

Wayside. This mine is situated on the north side of Bridge river, forty miles by wagon-road from Mission Station, on the Pacific Great Eastern, being operated by D. C. Paxton with a force of two men. Work has consisted in continuing the main adit referred to in Mr. Brewer's report; this had reached a distance of approximately 700 feet in the month of November, but no developments of particular interest were reported.

The above-mentioned four properties are the only ones on which work of any magnitude has been carried out during the past two years in the Cadwallader diorite-belt. I have not in my possession figures as to the total amount of gold produced from this district since work first began, but it must have reached a fairly large figure. This fact taken in conjunction with the favourable reports by eminent geologists and the encouraging results from the rather casual nature of the prospecting-work so far carried out, makes it difficult to understand why development on a broader scale than that hitherto carried out has not been undertaken. No doubt transportation difficulty has been to a large extent responsible for this condition, the distance now that the Pacific Great Eastern is operating still being over fifty miles by wagon from the nearest station on the railway to the centre of mining operations.

Arlo Group. Three claims owned by Davidson & Marquis, Lorne Mine Post-office. Situated on south bank of Bridge river about one mile below Gun creek. Conditions did not allow of this property being visited. The following information was furnished by Mr. Davidson: A well-defined ledge running in a southerly direction; a tunnel on same 25 feet in length; width of ledge at portal 5 feet; 14 feet from tunnel ledge is 10 feet in width; balance of tunnel all in ore; width of ledge not determined.

A sample of the ore was sent to the Department of Mines, Ottawa, for investigation, and the following description of it was returned to Mr. Davidson: "Altered basic rock with veinlets and scattered particles of nickeliferous iron sulphides, a small amount of quartz, and a green chromiferous silicate which may be altered to or identical with malachite." The percentage of nickel was not given in this return, but another and larger sample was sent for a more complete analysis, the results from which had not been received at the time of the interview with Mr. Davidson.

Copper Mountain. Situated on Gun creek. A certain amount of work consisting principally of open-cutting was carried out on this property during the year. Charles Cammell, British Columbia representative of the Geological Survey of Canada, made an examination of the property during the past summer; his report will no doubt appear in the Annual Summary for 1918. The following table of distances along the Bridge River wagon-road from Mission Station, on the Pacific Great Eastern, Seton lake, may be useful to intending travellers in the Bridge River district: Mission to Rexmount Post-office, 18 miles; Mission to Tyaughton creek, 28 miles; Mission to Gun creek, 38 miles; Mission to South fork of Bridge river, 42½ miles; Mission to Lorne Mine Post-office, 50½ miles; Mission to Pioneer mine, 53½ miles.

TENQUILLE CREEK AREA.

Tenquille creek is a small stream emptying into the Birkenhead river from the west at a point on the latter stream about nine miles from where it diverges from the line of the Pacific Great Eastern Railway at Mile 71 from Squamish. The area in which claims have been staked is situated in the vicinity of the headwaters of the Tenquille, about six miles from where it joins the Birkenhead.

The claims are reached by taking the wagon-road from Pemberton Station up the Lillooet river for a distance of fifteen miles to McLeod's Crossing. The Lillooet is crossed by canoe, pack-horses wading at low water. From here a rough trail leads up over a saddle-back in the divide between Tenquille and Lillooet rivers, rising from an elevation of 750 feet at the Lillooet to 5,500 feet where it crosses the divide. The total distance from Pemberton by this route is approximately twenty-seven miles to the centre of the claim area. This is a difficult route, the trail in one five-mile portion rising on an average grade of about 18 per cent.

During the past year a new route was located, starting from Mile 71 on the Pacific Great Eastern Railway and following the Birkenhead river to the Tenquille creek; then up this creek to the claims. A portion of this trail has been constructed and completion will probably follow in the spring. This trail when completed will bring the claims within fourteen miles of the railway, over a wagon-road grade, or approximately half the distance of the present route. Very little development-work has been done in the area on account of the difficulty of getting in supplies.

The following extract referring to this locality is taken from the C.G.S. Summary Report for 1917, Part B. The report is made by Mr. Cammell from notes taken by Mr. Hanson during an examination of the district:—

"The rocks of this locality consist of conglomerate, sandstone, slate, limestone, and schists cut by a number of dykes and sills of quartz porphyry and granodiorite porphyry, probably apophyses from an underlying batholith of granodiorite. The deposits are associated with the porphyry dykes and are situated either in them or on their contacts with limestone or schists, and the chief values are in copper, with less amounts of gold and silver.

"On the *Eva* group, owned by Phil White, the ore, which is 6 feet wide, occurs as a replacement of siliceous, sericitic schist along the border of a dyke of quartz porphyry, and contains chalcocite, pyrite, and some zinc-blende and bornite. Surface assays of the ore are said to have yielded as much as 8 per cent. of copper.

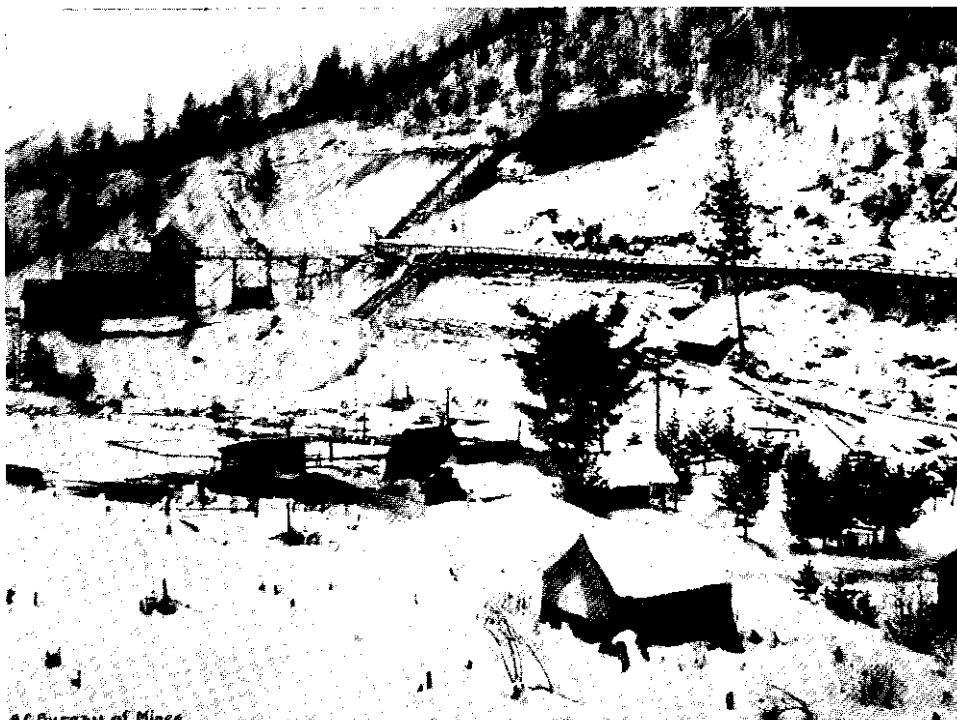
"On the two groups adjoining the *Eva* group—namely, the *Regal* and *Copperplate*—the ore occurs in shear-zones 4 or 5 feet wide in quartz porphyry, and the mineralization is by chalcocite, pyrite, and zinc-blende. On these three groups the development-work consists of open-cuts and shallow pits.

"Situated a few miles south of the *Eva* group, on the ridge between Lillooet valley and Tenquille creek, at about 6,800 feet elevation, are a number of other claims owned by McLeod. The ore here appears to be the indefinite contact-metamorphic type in limestone on the borders



B.C. Bureau of Mines.

Lorne Mine, looking East, Lillooet M.D.



B.C. Bureau of Mines.

Pioneer Mine, looking Across and Down Cadwallader Creek.

of a granite porphyry. Mineralization is mainly by magnetite and some chalcopyrite over a zone from 8 to 50 feet in width. Here also the development-work consists of open-cuts and shallow pits."

Referring to the *Eva* group mentioned in the above extract, the writer took a sample across 4 feet 6 inches at the bottom of an open-cut at a depth of 12 feet vertically below the surface; this gave on assay at the Provincial Assay Office: Copper, 2 per cent.; silver, 0.80 oz. a ton; gold, trace.

This group comprises four claims and is owned by T. Lewis, of Vancouver.

Thelma Maud Group. These are situated on a high ridge lying to the north of Tenquille creek, between it and the Birkenhead river. The side sloping toward the Birkenhead

river is very steep and precipitous from the top of the ridge downward for a vertical distance of nearly 2,000 feet; continuing toward the river the slope is more gradual, although still fairly steep, the surface being made up of the talus broken away from the bare rugged face of the ridge referred to. The country-rock is the schist mentioned in Mr. Camsell's report. At several places in this exposed face appear zones of mineralization in which chalcopyrite predominates, the general direction of strike being vertically up and down the face. One of these showing the best exposure was followed up the face for a distance of approximately 1,500 feet. It appeared to consist of a mineralized parting in the schist, carrying fairly high-grade chalcopyrite running in width from a knife-edge up to 6 inches. From this parting in places the mineralization extends with more or less persistency into the country-rock. As no work had been done on this property, no samples were taken.

LILLOOET LAKE.

An examination was made of some of the properties lying on the south side of the west end of Lillooet lake. The formation here is described by Camsell as consisting of quartzite, argillites, limestone, and schists. Samples were taken from several of the properties, but as assay results were not promising a description would be of little interest.

Situated on the east side of Owl creek and operated by Copper Queen Mining and Smelting Company. A full report by W. Fleet Robertson, Provincial Mineralogist, is given in the Minister of Mines' Report for 1916, page 270. Geology by Camsell in C.G.S. Summary Report, 1917, Part B, page 19b. A small amount of development has been carried out since Mr. Robertson's report.

A considerable amount of prospecting-work is going on in the vicinities of Lillooet lake, Birkenhead river, and Owl creek.

KAMLOOPS MINING DIVISION.

Iron Mask. Kamloops. Situated about seven miles in a south-westerly direction from the city of Kamloops. This is the only mine in District No. 3 operating a reduction plant of any magnitude. In the Minister of Mines' Report for 1915 there is a comprehensive report on this property by W. M. Brewer, giving a description of the geology, underground workings, surface equipment, power-installation, and transportation arrangements at that date. The following information was supplied by the superintendent, A. E. Wallinder: The management, transportation system, and general power arrangement remain the same as at the time of Mr. Brewer's report referred to. During the past two years a considerable amount of underground development has been carried out, as well as approximately 8,000 feet of diamond-drilling. From the 750-foot level of the *Iron Mask* claim a raise has been put up to connect with the 300-foot level from the *Erin* shaft. This raise is about midway between the two shafts, which are 1,500 feet apart, and serves as an outlet for the ore from the *Erin* claim, which is taken along the 750-foot level to the *Iron Mask* shaft and hoisted to the concentrating plant.

The diamond-drilling was carried out from the 750-foot level for the purpose of locating the original *Iron Mask* ore-body, which was cut off at the 690-foot level by a horizontal fault (see Mr. Brewer's report); this has been located and development-work is being directed toward opening it up.

The water-concentrating plant described in Mr. Brewer's report has been entirely discarded in favour of a "flotation system." During the year 1917 a plant having a capacity of 150 tons gross in twenty-four hours was installed. This proved so satisfactory that another unit of like capacity was added early in 1918. Each unit is comprised of a jaw-crusher, Macey ball-mill,

three rougher Callow cells, one Callow finishing-cell, Dorr classifier, and Dorr thickener; and for the two units a settling-tank, Oliver filter, and storage-tanks for the liquor from the settling-tank, making a closed circuit for the oil-impregnated water. The whole plant is electrically operated, power being supplied by the city of Kamloops light and power plant.

The concentrating plant has not been operated to full capacity during the year 1918, the total shipments of copper concentrates amounting to approximately 2,800 tons. The power-consumption for the year was approximately 1,400,000 kilowatt-hours.

(See report by W. M. Brewer in Minister of Mines' Report, 1915, page 221.)

Lydia Group. This property is situated on Canyon creek, a tributary of and flowing northerly into the North Thompson river, and is approximately seven miles south of Birch Island Station, on the Canadian Northern Railway. The altitude of the workings is, roughly, 5,700 feet, the creek directly below being about 5,200 feet, and Birch Island, on the Canadian Northern Railway, 1,360 feet. The property now comprises a block of fourteen claims and is being operated for New York interests under the direction of R. H. Stewart and management of P. W. Racey, both of Vancouver, No. 736 Granville street.

The country-rock generally appears to be of the nature of a chloritic schist cut by porphyritic and other types of igneous dykes and probably belongs to the Pre-Cambrian Adams Lake series. On the west side of the creek a zone of mineralization consisting principally of chalcopyrite associated with iron pyrite is exposed for a considerable distance along the steep face of this west bank, striking in a S. 40° W. (mag.) direction and dipping to the north-west (mag.). The object of the development-work now being carried out is to determine values and quantities in this mineralized occurrence.

During the past year a considerable expenditure has been made and a large amount of work accomplished, a good deal of the latter being of a preliminary nature. A trail seven miles and a half in length has been constructed from Birch Island. This is wide enough to allow a narrow-gauge wagon or sleigh to be used, so that transportation can be carried on throughout the year. A new camp has been built at the foot of the hill large enough to accommodate twenty men, and consisting of bunk-house, cook-house, compressor building, office, oil-house, and tool-shed, also blacksmith-shop at the workings. A compressor plant operated by gasoline-engine of 2-drill capacity has been installed, which gives a pressure of 80 to 100 lb. a square inch at the machine. A complement of eighteen men working on two shifts is employed.

Two tunnels are being run on the ore-body. At the end of the year the figures on development-work were: No. 1 tunnel, 220 feet drifting, 63 feet crosscutting; No. 2 tunnel, 270 feet drifting, 52 feet crosscutting, and 62 feet of raising.

Queen Bess Mines Co. President and manager, O. A. Thomas, Hoge Building, Seattle; resident secretary, C. E. Max, Kamloops, B.C. The property being operated under bond by this company comprises six claims situated on the east side of the

North Thompson river and adjoining the Canadian Northern Railway track about two miles south of Blackpool Station. The claims are situated on the steeply inclined westerly face of the mountains which flank the east side of the North Thompson valley at this point. At the time this property was visited (January 19th, 1919) there was a considerable amount of snow on the ground, so that surface conditions could not be investigated. From evidence furnished from the underground work so far carried out, the country-rock appears to be a fine-grained compact greenstone, in which are fissures carrying a mixture of galena (silver-lead) and zinc-blende in a quartz and quartz porphyry gangue.

At an elevation of 1,000 feet above the valley a drift-tunnel (No. 2) has been run on a vein having a strike of approximately N. 28° E. (mag.). This vein varies in width from 2 to 6 feet, the latter being the width now showing in the face. The length of the drift or tunnel is 100 feet, but the vein is said to have been traced on the surface for over 350 feet.

At a vertical distance of 270 feet below No. 2 tunnel a crosscut working-tunnel running in a direction N. 70° E. (mag.) has been driven to intersect the vein at an estimated distance of 375 feet from the portal. At the time the examination was made this working-tunnel was in a distance of 265 feet, and at 235 feet a small fissure was passed through carrying mineralization similar to that in the upper workings, but it was believed that the main No. 2 lead had not been reached.

At 180 feet from the portal in the working-tunnel a fissure was intersected having the same strike as that referred to as No. 2, and dipping north-westerly about 70 degrees. This crosses

The power is supplied by a boiler burning wood or coal of sufficient capacity to take care of a small compressor plant when it is thought advisable to install one. A considerable amount has been expended in camp buildings, consisting of superintendent's house, office, large rooming-house with dining-room, kitchen, and reading-room, also several cottages for married quarters. The concentrating plant started operations early in February, 1919.

Situated three miles west of Adams lake, on the north side of Pass creek.

Homestake. (See Report of Minister of Mines, 1917, page 221.) This property has recently been bonded to Eastern interests and is being developed under the local management of H. D. Cameron, Blucher Hall Post-office, B.C. A camp capable of accommodating a dozen men has been erected and hand-development is now proceeding, with, it is said, satisfactory results.

Situated on the west shore of Adams lake, about fourteen miles above Adams Lake Post-office; owner, George L. Breeden, Kamloops. The mineralization on this claim is with zinc-blende. It occurs in a bed of the Pre-Cambrian Tshinakini limestone of the Adams Lake series. The occurrence can be traced along the shore of the lake just above the water-level for a considerable distance; it appears to dip to the north-west away from the lake at an angle between 10 and 15 degrees. An open-cut which was started as a shaft to test the depth of the occurrence, but which was really crosscutting the mineralized bed, shows it at this point to be about 5 feet in thickness. A sample taken across 18 inches next the foot-wall, and which was much more highly mineralized than the overlying portion, gave on assay at the Provincial Assay Office 22 per cent. zinc. Practically no work has been done on this claim. The ore would be easily amenable to concentration.

Situated on Seymour river. (See report by W. M. Brewer in Report of Minister of Mines, 1913, pages 202-203.) On account of the Granby Company doing a very considerable amount of exploratory work on these properties the Government assisted in the construction of a trail from the head of Seymour arm. During the season this was completed, with the exception of about two miles, which will no doubt be finished in the spring. Diamond-drilling was carried on during the past summer, and it is intended to resume operations again when weather conditions are favourable.

Copper King and Camp *Mavine Group.*—Situated on north shore of Kamloops lake. (See report by W. M. Brewer, Minister of Mines' Report, 1915, page 216.) Very little work has been done on this property during the year. About 20 tons of ore was shipped.

McLeod Groups. *Tenderfoot.*—Situated near Copper creek, on north shore of Kamloops lake. (See report by W. M. Brewer, Minister of Mines' Report, 1913, page 196.) A small amount of development-work has been done on this claim during the past summer. No ore was shipped.

Situated about ten miles east of Louis Creek Station, Canadian Northern Railway, near Blucher Hall Post-office; owner, G. N. Richmond, of Philadelphia. The ore on these claims is an iron pyrite, said to contain small amounts of metals of the Platinum group, although some assayers to whom samples were submitted could not get results, others claimed returns of 0.2 to 0.3 oz. of platinum a ton. Early in the year two car-loads of the ore was shipped to Republic, Wash., for treatment. The returns from this shipment are not available. No work has been done at the mine since the shipments referred to were made.

Fortuna Group. Situated on Cherry bluff, near Cherry Creek Station, Canadian Pacific Railway, on south shore of Kamloops lake. Although this property has not been worked for a considerable number of years, in view of the interest that is being taken in the matter of the iron-ore resources of the Province a few notes on it may not be out of place. This property was reported on by Dr. G. M. Dawson as far back as 1877, by McEvoy in 1892, and again by Dawson in 1894. Of more recent date is a report by W. M. Brewer appearing in the Report of the Minister of Mines, 1913, page 184.

On September 11th, 1918, a visit was made to this property, but conditions were not favourable for a satisfactory examination, the shaft in the lower workings near the Canadian Pacific Railway track being full of water and the tunnel at the upper workings being inaccessible, the slide-rock from the open-cut workings above having filled the mouth. From the large number of outcrops observed occurring over and within an area of at least 2,000 feet in diameter, it is obvious that there must be in the aggregate a large tonnage of high-grade magnetite; however,

it would be premature to attempt an estimate of "ore in sight" or "probable ore" before the sizes of some of these lenticular masses, both laterally and in depth, have been proved to some extent by diamond-drilling or some other method of development. Besides the high-grade or clean ore, there appears to be quite considerable bodies of magnetite associated with lime and feldspathic material and mixed with the country-rock which could be cheaply concentrated by magnetic separation.

I think there is no doubt that when the steel and iron industry in British Columbia has reached the stage where local requirements warrant the working of domestic deposits, the Cherry Bluff vicinity will form a not insignificant reserve to meet these demands. A sample was taken across an 8-foot face in the open-cut above the tunnel at the upper workings, and gave on analysis at the Provincial Assay Office: Iron, 61 per cent.; silica, 1.50 per cent.; sulphur, trace.

CINNABAR-MERCURY.

In the C.G.S. Summary, 1912, page 145, the following note by C. W. Drysdale occurs: "In the vicinity of Copper creek, Kamloops lake, occur deposits of cinnabar which have not been worked since 1897. The cinnabar occurs in irregular veins traversing a grey feldspathic and dolomitic rock which readily weathers to a yellowish colour. The country-rock is an altered greenstone containing pyroxene and olivine. The cinnabar is associated with small quantities of stibnite and has a calcite and quartz gangue. The mines have produced over 7,000 lb. of mercury. It is said that 150 tons of ore produced 114 flasks of mercury valued at £900."

During the past summer (1918) an examination of this property was made by Charles Camsell; his report will doubtless appear in the C.G.S. Annual Summary.

ASHCROFT MINING DIVISION.

The only development of interest or magnitude that has taken place in this Division during the year is that in connection with the epsomite or magnesium-sulphate deposits. There has been no development-work done on the copper properties in Highland valley; this condition probably being partially due to the excessive cost of carrying on such work under present conditions. The O.K. mine, the only shipper of any importance, has been closed down during the year.

BASQUE CHEMICAL PRODUCTION COMPANY, LIMITED.

President, George J. Hammond, No. 509 Richard street, Vancouver, B.C. Operating epsomite or magnesium-sulphate occurrences. These comprise five small lakes situated about twelve miles in a south-westerly direction from Ashcroft and three miles and a half by wagon-road from Hammond's Spur, on the Canadian Northern Pacific Railway. No. 1 lake has an area of approximately 8 acres and No. 2 about 3 acres; the other three lakes are not of great importance.

This property was examined on March 8th, 1918, by Charles A. Newhall, of Seattle, Wash. The following extracts are from Mr. Newhall's report:—

"The examination was made on the lakes on March 8th. Considerable snow was on the ground and it was impossible to form an exact estimate as to the extent of the salts, in that we could not distinguish between the mud and the salts. In general the formation of these lakes is similar to the ones that are being worked in the district tributary to Oroville, Wash. The salts occur in pools of varying shapes and sizes; these pools being surrounded by mud-rings. The excavations made on the lakes indicate that the pools carry layers of salts to a total depth of approximately 20 feet, the salts lying in layers and intermixed with mud. These pools are more or less conical in shape, tapering off towards the bottom. In other words, the greatest area is exposed at the surface. Mud to varying depths lies between the pools, and this mud in other lakes has always been found to carry more or less salts.

"On the property examined there were five lakes, lake No. 1 being the largest. Salts were found in lakes Nos. 1, 2, 3, and 4. Only on lakes Nos. 1 and 2 was there apparently any great quantity. In the other lakes there was just a thin layer at the points sampled. However, as indicated above, our examination could not cover the whole surface of the lakes on account of the snow, and it is quite possible that there were more salts in lakes Nos. 3 and 4.

"A test-pit was put down to a depth of approximately 4 feet in lake No. 1 and samples of salts taken in the different layers. A second test-pit was put down in this lake, the salts showing in identically the same formation as in the first pit. One hole was put down in each of the other

lakes. In lake No. 2 there were a number of distinct layers of salts, and referring to the analysis below you will note that there was some variation in composition.

"All these salts are of high quality enough to work up into Epsom salts, in both U.S.P. and technical grade. The salts from lake No. 1 are particularly high grade, and the amount of impurity as shown by the 'other soluble' salts will cause little or no difficulty in refining.

"If the top layer on lakes Nos. 1 and 2 could be worked with before the water from the melting snow dissolves it, these layers would be of a shipping grade as technical salts. All the other layers of salts in all the lakes would have to be worked up in a plant, and should be freed from insoluble matter and the black mud."

Eleven samples were taken by Mr. Newhall, and the analyses of these are given in his report, but only one will be quoted here; this is from "Top layer 5 inches thick, lake No. 1," and is as follows:—

	Sample No. 1. Per Cent.
Insoluble matter	0.76
MgSO ₄	44.58
Water	50.84
Other soluble solids	3.82
Total soluble matter	99.24
Epsom equivalent to MgSO ₄	91.28

The property was visited by the writer on March 20th, when there was 4 inches of liquid solution over the crust on lake No. 1. It was visited again on June 25th, when the liquid had all evaporated and the crust would stand being walked over.

During the year a wagon-road has been constructed from the loading-bunkers erected at the railway siding to the property. A storehouse has been built at lake No. 1, in which 200 tons of the salts are now stored awaiting shipment, and the company is proceeding with the erection of buildings and preparation for putting in a refinery.

CHROMITE.

Six miles north of Ashcroft, on the west bank of the Bonaparte river and adjoining the Cariboo road, Phil Oppenheim, of Ashcroft, staked a claim on which he had discovered chromite. The ground is deeply covered with overburden and the exposure was discovered in a small gulch which has been washed out by freshets. A couple of small pits had been excavated in the side of the gulch, in which chromiferous ore in a serpentine rock showed up. A sample of the ore was sent to the Provincial Assay Office for assay, from which returns were: Chromic oxide, (Cr₂O₃), 10 per cent.; platinum, *nil*. This examination was made in the company of Dr. W. F. Ferrier, of the Munitions Resources Commission, Ottawa, who later had a 500-lb. sample sent to Ottawa for the purpose of having it tested as to its amenability to concentration; these results have not yet been published. *

Snowstorm Group, Highland Valley.—(See Report of Minister of Mines, 1917, page 223.) The Department of Mines has let a contract for diamond-drilling this property. Drilling operations began the latter part of January, 1919.

NICOLA MINING DIVISION.

Practically the only activity in this Division during the past year has been in the line of coal production from the Nicola Valley coalfield. Two coal-mines, the Middlesboro Collieries and the Fleming Coal Company (old Inland Coal and Coke), have been operating. The Diamond Vale Colliery Company has done a small amount of development, opening up a new seam on the southern part of their property. A new tippie has been erected on a spur line from the railway to facilitate shipping from this recently opened seam. There is a full report by W. M. Brewer on the Nicola Valley coalfields in the Report of the Minister of Mines, 1915; this contains extracts from and references to several other reports by recognized authorities on these fields.

ASPEN GROVE COPPER CAMP.

This field covers an area of about eight miles in a north-and-south direction by two to three miles in an east-and-west. The centre of the area is approximately twenty-four miles by wagon-road south of the town of Merritt. There are 150 claims in good standing, of which sixty are

Crown-granted. This district first came into prominence about 1900, since which time there has been spasmodic attempts made at development, but no really serious work has been accomplished as yet. The mineralization is widespread and consists principally of chalcocite scattered through the volcanic country-rock, with considerable amounts of native copper in places. In a few places shafts have been sunk on fractures carrying high-grade ore consisting of native copper and chalcocite, probably largely the result of secondary enrichment. Shipments have been made from these workings, but the aggregate tonnage has not been of very great amount. The camp was reported on by W. Fleet Robertson, Provincial Mineralogist, in 1901; by A. A. Johnson, of the Canadian Geological Survey, in 1904; by J. D. Galloway, Assistant Provincial Mineralogist, in 1913; and by W. M. Brewer, M.E., in 1915. The writer spent several days in this district during the month of July. Samples were taken and forwarded to the Provincial Assay Office for assay; these results checked so closely with those published in the reports above referred to that it is considered superfluous to repeat them here, particularly as there has been no recent development-work of importance carried out.

During the past year a company was organized under the presidency of J. E. Bate, of Aspen Grove, for the purpose of consolidating sixty of the claims into one group. An option has recently been taken by Eastern interests on the holdings of this country, as well as on several other groups of claims, with the intention of thoroughly prospecting the ground by diamond-drilling. It is the intention to start operations in the spring.

Donohoe Mines, Stump Lake.—The workings at the *Joshua* shaft were unwatered early in the year to a depth of 300 feet for the purpose of having an examination made by Mr. Leedy, of Seattle. No further developments have been reported.

Mary Reynolds.—R. R. Hedley, of Nicola, has secured an option on this property and has been taking out ore and doing some development-work on the 45-foot level. Last reports mentioned 80 tons of ore on the dump, but no shipments made.

Owner, Oscar Schmidt, Nicola. Situated about ten miles slightly west of north from the town of Nicola, at an elevation of approximately 5,000 feet. Near the south-west corner of the claim is an outcropping of limestone striking in an easterly direction, but which gradually trends north until near the north-east corner of the claim the strike is in a northerly direction. Surface conditions prevented the ascertaining of the width of this limestone. The country-rock on the concave side of the outcropping limestone has the appearance of an altered diabasic rock carrying considerable amounts of epidote and calcareous matter, and has been classified in the field by some observers as an altered limestone. This country-rock carries disseminated through it considerable amounts of iron pyrites associated with chalcopyrite, in some places segregations occurring of sufficiently high value to be classified as ore.

A shaft has been sunk to a depth of 50 feet on the contact between the limestone and the country-rock; this was full of water when the examination was made, but was said to show the limestone dipping away from the concave side at an angle of about 80 degrees. A considerable amount of bornite and chalcopyrite was encountered at the contact during the sinking of the shaft. A sample taken across 15 feet of surface rock, about 300 feet from the limestone-outcrop, gave on assay at the Provincial Assay Office: Copper, 0.80 per cent.; silver, trace; gold, trace.

The first work done on this claim was in exploiting a body of ore which occurred near the north-east corner. A shipment was made from which 4.5 per cent. copper was returned; the property was then bonded and a diamond-drill put to work; the results from this went to show that this ore-body was simply an inclusion of very limited size, occurring in a trap-flow which in itself was barren.

Several claims have been staked in the neighbourhood of the *Lucky Mike*, on which showings of copper ore occur.

YALE MINING DIVISION.

This group is being operated by the Emancipation Mining Company, Limited; registered office, Room 502, Credit Foncier Building, Vancouver; manager, William Thomson, Hope, B.C. It is situated on the north-west side of the Coquihalla river and Kettle Valley Railway, about fifteen miles from the town of Hope. This property was visited on May 13th, 1918. In the Report of the Minister of Mines, 1915, page 257, Mr. Brewer gives a description of these claims and discusses the general geological

features. At the time of Mr. Brewer's report the work consisted mainly of open-cuts on a large quartz occurrence carrying low gold values. Mr. Brewer also mentions a narrower quartz lead occurring on the hanging-wall side of the larger vein and on which work had just been started.

Development-work has since been confined mainly to this narrower and richer lead. At the time the mine was visited in May a drift-tunnel had been run on this body for a distance of over 200 feet, exposing lenses of high-grade gold ore associated with arsenical pyrite, in some places the values extending into the wall-rock. Most of the high-grade ore encountered was shipped as the work progressed. The following statement of shipments was supplied by the manager: "1916, 3 tons netted \$1,542. In 1917 C. H. Lighthall bonded the property and shipped 53 tons, which netted \$18,295, afterwards throwing up the bond. Afterwards in the same year Mr. Merrick, the owner, shipped 8 tons and 40 lb., which netted \$2,828.95.

"In February, 1918, a shipment of 401¼ lb., dry weight, of specially selected ore gave gross returns of 462.31 oz. of gold a ton and 87.85 oz. of silver a ton, and another shipment made at the same time of 5½ tons gave gross returns of 34.15 oz. of gold a ton and 6.50 oz. of silver a ton. The total shipments for 1918, as given in recent returns received from the manager, are: Total shipped during 1918, 19 tons, for which the Tacoma smelter gave the following returns: Gold, 458 oz., value \$9,150.82; silver, 79.73 oz., value \$67.98; total, \$9,218.80."

In all the shipments made the relation between the amounts of silver and gold present is in the proportion, roughly, of 1 oz. of silver to 6 oz. of gold. All development-work has been carried out by hand and the ore hand-sorted.

This property is situated in the same mineral belt as the *Emigrant* mine, situated about seven miles north-westerly on Siwash creek. The intervening ground has all been staked and good ore is reported to have been discovered on several of the claims. The country-rock of this mineralized zone may be described generally as slaty argillite, in which occur lenticular or ledge-like occurrences of quartz, with which the gold is associated.

(See Report of Minister of Mines, 1917, page 226.) This property was not **Emigrant Group.** visited during 1918. The Mining Recorder at Yale reports that active development has continued throughout the year under the management of Mr. Wilson. Reduction machinery has been forwarded to the mine, and it is expected that this will be erected and gold production begin during the coming season.

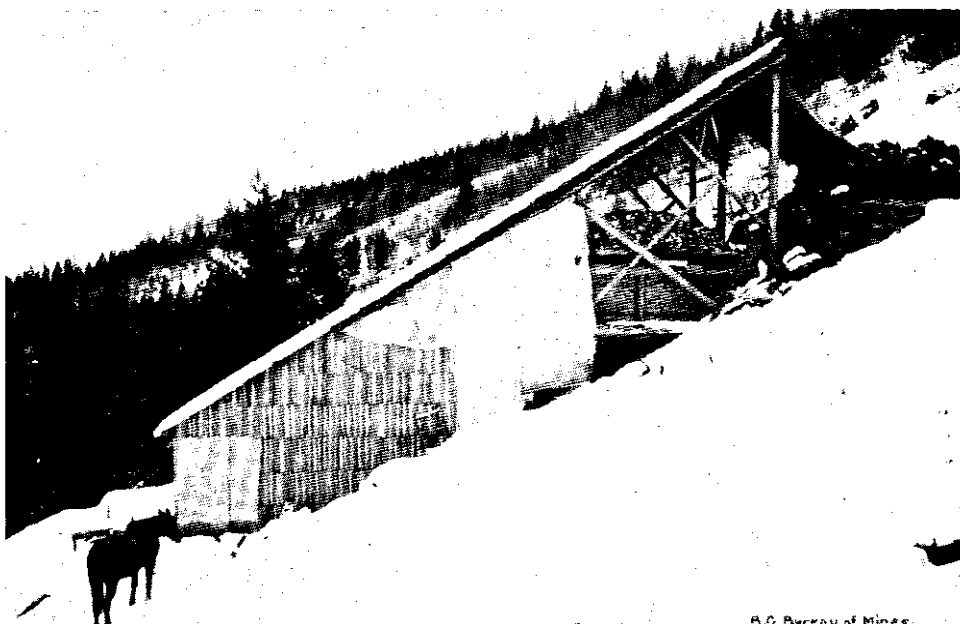
Aufas Gold Mining Co.—(See report by W. M. Brewer in Report of Minister of Mines, 1915, page 255.) This company has not been operating for some little time, but during the summer of 1918 a small staff of men was engaged putting in a cable-tramway from the tunnel to the road.

River Gold Recovery Co.—This company has been operating on a placer proposition on the Fraser river about half a mile below the town of Hope, using a Roberts rotary gold-saving machine for recovering the gold. No returns are available in regard to the results of the season's work.

Considerable prospecting has been going on in this Division during the year and several finds have been vaguely reported, but nothing sufficiently definite has been brought to my notice to warrant further mention.



Queen Bess Mine, looking down North Thompson River.



Ida May Mine, New Mill, looking West.

LILLOOET DISTRICT.

LILLOOET MINING DIVISION.

REPORT OF 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 1918.

MINERAL CLAIMS.

In the Cadwallader subsection of Bridge River section the recovery of gold by mining and milling process, owing to scarcity of labour and other causes, does not quite compare with results obtained in former years; in fact, milling of ore ceased for a considerable period, but was resumed late in the fall. Development-work, however, was maintained throughout the year.

Pioneer Mine.—Shaft was sunk to the 300-foot level; the ledge tapped there was found to be wider and richer than in the upper levels. One sample lot taken from the drift on the 300-foot level yielded \$46.99 in gold to the ton, and 75 tons of ore milled gave a return of \$3,510 in gold. Altogether this mine treated during the season 3,248 tons of quartz and the bullion returns for the year are placed at \$37,921.

Lorne Mine.—This mine has been practically closed the greater part of the working season through the scarcity of labour, except for a short time, during which 380 tons of ore was treated. The stamp-mill has been idle, the management utilizing the limited help in development-work. The work done consisted of tunnel extensions, crosscutting, and upraise, also building addition to tram line.

Ida May Mine.—The operating syndicate erected a Huntingdon mill on the ground, and it is expected that milling operations will commence next season. Some development-work was done, but I have no information as to the character of the work performed.

Wayside Mine.—Work during the past year was confined to extending tunnel No. 4, the face of which is now advanced 700 feet from the portal. Character of ore is not changed, although lenses of good ore have been encountered; the mass of the filling remains non-siliceous. The chief object in driving ahead and following the contact of the No. 4 with the No. 3 ledge is not yet attained, though it is expected to be cut a few feet ahead of present face. The management deserves every credit for its perseverance and staying qualities.

GUN CREEK.

Apart from the annual assessment-work done by the owners of mineral claims in and around Copper mountain and the extension of the trail, commenced the previous year, there is but little to comment upon. I understand that a member of the Dominion Geological Survey visited this section during the year.

TENQUILLE CREEK.

The above remarks apply also to this section. Quite a number of the locations are bonded, and a trail was commenced which will greatly aid in reducing cost of transportation of supplies and be an incentive to development-work.

PLACER-MINING.

Mining leases remained inactive. Golden Dream Company is organizing and intends to resume operations early in 1919. The Lillooet (B.C) Mining Company is planning in the same direction, in view of the cessation of war.

The recovery of gold by the individual miner, including Indians, for the past season is the lowest on record—namely, \$350.

OFFICE STATISTICS—LILLOOET MINING DIVISION.

Free miners' certificates issued	172
Mineral claims recorded	191
Certificates of work recorded	300
Placer claims recorded and rerecorded	5
Mining leases in force	34
Conveyances, etc., recorded	52

Revenue.

Free miners' certificates	\$1,047 75
Mining receipts, general	2,185 75
Tax, Crown-granted mineral claims	816 50

CLINTON MINING DIVISION.

REPORT OF 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, 1918.

During the past year there was probably greater activity in the mining industry than ever before, both in regard to development-work and location of new claims.

In the vicinity of Clinton the Epsom-salts lake, which is embraced by two Crown-granted mineral claims, developed in the hands of the Stewart-Calvert Company, Inc., into a shipping proposition. Four cars comprising 140 tons of salts were shipped direct to distributors for use without treatment of any kind, and about 1,200 tons were collected for shipment to the company's refinery at Oroville, Wash. I understand an estimate places the total of salts collectable from the lake at about 10,000 tons, and that when that quantity is removed this source of supply will be exhausted for many years to come.

The Pacific Coast Contractors, Limited, have erected and put into use, in connection with their soda claims near the 70-Mile House, equipment for the extraction of the soda. I understand that one car-load was shipped and that a further quantity is ready for shipment.

C. E. Cartwright, who during the year staked a large number of claims adjoining the town of Clinton on the east, has been continuously doing development-work on them, and has driven a tunnel facing the town to a depth of about 100 feet. He informs me that he intends to put in a diamond-drill in the future in order to ascertain as quickly as possible the extent of the magnesite-deposit. Mr. Cartwright also has done development-work on his claims near Kelly lake, and will during the coming year continue the work in the expectation of developing a gypsum industry.

The claims on Scottie creek have been worked during the year with a small pay-roll, and upwards of 500 tons of chrome-iron ore has been mined and is ready for shipment.

All the above-mentioned claims are within easy reach of the Pacific Great Eastern Railway and are receiving attention because of the nearness of transportation.

The claims at Chilko lake referred to in last year's report were further developed during the season, but I am unable to say anything as to results obtained.

From the office statistics will be seen that nearly eight times as many mineral claims were recorded this year as compared with the previous year. Several considerable groups of claims were located, three of which are situated in the vicinity of Clinton and one near the northern boundary of the district.

Two of the groups near Clinton and that near the northern boundary were located for magnesite, and the other one, near Clinton, I was given to understand, was a nickel proposition. No development-work has as yet been done on the latter group, which was recorded about July last.

There has been practically no placer-mining activity, owing to some extent to the enlistment of some of the miners. However, one placer-mining lease on Watson Bar creek was applied for, and it is likely that the usual limited activities will be resumed this year.

OFFICE STATISTICS—CLINTON MINING DIVISION.

Free miners' certificates	124
Mineral claims recorded	313
Placer claims recorded and rerecorded	16
Certificates of work	27
Dredging leases in force	14
Placer-mining lease applied for	1
Transfers and agreements recorded	52
Crown grants issued	2

Revenue.

Free miners' certificates	\$ 48 25
Mining receipts	1,155 30
Total	\$1,636 55

CLINTON MINING DIVISION.

NOTE BY PROVINCIAL MINERALOGIST.

HYDROMAGNESITE DEPOSITS.

The following notes regarding these deposits, situated near the 105-Mile House on Cariboo road, have been received from one of the owners:—

The 105-Mile House deposit is estimated to contain about 100,000 tons of hydromagnesite, of which it is considered that 50,000 tons will prove to have a purity equal to the following analysis:—

After heating to a temperature of 100° C.—

Silica	0.76
Magnesium oxide	2.24
Ferric oxide	0.04
Alumina	0.49
Lime	<i>Nil</i>
Magnesium carbonate basic	96.47, equiv. 44.52 MgO.
Ignition loss	50.65

The moisture content will vary from 20 per cent. in the spring and fall to practically *nil* in the summer-time.

The material obtains in a very finely divided form in beds which vary in thickness of composition; in some cases giving only a couple of feet of the purest white material, while in other cases the material remains the same for a depth of 7 feet. As, however, it can easily be bored by means of a post-hole auger, it is not difficult to test for quantity. At a depth of 5 feet water is struck, and this water appears to be very full of gas, but is most palatable. In most cases the hydromagnesite is quite noticeable on the surface of the ground, as it generally shows white, bare surfaces with no vegetation; but I have found at other places it is not observable on the surface, having been covered at a date subsequent to its deposition with a surface wash of alluvial soil. Beneath the fine white material this deposit, in general, shows a yellowish-tinged material of a more granulated form and which appears to hold more impurities.

The Chilcotin deposit appears to be considerably larger in extent, but has not been tested out to any extent.

Although there should be some market for this material in its crude state, the main market seems to be for the calcined product. Owing to this material being in a fine powdered form and very light it was a difficult matter to find a suitable form of calciner to treat the material. We think this difficulty has now been solved, with a resulting product which will be superior to the rock-made article, as it will have a greater purity and a greater uniformity in its calcination, and at the same time be of a finer character. This will place it in a class by itself, far ahead of anything now on the market for the manufacture of sord-cement and kindred processes, and it will be of a sufficient purity to be used for all usual chemical purposes without using the costly process now required to obtain that purity. The use of magnesite flooring, stucco, imitation marble, etc., is being extensively developed and will augment the growing market for the purest material of a fine texture; while the usual uses for refractories in the form of plaster, brick, and for insulation of steam-pipes, etc., will always afford a steady demand. Unfortunately, owing to the prohibitive duty of \$70 a ton on the calcined article, to reach the United States market, the raw product will have to be treated in the United States, as there is no duty on the raw material. It is now a question if the Canadian market will warrant the erection of a plant to supply the domestic market alone.

It is a difficult matter to ascertain the names of the users of this class of material, and therefore it is not possible to find out what quantity is required per annum in Canada. Last year from one inquirer alone in the United States I could have marketed 7,000 tons of the calcined material at a very high price. There also must be a market for the crude material in considerable quantity if only it could be located in Canada.

YALE DISTRICT.

NICOLA MINING DIVISION.

REPORT OF 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, 1918.

Owing to the adverse economic conditions prevailing there has been no extensive development-work on any of the groups of mines.

TEN-MILE CREEK.

Aberdeen. This mine has not been operated during the current year, but I am informed by Thomas J. Corwin, of Vancouver, that development-work is to be resumed shortly, and that a mill is to be installed on the property. About 1,600 tons of ore, averaging $6\frac{1}{2}$ per cent. copper, has been shipped from this property, which is situated on the Ten-mile creek about ten miles from Coyle Station, on the Kettle Valley Railway.

ASPEN GROVE.

Aspen Grove Amalgamated Mines, Ltd.—American capitalists have secured an option on this company's sixty copper claims in the Aspen Grove district, and it is the intention to thoroughly prospect this property with diamond-drills so soon as weather conditions will permit.

STUMP LAKE.

Donohoe. This group of claims is owned by the Donohoe Mines Corporation. Frank M. Hawkes, of Seattle, informs me that active development-work is to be resumed on this property as soon as circumstances will permit. This company's holdings now comprise eight Crown-granted mineral claims and a number of recent locations. When the necessary machinery to allow of economical mining has been installed, it is confidently expected that this mine will become a large producer.

A new feature of interest in this district is the resuming of operations at the **Mary Reynolds.** *Mary Reynolds* mine after a term of thirty years of inactivity. This property, which is situated near the Donohoe mines at Stump lake, and which is said to carry good averages in silver and gold, is being operated, under option of purchase, by Robert R. Hedley, a mining engineer, of this place.

COUTLEE-JUNIPER MOUNTAIN AND IRON MOUNTAIN IRON-DEPOSITS.

During the current year an increased interest has been taken in the iron-deposits of this district, and it now appears altogether likely that concentrations may be discovered which will eventually lead up to a profitable iron industry. The iron interests are as follows:—

Coutlee Group.—F. C. Porter *et al.*, of Vancouver, with claims at Coutlee.

Titantic Group.—W. H. Boothroyd *et al.*, of Merritt, with claims on Juniper mountain.

Fairview Group.—F. M. Warner *et al.*, of Merritt, with claims on Juniper mountain.

Iron Dollar Group.—Emmett Todd *et al.*, of Merritt, with claims on Iron mountain.

OFFICE STATISTICS—NICOLA MINING DIVISION.

Locations recorded	109
Free miners' certificates	116
Certificates of work	150
Bills of sale	11

YALE MINING DIVISION.

REPORT OF H. BEECH, MINING RECORDER.

I have the honour to submit the annual mining report and office statistics for the year ending December 31st, 1918.

PLACER-MINING.

This branch of mining has been neglected in this Division of late years, but eventually, with improved methods, the fine gold in the river-bottoms will be recovered. The only company at present at work is the River Gold Recovery Company, Limited, which installed machinery for the saving of gold values on the banks and in the bed of the Fraser river; about twelve men are employed. As numerous inquiries are being made as to placer-ground between Hope and Yale, it is quite possible that other companies will make an attempt to recover the gold known to exist.

LODE-MINING.

Altogether the year has been one of great promise, and many of the properties have reached a stage which justifies a large expenditure of capital. This will be forthcoming at an early date, no doubt, now that the war is over and mining resumes its normal activity.

The *Emancipation* group, owned by the Emancipation Mining Company, has been a regular shipper during the year. The manager reports the total tonnage and values shipped in 1918 as 18½ tons, which was sent to the smelter at Tacoma, and yielded 457½ oz. of gold, valued at \$9,150.82; silver, 79 oz., value, \$67.98; or a total of \$9,218.80 from 18½ tons of ore. This output should ensure particular attention to this district, which has been kept back by discouraging reports.

On the same lead as the *Emancipation*, on claims for a distance of six miles, considerable excitement was caused early in the year by the discovery of free gold in the outcrops. The country between the *Emancipation* and the *Emigrant* group is now staked solid for a distance of eight miles. The past year has been the most promising since the district was first opened.

The Aufeas Gold Mining Company has had a few men at work on its claims and has put in a tramway for the handling of ore and supplies.

The 23-Mile district, on the Hope-Princeton trail, has kept a number of prospectors busy during the year, but owing to lack of transportation facilities the district is being retarded.

Prospecting the country on the headwaters of Peers and Dewdney creeks has been helped considerably by the erection of the new foot-bridge across the Coquihalla river. This section is rich in mineralized country and will no doubt be opened up in the near future.

The *Emigrant* group, on Siwash creek, has had men at work under the management of Mr. Wilson, mostly on development-work and preparation for ore-treating machinery. The ore-showings have been very encouraging and the district is being staked by prospectors.

The Gold Creek Mining and Development Company, Limited, which owns mining property near Spuzzum, is continuing development-work under the management of A. A. Macdonald, who recently reported the opening-up of good milling-ore.

OFFICE STATISTICS—YALE MINING DIVISION.

Free miners' certificates issued	144
Special certificates issued	<i>Nil</i>
Locations recorded	152
Certificates of work issued	137
Bills of sale, etc., recorded	48

Revenue.

Free miners' certificates	\$1,022 00
Mining receipts, general	1,018 85
Revenue, other sources	149 50

ASHCROFT MINING DIVISION.

REPORT OF H. P. CHRISTIE, MINING RECORDER.

I have the honour to submit my annual report as Mining Recorder for the Ashcroft Mining Division for the year 1918.

The situation remains unchanged since my last report. The annual assessment-work has been done on practically all the old claims. I understand the Resident Mining Engineer is making a more detailed and extensive report.

OFFICE STATISTICS—ASHCROFT MINING DIVISION.

New locations recorded	179
Certificates of work	104
Conveyances, etc.	40
Free miners' certificates issued	102

KAMLOOPS MINING DIVISION.

REPORT OF E. FISHER, GOLD COMMISSIONER.

I have the honour to submit the annual report on the Kamloops Mining Division for the year ending December 31st, 1918.

The past year has shown a considerable falling-off in the number of claims located in this Division as compared with the preceding year; but, on the other hand, there has been steady progress in development-work, as is evidenced by the number of certificates of work issued, which show an increase of 10 per cent. over the number issued in 1917.

The principal mining operations have been at the *Iron Mask* mine, *Lydia* group, *Queen Bess* mines, and the *Homestake* group, full particulars of which are covered in the report of R. W. Thomson, District Engineer. Except for three placer claims which were recorded on Louis creek, and on which no work was done, there has been no activity in the way of placer-mining.

OFFICE STATISTICS—KAMLOOPS MINING DIVISION.

Free miners' certificates	340
Mineral claims recorded	167
Certificates of work issued	202
Placer claims recorded	3
Bills of sale	30

Revenue.

Mining receipts	\$3,168 00
Mineral-tax collected	655 18

WESTERN DISTRICT (No. 6).

REPORT BY WM. M. BREWER, RESIDENT ENGINEER.

OUTLINE OF REPORT.

It is unnecessary to repeat the description of the boundaries of the Western Mineral Survey District, as these were published in the Annual Report for 1917.

For convenience in designating the location within the various Mining Divisions in which the groups of mineral claims are located, it has been deemed advisable to divide each Mining Division into sections. These sections are as follows:—

Name of Mining Division.	Section.	Subsection.
Alberni	Alberni Canal. Barkley Sound	Uchucklesit Harbour. Copper Island. Hawkins Island. Henderson Lake.
Clayoquot	Great Central Lake. Tofino Inlet	Kennedy Lake. Deer Creek.
	Central West Coast	Bedwell Sound. Ahousat. Sidney Inlet. Nootka Sound.
Quatsino	South-east Arm	Elk Lake. South-east Arm.
Nanaimo	West Arm. Strathcona	Buttle Lake. Quinsam Lake.
	Salmon River. Quadra Island. Phillips Arm. Texada Island. Redonda Island. Comox. Cumberland. Nanaimo	Cassidy. Nanoose.
Victoria	East Sooke. Jordan River. Saltspring Island. Cowichan Lake.	
Vancouver	Britannia Belt. Lynn Creek. P.G.E. Rly.	Alta Lake. Cheakamus Lake.
New Westminster	Cheam Range. Agassiz. Stave River.	

In the following report a description of the properties examined during the season of 1918 is given under the head of the section in the Mining Division in which the properties are located.

The progress in the mining industry in the Western Mineral Survey District was quite satisfactory during the first nine months of the year 1918, but during the last quarter of the year the production in both the coal and metalliferous mines fell off to a marked degree, owing to the influenza epidemic which prevailed throughout this district. The working forces during October and November last in all of the producing mines were reduced by at least one-third, and for a portion of the time only about 50 per cent. of the miners reported for work.

In portions of the district there were quite a few prospectors in the field during most of the year, but the number was not as great as during 1917. The question as to what means is best to pursue to encourage more interest in the exploration of the practically unknown parts of the district is a very difficult one to solve. The University of British Columbia as well as the Chamber of Mines have endeavoured to encourage men, and especially returned soldiers, to adopt prospecting as an occupation, by giving a short course of lectures on the subjects pertaining to the mining industry, which have been taken advantage of by several miners and others. Possibly during the coming season satisfactory results will be observed from these efforts.

Nature has placed serious obstacles in the way of the prospector, such as a dense growth of underbrush, fallen timber, etc.; yet these difficulties are not insurmountable, as was proven by very many prospectors who have been successful in making good stakes as the results of their explorations. This subject is mentioned in this report to encourage more men to take up the occupation, which, despite the hardships, is one of the most fascinating employments a man can engage in.

There are approximately 2,000 metalliferous mineral claims in good standing in the Western Mineral District, of which number about one-half are Crown-granted. More than 25 per cent. of the claims are located in the Vancouver Mining Division, the majority of which are situated between Britannia Beach, on Howe sound, and the Indian river, which flows into the North arm of Burrard inlet.

An important event in the Vancouver Mining Division in 1918 was the purchase by the Britannia Mining and Smelting Company of the *Roy* group of mineral claims, situated on the east side of the Indian river, which property was acquired from Geo. McLeod and associates. The same company also bonded several other groups in the same locality, as well as acquiring by staking a number of claims between Loch Lomond, the source of Seymour creek, and the west side of the Indian river, thus forming a connecting-link between the company's former holdings and the Indian River district. Eventually the entire property can be connected by a tunnel from Britannia Beach to the east side of Indian river, should development prove that such a course is advisable. The distance from Britannia Beach to Indian river in a direct line is about twelve miles. The general manager, J. W. D. Moodie, has informed the writer that the cost to the company for the mineral claims acquired outside of the original holdings of the old Britannia Copper Syndicate has been approximately \$1,500,000.

The discovery of oil-seepages on Still creek and in the peat marshes near Burnaby lake gave a very decided impetus to operations in exploring for oil in that vicinity. The Spartan Oil Company, Limited, was organized in 1918. W. R. Jewell, Kansas City, U.S. geologist and petroleum engineer, was consulted, and after an examination advised boring with diamond-drill, which advice was followed and the results are referred to later in this report.

The desire of the Imperial and Dominion Governments to obtain supplies of manganese, molybdenite, chrome ore, bauxite, and other war minerals encouraged a few prospectors in this district to search for occurrences of such minerals. The results were that about twelve mineral claims, on which a good grade of manganese ore occurs, were located in the vicinity of Cowichan lake, Vancouver island, and several occurrences of molybdenite ore were found on Buttle mountain, near Cowichan lake, as well as on the Mainland. Unfortunately for the discoverers, none of the deposits were developed to a shipping stage previous to the signing of the armistice.

There was a notable advance made in new development-work in the coal-mining sections in the Western District during 1918, and new mines were brought into the shipping class, while others are being equipped to produce coal early in 1919. At some other places within the coal-bearing formation prospecting with diamond-drills is being done.

The progress in the metalliferous mines was satisfactory, especially at the *Britannia*, *Marble Bay* and *Sunloch* mines, a description of which with others will be found later in this report.

The production of copper from the Southern Coast section of the Western District was greater than that for any previous year by about 2,500,000 lb. This gratifying showing is accounted for by the increased production from the *Britannia* mine.

The production of gold from the Western Survey District was also greater in 1918 than in 1917, which is accounted for by the increased production of copper-gold ores, because practically all of the gold produced is found associated with the copper in the ores mined in the district, as there are at present no mines being operated which produce ores carrying values in gold exclusively.

The labour conditions in the district were satisfactory during 1918; the wages were the highest ever paid in both the coal and metalliferous mines, and there were no labour troubles that resulted in strikes, although some were threatened, but the questions in dispute were settled by conferences between the employers, employees, and Government officials.

The smelter facilities on the Coast have been curtailed since the Ladysmith smelter closed down during the summer of 1918, after being in operation intermittently from the spring of 1917, when the property was acquired by the Ladysmith Smelting Corporation, Limited.

Shipments of about 1,000 tons of magnetite from the *Good Hope* mine on Raven bay, on the east coast of Texada island, and about the same quantity of bog-iron ore from Mons, on the Pacific Great Eastern Railway, were made to the Irondale blast-furnace in the State of Washington.

BIBLIOGRAPHY.

In the Annual Report for 1917 a full bibliography pertaining to the Western Mineral District published previously to that date appeared on pages 239-241, so that it is not necessary to repeat in the present report, but only to add the publications that have been published during the past year, which are as follows:—

Summary Report, Geological Survey, Canada, 1917, Parts B. Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet, also Indian River Copper Deposits, Vancouver Mining Division.

Robertson, Wm. Fleet, Prov. Mineralogist. Preliminary Review and Estimate of Mineral Production, 1918. Bull. No. 1, British Columbia Department of Mines, 1919.

Stansfield, Alfred, D.Sc., A.R.S.M., F.R.S.C. The Commercial Feasibility of the Electric Smelting of Iron Ores in B.C. British Columbia Department of Mines, Bull. No. 2, 1919.

INTRODUCTION.

In introducing this, the second annual report on the Western Mineral Survey District, B.C., the writer desires to acknowledge the uniform courtesy he has received at all times, especially in the field-work, from the owners of the properties he has examined. He is indebted for many favours to the prospectors and mining men in his district, for which he takes this opportunity to extend his thanks. He is also indebted to the officials of the staff of the Branch of the Geological Survey for many favours and assistance.

The work done during the past year includes examinations of fifty groups of mineral claims. In doing this work every Mining Division in the district was visited several times, and as far as possible the properties selected for examination were those of which little, if any, information has previously been published.

Although there are, as stated in the "Outline of Report," about 2,000 mineral claims in good standing in the Western District, these are grouped into about 150 groups for the purpose of doing assessment-work on one claim in the group to apply on all previous to procuring a Crown grant; consequently a large proportion of the total number of claims have no development-work done on them and their commercial value is problematical.

During the summer of 1918 considerable time was occupied in rendering assistance to Dr. Stansfield in his investigations as to the feasibility of the electric smelting of the magnetite ores of Vancouver and adjacent islands. Large samples of magnetite from the west coast of Texada island were shipped to Dr. Stansfield, Montreal, and to the Noble Electric Steel Company, Heroult, Cal., for experimental purposes.

It is gratifying to be able to state that there have been only three cases reported in the Western District during 1918 where attempts have been made of encouraging wild-cattling or promoting mining companies with alleged fraudulent intent. One of these cases was brought before the Courts in Vancouver and the principals sentenced to the penitentiary.

Late during the summer of 1918 representations were made of an important discovery of platinum at the head of Jervis inlet, but an examination by G. C. McKenzie, of the Canadian Department of Mines, proved that the reported discovery had no commercial value. Mr. McKenzie also made more than one examination of the occurrences of manganese ore near Cowichan lake, and was so much interested that, in conjunction with Wm. Fleet Robertson, Provincial Mineralogist, he recommended the properties to the Dominion Government Munitions Board, but the armistice was signed before any action by the Government was taken, and consequently the properties have not been developed owing to the lack of a market at the present time.

As a fairly complete history of the early progress of the mining industry in the Western District was published in the Annual Report of the Minister of Mines for 1917, it is unnecessary to refer to that subject again in the present report.

The district has only been scratched over so far by prospecting, and presents an excellent field for the prospector who is willing to work intelligently and is not afraid of tackling a few difficulties. The prospector who attempts to search for mineral deposits through the Western Mineral Survey District should be accustomed to the water, a fair boatman, know how to handle a canoe, be able to use an axe, crosscut saw, a rifle, and fishing-rod. The various lakes, sounds, and inlets, where the several bays afford protection and shelter in case of storms, provide unsurpassed transportation facilities as well as excellent fish-food.

There is an old saying amongst the Coast prospectors that "when the tide is out the table is spread"; in other words, all a man need do is to go out at low tide and dig clams and he will never be hungry.

FAVOURABLE DISTRICTS TO PROSPECT.

The most attractive sections for prospecting, in my judgment, are on the borders of the Coast range of mountains on the Mainland and sections of the west coast of Vancouver island. With regard to the Coast range, it has become recognized by geologists that the idea which prevailed some years back to the effect that the Coast mountains are made up entirely of a great mass of eruptive rock, mainly granodiorite, is incorrect, or as Camsell says in his Summary Report for 1917: "Investigations during the past season 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 bands referred to by Camsell occur in a zone about forty miles north-east of the Britannia zone and nearly parallel to it, where a similar condition is mentioned by McConnell in his description of the *Britannia* mine published by the Geological Survey in 1913, and if a straight-edge is laid on the map of the Coast we find that in a north-westerly course from the *Britannia* mine the line will intersect the vicinity of known mineral deposits on Jervis inlet, Powell lake, Phillips arm, Loughborough and Knight inlets.

The occurrences of the bands of stratified rocks are apparently in nearly parallel zones, with one zone extending from the vicinity of Chilliwack lake near the International Boundary toward the north-west, where it again occurs in the Cheam range near the head of Wahleach or Jones creek, and again farther to the north-west along the Pacific Great Eastern Railway, as reported by Camsell and also examined by the writer.

At the head of Wahleach creek an opportunity occurred last autumn to examine the *Lucky Four* group of mineral claims, on which an ore-body of chalcopyrite occurs in a zone of altered sedimentaries intruded by granodiorite. Last season the writer also examined several mineral claims in the section traversed by the Pacific Great Eastern Railway, where good prospects are found. One of them is the *Fitzsimmons* group near Green lake, which has been bonded by the Consolidated Mining and Smelting Company, of Trail.

For the above reasons there is no hesitation in recommending the Coast range as a good section for the prospector to explore. There are other reasons which will appeal to a prospector, one of the chief being the fact that since the original *Britannia* group was located in 1897 or 1918 the mining company has purchased about 350 claims, nearly all of which were staked by prospectors some years ago. The cost to the company for these purchases is about \$1,500,000.

All of these claims are situated in what is termed the Britannia belt, and between the shore at Britannia Beach and the east side of Indian river, about twelve miles easterly from the original *Britannia* group. Of course, a large proportion of the purchased claims will probably prove of little value, but the fact that the company has made these purchases after examinations made by its engineers is evidence of the indications that extensions of the mineralized zone occur in that direction from the original group.

That being the case, it is reasonable to presume that similar occurrences of bands of stratified rocks occur on the westerly side of Howe sound in contact with the granodiorite, and that that section should be a favourable one for a prospector to explore, especially when it is considered that but comparatively little prospecting has been done in the mountains between Howe sound and Jervis inlet, or to the north-westerly from the latter.

The section in the vicinity of Loughborough inlet, Phillips arm, Bute inlet, Knight inlet, and Seymour inlet was prospected to some extent about twenty years ago, and a part of that section was then one of the active portions of the Coast District, but it has been neglected since the *Dorothea Morton* mine closed down. The fact that occurrences of bornite and chalcopyrite were discovered not very long ago in the mountains adjacent to Knight inlet suggests that the entire section is entitled to further consideration from prospectors, especially when it is considered that an ore which was practically valueless ten years ago may to-day be a commercial asset. Only recently a prominent operator informed me that he expected to see the day when he could successfully mine and treat a copper ore carrying not to exceed 1 per cent. in copper, provided the extent of the deposit was sufficiently great.

The question is often asked as to the best places for the investment of capital in mining, and the following sections of the Western District are recommended: Quadra island, Texada island, *Lucky Four* group in the Cheam range, *Big I.* group near the head of Great Central lake in the Alberni Mining Division, and the *Ptarmigan* group adjoining the *Big I.* The three last-mentioned groups of mineral claims require very large expenditure of capital to develop them, but they all promise to develop into such extensive properties as are in favour with big operators. So far as location, climate, and general surroundings with regard to costs, there are many operating properties in other mining countries which are much less favourably situated.

Texada island is another field that should attract capital. It cannot be considered, though, as a field where big low-grade ore-bodies occur, as the ore occurs in irregular bodies ranging from about 75 to 200 feet long and from a few feet to 30 feet wide, but comparatively high grade, presenting an opportunity to the mining capitalist who is looking for a property to work on a comparatively small scale where the transportation facilities are as nearly ideal as it is possible to find. The fact that the contact-metamorphic type of deposits on this island has been proven to maintain continuity to considerable depth, having been mined to a vertical depth of over 1,500 feet at the *Marble Bay* mine, should encourage mining operators to continue the development on other properties, such as the *Copper Queen*, *Cornell*, and *Little Billie*, where the ore occurs under similar geologic conditions.

On Vancouver island there are several localities where intelligent prospecting and the investment of capital should result satisfactorily; notably the East Sooke peninsula, Jordan river, the section westerly from that river near the coast-line, the mountains at the heads of the creeks which empty into Alberni canal, and the west coast of the island generally. But little real prospecting has been done on Vancouver island during the past fifteen years. Previous to that time there were about 200 prospectors exploring the mountains on the west coast, but many of these men about 1903 abandoned prospecting to stake timber claims, and a large number became fairly rich by selling out. Capital was easier to secure for purchasing timber than to develop mining properties, although many of the pioneer prospectors, whom the writer knew personally, cleaned up good stakes from their prospects.

For about twelve years, or from 1903 until about 1916, when the Coast Copper Company, a subsidiary of the Consolidated Mining and Smelting Company, of Trail, bonded the *Old Sport* group in the Quatsino Mining Division after it had been adversely reported on, there was practically no mining activity on Vancouver island, except at the *Tyee* mine on Mount Sicker, which closed down in the fall of 1907. The ores are usually low grade and will not stand direct shipment to smelters, but are well adapted to concentration by the flotation process, and after the Britannia Company installed this process some mining operators with foresight turned their attention to Vancouver island. This resulted, during 1916, in the reopening of the *Indian Chief* mine on Sidney inlet and the *Monitor* mine on Alberni canal, as well as the bonding of the *Sunloch* group on Jordan river, the *East Sooke* property at the base of Mount Maguire on the Sooke peninsula, the *Willow Grouse* in the same section, the *Blue Grouse* on Cowichan lake, as well as the *Yreka* and *Old Sport* in Quatsino Mining Division.

The above-mentioned properties were all staked by the pioneer prospectors between 1897 and 1903, except the *Sunloch* and the *Blue Grouse*, so that it is readily seen how "the prospector

has been conspicuous by his absence" during late years. In fact, it looks as though a new generation of prospectors is needed; and the question is, where shall we find them?

There are still vast areas of mountain ranges on Vancouver island unexplored; in fact, the group of mineral claims on which outcrops an ore-body of apparently considerable and possibly of about equal grade as the *Britannia*, and which is known as the *Big Interior*, is an illustration. It is about ten miles from the head of Great Central lake at an elevation of about 5,000 feet, and is, with the exception of the adjoining groups, the *Ptarmigan* and *Della*, about the only instance where prospectors have located claims on the mountain ranges in the interior of the island. The occurrence of ore on the *Ptarmigan* and *Big Interior* was discovered in 1899 in a band of altered sedimentary rocks under almost similar geologic conditions as are found at the *Britannia* mine and on the *Lucky Four* group in the Cheam range. The unexplored interior mountain ranges on Vancouver island should be attractive to the prospector. The conditions are nearly ideal with regard to travelling, for there are chains of lakes abounding in fish, such as Great Central, Sproat, Buttle, Cowichan, Cameron, Horne, and Kennedy in the central part of the island, and Alice, Victoria, Kathleen, and Nimpkish in the north-westerly part.

During 1918 the Government threw open Strathcona Park for prospectors to explore. One group of mineral claims has been located on Myra creek, and there is no reason why other outcrops of copper ores should not be found in the mountains surrounding Buttle lake of equal extent and carrying as good values as occur at the *Big Interior*.

The difficulty of transporting supplies in and hauling ore out of this section of the island has retarded its development, it is true; but each year sees vast improvements in transportation facilities, and it is only a few days since that an announcement of preparations has been made by the Esquimalt & Nanaimo Railway to extend that system from the Alberni branch into the mountains in the vicinity of Great Central lake, so that it appears as though transportation facilities on the island will be vastly improved in the future, and that a prospector need not hesitate to explore the interior mountain fastnesses because of fear that if he should find a good prospect he might have to hold on to it for many years before he could sell out to advantage, as his predecessors had to do.

ALBERNI MINING DIVISION.

Considering the scarcity of labour and absence of the usual number of prospectors, many of whom volunteered for overseas service during the war, the progress of the mining industry in the Alberni Mining Division has been satisfactory during 1918. Active development-work was done on some of the properties on Alberni canal, and a better opportunity than usual was afforded for examining the mineral claims in the *Big Interior* basin, owing to the fact that during the past two summers the glacier that fills the basin at the head of Della lake at an elevation of about 3,500 feet has receded to such an extent that samples could be taken at points about 50 feet lower than has ever been permissible in previous years. This condition was taken advantage of by Mr. Archibald and G. H. Kilbourne, mining engineers for the Consolidated Mining and Smelting Company, during the summer to make an examination of the *Big I.* group of mineral claims.

ALBERNI CANAL SECTION.

This group of mineral claims, which was described in the Annual Reports for **Monitor Group.** 1916 and 1917, is again reported on because the development-work has been extended so materially during 1918 that the conditions as to the geology and structure of the ore-bodies are much better understood. The group is situated on the west side of Alberni canal, about seventeen miles below Port Alberni, and is owned by Samuel Ryder, of St. Albans, England. There are six Crown-granted mineral claims and one claim not Crown-granted in the group, containing approximately 300 acres.

Geology.—The geologic formations on the *Monitor* group are typical of very much of the geology along the west coast of Vancouver island. The rocks are for the most part igneous, which contact with metamorphosed limestone. The limestone is crystalline, with much of it altered to lime silicate and garnetite, and associated with the garnetite is epidote and hornblende. The igneous rocks are for the most part diabasic and dioritic. The rock formation is very much sheared, fissured, and faulted. Slickensided cleavage-planes are very abundant, with their lines of strike varying from about N. 40° W. (mag.) to W. (mag.), and the dips varying from about 60° S. to 80° N. The variation of the dips of the slickensides is especially noticeable in the main adit of the Leonard showing on the *Monitor No. 1 Fraction*.

The contact-metamorphic rocks on the *Monitor* group occur in well-defined zones. There are apparently two, if not three, of these zones extending along their lines of strike for several hundred feet from the shore-line of the canal into the mountains in a north-westerly direction. Bodies of copper-sulphide ore occur irregularly within the contact-metamorphic zones; sometimes the ore is found immediately at the contact between the igneous rocks and the limestone, and at other times several feet from the actual contact. The ore is generally found associated with garnetite and epidote. The width of the contact-metamorphic zone at the Leonard showing is about 75 feet on the shore-line. The width of the other zones has not been determined, as the surface is covered with brush and debris and prospecting has only been done in isolated places where the bare rock is exposed.

Characteristics of the Ore-deposits.—Occurrences of ore-bodies are found at three points on the property. These are known as the Maynard, the Hedley, and the Leonard showings. The Maynard is about 2,000 feet by aerial tramway from the canal, and is where the development-work was done in 1900-1902, from which a considerable tonnage of copper ore was shipped, averaging about 6 per cent. in copper, with low gold and silver values. The Hedley is about 1,000 feet from the canal and in close proximity to the right-of-way of the tramway. This showing was partly developed after it was discovered in 1910, and further in 1916, when about 50 tons of ore was shipped, which yielded 8.36 per cent. in copper, with low gold and silver values.

The discovery of the Leonard showing was made about the date of the shipment from the Hedley, since which time all work has been confined to the Leonard body, which apparently occurs in the contact-zone extending south-easterly from the Hedley mine-workings, but at a lower elevation of about 250 feet, and about 1,700 feet distant along the general strike of the rocks.

In the Leonard mineralized zone there had been more than one movement of the rock formation, and the shearing action has resulted in producing almost a schistose structure, with the slickensided planes very pronounced. These planes appear to have little or no influence on the occurrence of the ore, for where such planes have been followed in the main adit it is seldom that they form walls of an ore-body, although in places ore is found along what may be called the main plane, which was considered to be the south-west boundary or hanging-wall of a lens of copper ore in magnetite, with outcroppings at the portal of the adit. A short distance, though, from the portal all ore disappeared in the adit, and it was only after crosscutting about 15 feet—crosscut No. 1—to the north-east that any more was found. This ore is chalcopyrite in garnetite gangue. The general course of the adit is about N. 70° W. (mag.), and the strike of the ore-body in the crosscut is N. 40° W. (mag.), which corresponds with the strike of the contact-metamorphic country-rock outside the portal of the adit. An average sample across 2 feet of the crosscut 18 feet from the main adit assayed: Gold, trace; silver, 0.5 oz.; copper, 6.1 per cent. This was a lens of ore and has been mined out since the sample was taken. There is practically no ore remaining at this point.

The main adit was continued along the same slip or plane as it was started on, and at about 80 feet from the portal another lens of ore was exposed on the left or south-westerly side of the adit. A narrow fissure crosses the adit diagonally near this point, and at about 90 feet in from the portal there was about 2 feet of chalcopyrite on the right side of the adit which has since been mined out, a sample of which assayed: Gold, trace; silver, trace; copper, 9.6 per cent.

A short crosscut (No. 2) and an upraise (No. 1) are made on the left or south-westerly side of the main adit at a point about 80 feet from the portal. In the crosscut there occurs magnetite with impregnations of chalcopyrite for a width of about 6 feet, with about 18 inches of that width enriched, so that a sample from the crosscut of the enriched part assayed: Gold, trace; silver, 0.3 oz.; copper, 7.6 per cent. A sample of the remainder of the 6 feet assayed: Gold, trace; silver, trace; copper, 0.8 per cent.

A crosscut (No. 3) 21 feet long is driven on the right side of the adit at a point about 90 feet from the portal, where the narrow fissure crosses, but no ore is exposed. An upraise (No. 2) is made on the right side of the adit about 39 feet beyond the No. 3 crosscut. This upraise is 35 feet high, with about 18 inches of ore in the top, a sample of which assayed: Gold, trace; silver, trace; copper, 2 per cent. Some ore was taken and shipped from this upraise while work was progressing, according to information received from the mine foreman.

The south-westerly wall of the main adit is along a slip that appears to be the same fracture-plane as occurs at the portal of the adit. The main adit is driven for a distance of 21 feet beyond

upraise No. 2, where crosscuts are made from both sides; that to the right (No. 4) being 63 feet long, with a branch from the right side 32 feet long. No ore was exposed by this work. Crosscut No. 5, to the left of the adit, is made through a brecciated zone of mineralized rock 12 feet wide. An average sample along the first 6 feet of this crosscut assayed: Gold, trace; silver, trace; copper, 3.1 per cent. Two average samples from the next 18 feet showed no values. The mineralization in this crosscut is composed of magnetite chiefly, with some iron pyrite and grains of chalcopyrite disseminated through the magnetite.

Beyond the section sampled in the crosscut, or 30 feet from the main adit, the crosscut is made through a barren lime-silicate rock for 27 feet farther, with a well-defined boundary or contact line at the face of the section sampled. This appears to be the main line of contact between the metamorphosed igneous rock and limestone, with its strike north-west (mag.) and dip almost vertical.

The face of the main adit is about 160 feet beyond crosscuts Nos. 4 and 5. A change in the direction of the adit is made from N. 80° W. (mag.) to W. (mag.) about 10 feet south-easterly from upraise No. 2, and this change was made to conform with a similar change in the strike of the fracture-plane; but the direction was changed again to N. 60° W. (mag.) 56 feet from the first change; then to N. 80° W. (mag.) for about 80 feet; then to N. 60° W. (mag.) to the face, which is in limestone.

The dip of the fracture-plane which forms the south-west wall of the main adit changes from about 70 degrees to the southerly to about 80 degrees to the northerly and back again more than once in the length of the main adit. This fact, considered with the shearing and crushing movements and the irregularity of the structure of the ore-bodies that are so much in evidence, tends to increase the difficulties of doing development-work to the best advantage. The No. 2 upraise has been made where the dip is towards the north, but the No. 3 upraise, which is about 80 feet to the north-westerly from No. 2, is made where the dip is 74 degrees to the south.

Some ore occurred in the main adit where this upraise is made, and the management states that the raise passed through bunches of good-grade chalcopyrite to near the top, which is about 80 feet above the floor of the adit. It is proposed to continue this raise to the surface for ventilation and prospecting purposes. Beyond this upraise it appears as though the work has been done too far toward the south-west.

Between the No. 3 raise and the face of the adit, a distance of about 100 feet, there is no ore exposed and the country-rock is badly sheared and faulted. Some garnetite occurs near the face of the adit, but this is displaced by barren limestone at the face.

Unfortunately, practically no drifting has been done at places where ore is exposed, except from the face of the No. 1 crosscut, where drifts have been driven in both directions, each about 20 feet long, and ore mined from an excavation about 9 feet wide, 36 feet long, and 7 feet high. At the south-easterly end of the chamber a little ore is exposed in garnetite and epidote gangue, but this is not many feet from the outcrop near the portal of the adit, so that it is hardly worth while continuing work in that direction. At the north-westerly face of the chamber there is a body of garnetite with a little chalcopyrite disseminated through it, and it appears as though it would be advisable to continue to drive in that direction to prospect the possibilities.

From the foregoing description it will be seen that the occurrences of ore-bodies in the contact-metamorphic zone are erratic and irregular, and that the bodies of higher-grade solid ore are lenticular in shape, but that apparently some of the lenses can be traced from one to another. Such connections are generally difficult to trace, and consequently a very close study of the geologic structure is essential in order to carry on development-work to the best advantage.

The prevailing minerals are chalcopyrite, pyrite, magnetite, and a little pyrrhotite. The gangue in which ore occurs is almost invariably garnetite, epidote, and altered limestone, but sometimes it is brecciated diabase.

The prominent structural features of the ore-bodies is the occurrence of lenses of chalcopyrite of shipping grade in the contact-metamorphic zone, together with ore-bodies of greater extent of concentrating grade; consequently it should prove more satisfactory to carry on development-work in such a manner as to demonstrate the quantity of ore as a whole, rather than to gouge around in order to attempt to find the higher-grade lenses. The feature of irregularity in the occurrences of the lenses of chalcopyrite, of high enough grade for direct shipment, is particularly shown in the No. 3 upraise. This was started in a body of chalcopyrite of good grade, but within a few feet this gave place to low-grade concentrating-ore, and a few feet

higher another lens of shipping-ore occurred, which was passed through into low grade and so on to the present top of the raise. The most persistent ore-body apparently occurs between the No. 2 and No. 5 crosscuts, a distance of about 70 feet, but as the main adit has been driven parallel to the apparent wall of the ore-body instead of in the ore, the extent has not been proven, although drill-holes have been made into the wall on the south-westerly side of the adit, the drillings from which, it is stated by the manager, showed values in copper.

Development-work.—The development-work on the Leonard ore-body is as follows:—

	Feet.
Main drift-adit	308
No. 1 crosscut on north-east side of adit	34½
Westerly drift, No. 1 crosscut	15
Easterly drift, No. 1 crosscut	21
No. 2 crosscut on south-west side of adit	24
No. 3 crosscut on north-east side of adit	21
No. 4 crosscut on north-east side of adit	63
Branch of No. 4 crosscut north-east of adit	32
No. 5 crosscut on south-west side of adit	57
No. 6 crosscut on south-west side of adit	27
No. 7 crosscut on south-west side of adit	10
No. 8 crosscut on north-east side of adit	26
No. 1 upraise on south-west side of adit	10
No. 2 upraise on north-east side of adit	35
No. 3 upraise on north-east side of adit	80
Total	763½

A trail has been built around the steep bluffs that form the shore of the canal about half a mile long, and for nearly half the distance the trail is blasted from precipitous solid rock bluffs. This trail connects the camp buildings with the mine-workings.

Equipment.—The plant at the mine-workings on the Leonard showing consists of a well-equipped blacksmith-shop, 4-drill compressor plant, 35-horse-power boiler and ore-bunkers 49 feet long by 27 feet wide by 20 feet deep. The compressor plant, boiler-room, and bunkers are built on a solid rock foundation on the shore about 10 feet above high-tide mark.

Transportation.—The transportation problem is as nearly ideal as is possible. The portal of the main adit is about 60 feet above high tide and about 45 feet from the shore. The depth of water in this part of Alberni canal close to the shore is about 50 feet, so that no wharf is necessary, but merely a floating log to prevent a vessel from scratching against the rocks on the shore.

As no work has been done on either the Maynard or Hedley ore-bodies since 1916, and a description of what had been done was published in the Report for that year, on pages 321 and 322, it is not necessary to repeat it.

Conclusions.—Owing particularly to the extremely good transportation facilities and favourable location of the *Monitor* mine, it appears advisable to continue the development of the property and by systematic work demonstrate the *actual* tonnage of ore available for shipment direct or for treatment by concentration. Operations can be carried on at a minimum cost for mining and transportation, so that the mine has an advantage in these respects over a property less favourably situated.

The fact that a shipment of ore was made to the Tacoma smelter during the past summer, which was mined as development-work progressed, is encouraging, while the apparent extent of the contact-metamorphic zone, in which there are good opportunities for ore-bodies of considerable extent to occur, is an indication of the promising possibilities of the property if fully developed.

This group consists of the *Happy John*, *Happy John No. 2*, and *Happy John No. 3* mineral claims, and is located on the west side of Alberni canal, adjoining the *Monitor* mine. Handy creek flows between the two groups of mineral claims and forms the dividing line between the *Happy John No. 1* and the

Nawitka claim of the *Monitor* group. The *Happy John No. 1* extends to the shore of Alberni canal and has a water-front about 1,500 feet long, with a good location for a wharf and ore-

bunkers. The group is owned by Samuel Ryder, of St. Albans, England, and the property is Crown-granted and known as Land Lots 606, 607, and 608. The mineral claims contain approximately 150 acres.

Geology.—The rock formation on the *Happy John* group is very similar to that on the *Monitor*. There are at least two parallel zones of contact-metamorphic rocks occurring on this group of mineral claims. There are indications that these zones are extensions of the contact-metamorphic zones which occur on the *Monitor* group. A well-defined contact between an igneous rock and crystalline limestone occurs on the *Happy John No. 2* claim. The line of strike of this contact, if extended towards the south-east, would intersect the *Nawitka* claim in the *Monitor* group near the Hedley ore-body, and if projected to the shore of Alberni canal would terminate near the portal of the main adit on the Leonard ore-body. The rocks on the *Happy John* group have been subjected to similar shearing and fracturing movements as those on the *Monitor*.

The steep banks of Handy creek have afforded good opportunities for prospecting, as that creek crosscuts the formation diagonally.

Characteristics of the Ore-deposits.—The most promising showing of copper ore on the *Happy John* group so far discovered is on the *Happy John No. 2* claim, about 2,500 feet from the mouth of Handy creek, at an elevation of about 1,000 feet above sea-level. A gossan or iron capping occurs which can be traced in an almost continuous line in a south-easterly direction for about 400 feet from an old shaft sunk in the mineralized outcrop. This shaft is said to be about 25 feet deep, but was full of water at the time of examination.

The shaft at the collar exposes an ore-body 5 feet wide, of the contact-metamorphic type, dipping vertically. A sample from the dump at the collar of the shaft assayed: Gold, trace; silver, 0.6 oz.; copper, 7.2 per cent. The mineralization of the ore-body is a combination of chalcopyrite, magnetite, and iron pyrite, occurring in a gangue made up principally of garnetite.

Prospecting on the bank of Handy creek has exposed several lenses of chalcopyrite associated with magnetite, iron pyrite, and some pyrrhotite, usually in a garnetite gangue.

Development-work.—The development-work consists of the shaft referred to above; an adit about 30 feet long, driven at a point about 400 feet south-easterly from the shaft and about 100 feet lower elevation; besides several open-cuts and trenches in the bank of Handy creek.

This group of mineral claims contains the *Dauntless No. 1*, *Dauntless No. 2*, *Dauntless Evelyn*, and *Cora* claims, and is located on the west side of Alberni canal about one mile and a half from the town of Port Alberni. The two first-named claims are located along the shore of the canal, with the two last named

adjoining on the west. The property is owned by Mr. Lewis, of Port Alberni, and contains an area of approximately 200 acres.

Geology.—The rock formation on the *Dauntless* group of mineral claims is igneous. There has been considerable shearing movement, and well-defined fissures are noticeable close to the shore of the canal, with about 200 feet of country-rock lying between them. The strike of the fissures is westerly and the dips nearly vertical.

Characteristics of the Ore-deposits.—There are deposits of ore which belong to the shear-zone type in each of the fissures mentioned. The mineralization consists of chalcopyrite associated with iron pyrite occurring in a gangue made up of quartz and breccia, with the quartz usually predominating. The mineral is scattered through the gangue as lumps and grains.

Where work has been done on the deposits the fissures in each case are at least 7 feet wide, but the length has not been determined in either. A small shipment of sacked ore was made from this property in 1918, and the sample taken for assay was from the dump remaining after the shipment was made. It assayed: Gold, trace; silver, trace; copper, 2.2 per cent.

Development-work.—The development-work so far done has been of a prospecting character and consists of three open-cuts, two of which are on the northerly fissure. One of the cuts is about 100 feet above sea-level and about 200 feet from the shore. This cut is about 20 feet long, 5 feet wide, and 8 feet deep.

The second open-cut on the northerly fissure is just above high-water mark. It is 52 feet long, 7 feet wide, and about 12 feet high at the face, from which it is proposed to drive an adit as a drift along the ledge.

The third open-cut is on the southerly fissure near the shore. It is 12 feet long to the collar of an incline, which is 15 feet long and about 4 feet deep at the face, but being full of water could not be thoroughly examined.

Three Jays Group.

This group of mineral claims contains the *Three Jay No. 1*, *Three Jay No. 2*, *Three Jay No. 3*, and *Blue Jay* claims, and is located on the west side of Alberni canal near the mouth of the Nahmint river, about fourteen miles below the town of Port Alberni, and at an elevation of about 1,500 feet above sea-level. The group is owned by W. G. Tanner, of Seattle, and associates, under a lease from the Provincial Government according to the Act of 1916, which provided for leasing any Crown-granted mineral claims that had reverted to the Crown by reason of tax sale. The property contains approximately 148 acres.

Geology.—The rock formation on the *Three Jays* group belongs to the Vancouver series and consists of igneous rocks and crystalline limestone typical of the west coast of Vancouver island. In the report by C. H. Clapp on "Southern Vancouver Island," he describes the igneous rocks on the westerly side of Alberni canal opposite the *Three Jays* group as belonging to the Vancouver volcanics, and the rocks on the *Three Jays* are very similar. In an old report by Chester Lee, published in the Report of the Minister of Mines for 1901, he classifies the light-coloured country-rock occurring on the property as "sausserite gabbro, containing augite and plagioclase, much altered by siliceous infiltration in cavities formed by the decomposition of monoclinic feldspars."

Characteristics of the Ore-deposits.—When development-work was first started on the property it appeared as though the strike of the ore-shoots was northerly, but as the work progressed it was found that the strike was easterly, and that there are three parallel mineralized zones in which the prevailing copper mineral is chalcopyrite, with spaces of about 100 feet between them. The ore-shoots dip about 80 degrees to the south, with a drag or pitch to the westerly.

The development-work shows that there are seven ore-shoots which vary considerably in both length and thickness. These are of the contact-metamorphic type, but are not always found close to the actual contact of the limestone and igneous rocks.

The ore mined during the early operations from about 1899 until 1901 often carried as much as 14 per cent. copper, but as the work progressed the percentage in copper decreased until it became too low in grade to be of commercial value under the then existing market price of copper, transportation, and smelter charges. The mine was closed down and remained idle until recently, when the Tanner interests arranged to reopen it, and began clearing out the old workings, rebuilding the camp, and repairing the road from the shore to the mine-workings. The intention of the lessees is to prospect the property thoroughly to determine its value as a concentrating proposition.

Development-work.—The total measurement of development-work on the *Three Jays* group is about 5,000 feet, made up principally of crosscut adits, drifts, and winzes. Nearly all of this work was done previous to December, 1900.

This mineral claim was mentioned in both the 1916 and 1917 Annual Reports, and is referred to again chiefly because Wm. Hutton, part owner, has shown so much industry in continuing to do development-work single-handed while Geo. Dickson, his partner, is serving overseas. The mineral claim is close to the grade of the Canadian Northern Pacific Railway near Coleman creek, on the east side of Alberni canal, about fourteen miles from Port Alberni. The area covered by the property is about 50 acres. The claim is owned by George Dickson and Wm. Hutton, of Port Alberni.

Geology.—The prevailing rock on the *Canadian* claim is classified by Clapp as Saanich granodiorite. Shear-zones are quite numerous and of considerable extent, as well as the evidences of contact metamorphism, although the actual contact between the igneous rock and limestone is not exposed in the vicinity of the occurrence of the ore-deposits. The contact is found about half a mile southerly from the mine-workings, where there are large massive beds of limestone which have been quarried for building purposes. Well-defined fissuring occurs within the shear-zones in the igneous rock, and slickensided cleavage-planes are of frequent occurrence, but these do not appear to have had much, if any, influence on the ore-deposits. Sometimes the walls of the main ore-deposit are slickensided, but often not.

Characteristics of the Ore-deposits.—The chief deposit of ore found on the *Canadian* claim is a more or less solid body of chalcopyrite varying in grade from 7 to 10 per cent. in copper, with low values in gold and silver. This body fills a fissure in a shear-zone in the granodiorite; its structure is lenticular. Below the outcrop the ore was about 6 feet wide and 30 feet long to a depth of about 15 feet, or to the bottom of the open-cut.

Another lens of chalcopyrite outcrops about 30 or 40 feet higher up the mountain and about 50 feet north-easterly from the open-cut just mentioned. This lens has not been prospected to any extent to determine its possibilities; it also appears to fill a fissure in the shear-zone and may have some connection with the ore-deposit opened up by the deep open-cut, or it may be a parallel deposit, which is quite probable and a not uncommon occurrence in the shear-zones on Vancouver island.

Since Hutton suspended work at the deep open-cut he has been driving a crosscut adit under the railway-grade in the expectation of intersecting the ore-body at a depth of about 20 feet below the grade. When the property was examined on July 20th last, this expectation had not been realized so far as exposing a body of solid ore similar to that he had been working on in the open-cut, but near the face of the crosscut adit some mineral was showing disseminated in the country-rock, with no well-defined walls.

Development-work.—There has been driven a crosscut adit about 70 feet long; an open-cut about 30 feet long, 14 feet wide, and 15 feet deep at the deepest point; and in addition several trenches and shallow open-cuts have been made. A wagon-road was built to the shore, about one mile distant, by the owners, with Government assistance of one-half of the cost, to enable Hutton to haul the ore mined; but, unfortunately, before this could be done the road-bed was so badly washed out by a cloudburst as to prevent hauling, and about the same time the Ladysmith smelter, which had been running for a while, closed down. About 75 tons of chalcopyrite ore, assaying between 6 and 10 per cent. in copper, is awaiting shipment on the dump. The property appears to possess sufficient merit to warrant further work.

As no new work has been done on other claims in the Alberni Canal section, and as the claims are referred to by the writer in previous Reports, repetition here is unnecessary.

BARKLEY SOUND SECTION.

Uchucklesit Harbour Subsection.

Except for the performance of assessment-work on mineral claims that have not been Crown-granted and which are situated in the mountains adjacent to Uchucklesit harbour, there has been practically little activity in the mining industry in that section of the Alberni Mining Division during 1918. The only exception has been at the *Sunshine* mineral claim, owned by W. Westwood, of Vancouver, the work on which is described later in this report.

Some years ago several shipments were made to the Ladysmith smelter of good grade of copper ore from the *Cascade* and *Southern Cross* mineral claims, situated near to the shore in Uchucklesit harbour, but after the *Southern Cross* was sold to an English syndicate, and it was proven that the *Cascade* is located on the Crown-granted land owned by the Wallace Fisheries Company, Limited, all work was stopped on both properties and has never been resumed.

There are several mineral claims adjacent to Snug basin, which is a part of Uchucklesit harbour near the entrance to Henderson lake, which have been partly developed and have promising possibilities, but have been idle for the past two years.

The geologic conditions are favourable for the deposition of ore-bodies; the outcrops are made up of chalcopyrite, pyrrhotite, magnetite, and iron pyrite, occurring in a gangue composed principally of garnetite and epidote. The ore-bodies so far as known occur as lenses and are irregular and of limited extent, but prospecting has not been carried on to any considerable extent. Beyond mining the ore that showed in the outcroppings, there has been comparatively little attempt to prove the possibilities of this section of the west coast of Vancouver island.

This mineral claim is one of the earlier locations in the Alberni Mining Division, from which a shipment of ore was made about 1915 to the Tacoma smelter, but the property has been idle from then until 1918. The group is located on Cascade creek, which flows into Uchucklesit harbour at Kildonan cannery, and is owned by W. Westwood, of Vancouver, who has been doing considerable development-work on the property during 1918. The group contains approximately 50 acres.

Geology.—The geologic conditions in the vicinity of the *Sunshine* group are very similar to those occurring on the *Monitor* and *Happy John* properties. The igneous rock is similar to the Saanich granodiorite and contains considerably more hornblende than is usually found in the rocks of the Vancouver volcanic series. The limestone is very thoroughly metamorphosed and the lines of contact between it and the igneous rock are very well defined.

Copper Island Subsection.

Marble Cove Group. This group of mineral claims contains the *Marble Cove Nos. 1, 2, 3, 4, and 5*, and is located on the west side of Copper island, Barkley sound. The property extends from the shore into the mountains in a south-easterly direction. The property is owned by James M. Russell, of Oak Bay, Victoria; George A. Smith, of Victoria; Andrew Smith and Carl Ulstrup, of Alberni; and contains approximately 250 acres.

Geology.—The rock formation on Copper island on the Marble Cove group is typical of that which prevails along the west coast of Vancouver island. It is made up of igneous rocks and crystalline limestone, with well-defined contacts, where the contact-metamorphic zones are of considerable extent, and in which much of the limestone is replaced by copper and iron minerals, as well as being altered to garnetite, with which is associated epidote.

Characteristics of the Ore-deposits.—Occurrences of copper ore are found on the *Marble Cove No. 1* claim about 900 feet in a south-easterly direction from the shore of a small bay. These occurrences are true types of the contact-metamorphic replacement deposits. The most important of these deposits outcrops on a limestone knoll about 400 feet above sea-level, where the copper and iron minerals have replaced the limestone over an area of about 60 feet long and 30 feet wide, a short distance from the actual contact between the limestone and igneous rock. Prospecting-work by driving an adit near the foot of the knoll has demonstrated that at this point the ore-deposit is also underlaid by limestone, appearing to grade off gradually from a fairly solid body of chalcopryrite and iron pyrite to grains and particles of the mineral disseminated irregularly through a gangue made up chiefly of a lime-silicate rock underlaid by crystalline limestone. The adit is about 70 feet long and is driven nearly the entire distance in limestone.

On the *Marble Cove No. 5* claim, about 800 feet in a south-westerly direction from the work above described, there is an occurrence of pyrrhotite and impure iron ore which belongs to the shear-zone type of deposits, as it occurs apparently filling a fissure in a rather wide shear-zone in igneous rocks. The strike of the fissure is towards the south-east and almost at right angles to the apparent strike of the limestone at the first-mentioned ore-deposit. A crosscut adit has been started to prospect this deposit of mineral, but work was discontinued after driving 15 feet and before any mineral was exposed.

About 200 feet in a south-westerly direction from the last-mentioned crosscut adit, and about 40 feet higher elevation, there are other outcroppings of impure pyrrhotite, but no work has been done to determine whether there is sufficient chalcopryrite mixed with the pyrrhotite to warrant mining.

About 60 feet south-westerly from the pyrrhotite outcroppings the line of strike of the rock formation changes to the south-westerly, and the rocks change to limestone and lime-silicate rock, with which is associated lenses of chalcopryrite, with much garnetite as the gangue. The mineralization occurs at the contact between the igneous rock and limestone.

Another occurrence of copper minerals outcrops about 500 feet in a south-easterly direction from that just referred to. The outcroppings indicate low-grade copper ore of the chalcopryrite variety, associated with pyrrhotite, magnetite, hornblende, garnet, and epidote. About 150 feet in a south-easterly direction from the last mentioned there is another outcropping of mineral made up chiefly of pyrrhotite and hornblende, with a little chalcopryrite.

Judging from the general geologic conditions surrounding this property, it appears as though they were favourable for deposition of ore-bodies, and that a more thorough and systematic method of prospecting is fully warranted.

Development-work.—The development-work on the *Marble Cove* group consists of about 100 feet of tunnelling and a number of open-cuts. A good trail has been made, with the assistance of the Government, from the shore to the main mine-workings, a distance of about half a mile.

All work was suspended last summer, as J. MacD. Russell had expended the total amount he had agreed to do, and his associate owners were reluctant to consider incorporating the property in a joint-stock company.

Hawkins Island Subsection.

At the westerly entrance to Barkley sound, on the west coast of Vancouver island, there is a large group of small islands, locally known as "The Thousand Islands," of which Hawkins island is the farthest westerly. It contains about 43 acres, more or less, is about half a mile

long, and has the shape of a triangle, with the widest end at the easterly side and the narrow end facing the west. There are about 10 acres cleared and a portion of it is planted in garden and orchard to supply the hotel, which is a favourite summer resort for some of the tourists. The writer visited the island on July 19th, 1918, to examine some mineral outcroppings reported to occur on the easterly end.

This mineral claim occupies all of the area of Hawkins island. It is reached by launch from Port Alberni, a distance of about forty miles, or from Sechart whaling-station, about eight miles distant. Hawkins island is owned by Mrs. Benson, the widow of an old-time sealing captain and one of the early pioneers on the west coast of Vancouver island.

Geology.—Hawkins island presents a view from the sea of being a bold rocky bluff that reaches an altitude of a few hundred feet, with an inhospitable coast against which the waves from the open ocean break with great violence during a storm, but a closer inspection reveals a sandy beach on the easterly side of the island slightly sheltered and on which small boats can land. An examination of the rocks shows that the geologic conditions are very similar to those already described as prevailing in the Alberni Canal section and on Copper island. The igneous rock, which resembles granodiorite, is the prevailing rock on the island, but there are also lenses of limestone which contact with the igneous rock, resulting in forming contact-metamorphic zones, in which are found outcroppings of magnetite of apparently limited extent. A sample from one of these outcrops assayed 44.5 per cent. of iron. As this ore appeared to be somewhat manganeseiferous, the sample was assayed for manganese, but the result showed that it contained none.

Henderson Lake Subsection.

Julius Donner, an old-time prospector on the west coast of Vancouver island, was engaged during a part of last season prospecting near the foot of Henderson lake. He located the *Krissie* group of mineral claims for himself and Andrew G. Larson, of Kildonan, as the result of his prospecting-work. With the exception of this work and some assessment-work done by the owners of other mineral claims near the shores of the lake, there was no activity in this section.

There are quite extensive contact-metamorphic zones at several points along the shores of Henderson lake, but comparatively little development-work has been done on any within late years. This inactivity is partly owing to the difficulty of transportation from the lake to Uchucklesit harbour because of the rapids in the narrows at the foot of the lake. Some years back the Dominion Government had work done to make a channel through the rapids for small boats, and, if this work was continued, a channel through which scows and launches could be taken might be made at a reasonable cost.

This group of mineral claims contains the *Krissie* and *Monk II.* and is located near the foot of Henderson lake, on the westerly side. The claims are located near an old claim from which a small shipment of copper ore was made to the Tacoma smelter in 1917. The claims were only staked during 1918; consequently but little work has been done, and thorough prospecting is necessary to determine whether the property possesses commercial value.

GREAT CENTRAL LAKE SECTION.

The *Big I.* and *Della* groups of mineral claims are the only locations in the Great Central Lake section which belong in the Alberni Mining Division. The claims in these two groups are near the summit of Big Interior mountain, but on the side which forms the watershed of Great Central and Buttle lakes. The groups were described in the Report for 1913, on pages 314-318; consequently, as there has been no development-work done since then, it is not necessary to repeat the description in the present report. The section is, however, mentioned here because of the fact that the geologic conditions bear a strong similarity to those found in portions of the Coast range of mountains on the Mainland, notably in the Britannia belt, and for that reason it is considered important that the attention of prospectors should be called to the conditions.

Only a small corner of the Big Interior range of mountains is included in the Alberni Mining Division, as the summit toward the north-west forms the dividing line between the Nanaimo and Clayoquot Divisions, under which headings the range is again referred to later in this report.

A casual examination of the geology leads to the opinion that this mountain range is made up of a mass of eruptive rocks, chiefly granodiorite, but after a closer inspection and a comparison with the conditions in the Coast range the occurrence of bands of stratified rocks is

noticeable, and the fact that at the contacts between these and the granodiorite intrusives there occurs more or less mineralization. The stratified rocks are schists, quartzites, argillites, and limestones. The mineralization is made up chiefly of chalcopyrite and iron pyrite, occurring in a siliceous gangue. Sometimes, as on the *Della* group, there occur fissures in the igneous rock filled with gold-bearing quartz veins, but this characteristic appears to be unusual, and to the writer's knowledge is only found as a rare occurrence.

CLAYOQUOT MINING DIVISION.

The Clayoquot Mining Division, for the purpose of this report, has been divided into the following sections: Tofino section, comprising Kennedy Lake and Deer Creek subsections; Central West Coast section, subdivided into Bedwell Sound, Ahousat, Sidney Inlet, and Nootka Sound subsections.

Despite the fact that the Clayoquot Mining Division was formerly much prospected, as it was quite a popular resort for prospectors about twenty years ago, it cannot be claimed that the Division has been much more than scratched over, and there are excellent opportunities for prospecting parties to explore the mountains at the heads of creeks which flow into the several inlets and arms of the sea. Transportation in the Clayoquot Mining Division is quite easy, as there are so many miles of inside protected waters where small boats or canoes can be used, as well as Kennedy lake, one of the largest lakes on Vancouver island.

The Clayoquot Mining Division probably still contains a greater area of unexplored territory than any other of the Mining Divisions on Vancouver island, except that portion of the Nanaimo Mining Division in which is situated Strathcona Park. The highest range of mountains on the island, which forms the watershed between the streams that flow to the easterly coast and those that flow towards the westerly, also forms the dividing line between the Clayoquot and Nanaimo Mining Divisions and is the backbone of the island.

The geologic conditions in this range of mountains are somewhat similar to those in the Coast range so far as known at present, being made up of masses of eruptive rock, mainly granodiorite, with some broad bands of stratified rocks which have been intruded by the eruptives. The contacts of these bands of stratified rocks with the granodiorite are more or less mineralized, with copper minerals, usually chalcopyrite, predominating.

TOFINO SECTION.

Kennedy Lake Subsection.

The Kennedy Lake subsection of the Clayoquot Mining Division contains some of the earliest discoveries of lode minerals, especially gold, that were made on Vancouver island. As far back as 1899 a concentrating plant was installed on the *Rose Marie* mine, now known as the *Rose* group, by the late Barclay Bonthron for an English syndicate. This property is located on Elk river, near the head of Kennedy lake, and was described by the writer in the Report for 1916, since which time it has been idle.

Several other mineral claims have been located near the *Rose*, on which fissure-veins filled with gold-bearing quartz occur. A small mill was operated some years back on the *Leora* claim, which was also described in the Report mentioned.

There is no doubt but that the vicinity of Elk river would be found to be a good section to prospect, provided transportation facilities for hauling ore and supplies were opened up between that river and Taylor river, which flows into Sproat lake, in the Alberni Mining Division. At the present time the prospects on Elk river, of which there are several, are handicapped to a greater extent than many other sections on the west coast of Vancouver island, because of lack of good transportation facilities.

The present route to reach Elk river is by steamer from Victoria to Clayoquot sound; launch from there to the mouth of Kennedy river; canoe or small boat up the rapids to Kennedy lake; boat up the lake to the mouth of Elk river; canoe up the river about two miles; then trail to the prospects. At some seasons a canoe can be taken about four miles farther up the river, but during high water or very low water it is not advisable to attempt to take a canoe farther than the first two miles.

During the summer of 1918 the writer attempted to make a thorough examination of all the prospects on Elk river, but on account of the extremely low water was unable to take a canoe up, and found the old trail impassable, so was compelled to abandon the trip.

This group contains two mineral claims—the *Wanderer* and *L. Grant*—and is **Wanderer Group.** located at the summit of a deep gulch about a quarter of a mile from the shore of Kennedy lake, about two miles from the mouth of Elk river and about 300 feet above the lake-level. The group is owned by L. Grant, of Tofino, and the claims are staked as full claims and contain about 100 acres.

Geology.—The rocks on the *Wanderer* group are igneous and apparently belong to an extension of the belt of Vancouver volcanics that occurs in the vicinity of Henderson lake, in the Alberni Mining Division. These rocks are much sheared, fissured, and altered. In places the shearing action has been so severe as to give the rocks schistose structure. The fissuring has resulted in the development of narrow quartz veins, which at and near the surface show quite good prospects in free gold by panning.

Characteristics of Ore-deposits.—The ore-deposits on the *Wanderer* group belong to the shear-zone type. The quartz veins which carry values in gold are narrow, but appear to be persistent, having the lines of strike S. 40° W. (mag.) and dip 72 degrees to the north-west (mag.). Some of the oxidized outcroppings furnish fine specimens of quartz, with particles of free gold in the quartz gangue. If further development determines that the veins increase in width and carry fair values throughout, this property would be a good milling proposition.

The topography of the ground is such that development-work can be carried on by a series of adits which would gain backs rapidly as they were driven into the mountain, which rises to an altitude of several hundred feet within a short distance from the outcroppings.

Development-work.—The development-work done up to September 7th, 1918, represented one assessment-work and consisted of two open-cuts and short adits. The upper open-cut is 12 feet long as an approach to an adit 6 feet long under cover. A sample from 6 inches of quartz assayed: Gold, 0.32 oz.; silver, 0.4 oz. The lower open-cut is about 25 feet below the upper; it is about 15 feet long as an approach to an adit 4 feet long. Two samples were taken at this work; one from the floor under cover assayed: Gold, 0.64 oz.; silver, 0.8 oz. The other sample, taken from near the face, assayed: Gold, trace; silver, trace. A selected specimen assayed: Gold, 1.86 oz.; silver, 0.8 oz.; copper, 15 per cent.

The location-line of the claim was followed in a north-easterly direction for some distance to the No. 2 post of the claim, where it appeared that the vein was persistent to that point, but this had not been determined by any work. This group of claims was only staked a short time prior to the examination.

This group of mineral claims consists of four claims known as the *O.K. No. 1*, **O.K. Group.** *O.K. No. 2*, *O.K. No. 3*, and *O.K. No. 4*, and is located at the summit of the mountain at an elevation of about 4,000 feet, between the Clayoquot arm of Kennedy lake and the main lake. There is practically no trail to the group, except up the bed of Sandy creek, which is full of large boulders. Sandy creek flows into Kennedy lake about six miles from the head, and the distance to the mine-workings on the *O.K. No. 3* claim is about four miles. There could be a fair trail built from the head of Clayoquot arm which would be shorter than the present route, but somewhat steeper. The group is owned by T. G. Norger, of Victoria, who staked the claims about 1900, built a cabin on the summit, and worked on the property almost continuously until he obtained a Crown grant, since which time but little further development-work has been done. The group contains about 195 acres. The claims are staked in a northerly direction from Norger creek, a branch of Sandy creek, in a line one claim wide, with the *O.K. No. 1* as the most southerly and the *O.K. No. 4* the most northerly.

Geology.—The rocks on the *O.K.* group belong to the Vancouver series and consist of white and blue limestones and dioritic rocks, with the limestone occurring in extensive masses on the southerly part of the property and dioritic rocks on the northerly part. The bedding-planes of the limestone strike east (mag.) and dip 40 degrees to the north. The dioritic rock is sheared, fractured, and altered, especially so near the line of contact with the limestone.

Characteristics of the Ore-deposits.—The occurrences of copper ore belong to the contact-metamorphic type, although they do not occur at the immediate contact of the igneous and sedimentary rocks, but are found enclosed by walls of the dioritic rock. The mineralization is chiefly chalcopryite, with which is associated iron pyrite and some pyrrhotite and magnetite.

The outcroppings are characterized by the chalcopryite occurring in masses of rather unusual purity and considerable size. These outcroppings are quite persistent for about 200 feet along the surface, where the mineral is about 3 feet wide, as shown by trenching. The strike is

S. 20° E. (mag.) and dip 50 degrees to the easterly. Samples from the outcrops can be taken which carry quite high-grade ore in copper values, but a sample taken from the underground workings assayed only: Gold, trace; silver, 0.8 oz.; copper, 4.7 per cent.

The surface outcrops are on the *O.K. No. 3* claim and gave promise that the property would develop into a mine that would produce a grade of copper ore sufficient to warrant shipping direct to a smelter, but in the underground workings, which are almost directly under the trench along the outcrops, it does not appear as though the ore-deposit had maintained continuity or value to any appreciable depth. The ore occurs on the northerly side of the summit between the main Kennedy lake and the Clayoquot arm of the lake, where the mountain-side is very precipitous, and float as well as some outcrops are found at other points on the mountain-side, but no work has been done to determine their extent.

Development-work.—The development-work on the *O.K. group* is confined to that on the *O.K. No. 3* claim, and consists of an adit about 105 feet long, in addition to about 200 feet of rather deep trenching. The adit was started as a crosscut and driven 60 feet. At a point 21 feet from the portal some ore is exposed and the course of the adit changed to the right or at right angles for 15 feet, where the course is again changed to the left at right angles for 30 feet. Some ore is crosscut in the last change in the course of the adit, and it appears as though this occurrence of ore is possibly an extension of the ore exposed near the portal in the main adit.

This mineral claim is owned by J. E. Martin, superintendent of Kennedy Lake Northern Crown. Hatchery, whose post-office address is Tofino, B.C. The claim is located about 300 feet above sea-level near the head of Clayoquot arm of Kennedy lake. The property is easy of access, being only about a mile and a half from the Kennedy Lake Hatchery by water and about half a mile by a good trail from the shore. The claim is staked for a full-sized mineral lode claim, 1,500 feet square.

Geology.—The geologic formations on this mineral claim belong to the contact-metamorphic type, the rocks being igneous and altered sedimentaries. The results of metamorphism are well illustrated and the line of contact clearly defined between the dioritic igneous rock and limestone. The latter occurs as forming high precipitous cliffs, with the line of strike of the bedding-planes N. 70° W. (mag.) and dip 65 degrees to the north-east (mag.). There are some igneous intrusive dykes which cut the limestone.

The mountain range back of the *Northern Crown* claim forms the watershed between the Clayoquot arm and the upper part of Tofino inlet. The peaks rise to altitudes exceeding 3,000 feet within a short distance from the shore. The section presents a promising field for prospecting.

Characteristics of the Ore-deposits.—The occurrences of ore on the *Northern Crown* claim are replacement deposits in limestone and represent illustrations of Clapp's contact deposits in a zone of contact metamorphism some distance from the actual line of contact. The mineralization is made up of pyrrhotite, chalcopyrite, and iron pyrite, with the pyrrhotite in some portions of the deposit the most abundant. The gangue material is chiefly limestone and the usual contact minerals, garnetite and epidote.

Samples taken from across about 3 feet where the outcrop has been stripped on the southerly side of a high precipitous limestone cliff assayed: Gold, trace; silver, 0.8 oz.; copper, 8.4 per cent. Gold, trace; silver, trace; copper, 1.5 per cent. Another sample from a sorted dump at the portal of a short adit assayed: Gold, trace; silver, 0.8 oz.; copper, 9.1 per cent.

Development-work.—The development-work on the *Northern Crown* mineral claim consists of an open-cut along the strike of an outcrop 38 feet long and an adit about 50 feet below the open-cut. The adit is driven about 62 feet long, with an open-cut approach about 12 feet long. The adit was driven with the purpose of intersecting the ore-deposit exposed in the upper open-cut, but it appeared to the writer that the adit had been driven too far to the left from the portal to accomplish the purpose, and that the course from the portal should have been nearly at right angles to that taken. Near the face of the adit the course has been changed to the right, and there are indications of ore near the face.

Deer Creek Subsection.

Deer creek empties into Tofino inlet, Clayoquot sound, at the head of the inlet. Several years ago this was one of the most popular fields for the prospector on the west coast of Vancouver island, when several mineral claims were staked and partly developed. The South

African war caused the first interruption to activity in the section, because some Englishmen who were operating on the *Jumbo* mineral claim left for the war and have never returned. The property reverted to the original owners and remained idle until 1916, when it was bonded by Sam. Silverman, who had considerable work done on it and on the adjoining claim, the *Crow*, but failed to complete the purchase, and the two claims again reverted to the original owners, remaining idle since. These properties were examined by the writer in 1916, and his report was published in the Minister of Mines' Report for that year.

There was some revival of prospecting during 1916 when a prospector named Walton staked the *White* claim on the northerly side of Deer creek, sold an interest in it, and enlisted for service overseas.

This mineral claim is on the northerly side of Deer creek about a mile and a half above the mouth of the creek by trail, and about 2,500 feet elevation. The claim is reached by launch from Tofino or Clayoquot to the mouth of Deer creek, and from there by an excellent trail up the northerly side of the creek. The claim is owned by Wm. N. Walton and Duncan McMillan, of Bamfield Creek, and is a full-sized claim, 1,500 feet square.

Geology.—The geologic conditions on this part of the Deer Creek section appear to be quite favourable for the deposition of ore, as there are some wide fissures in shear-zones in igneous rocks of a dioritic character. The fissures are filled chiefly with such non-metallic gangue minerals as garnet and epidote derived from contact metamorphism, scattered through which are pieces of chalcopyrite.

The most prominent of the fissures is about 12 feet wide between dioritic walls; its strike is westerly (mag.) and dip nearly vertical. It is exposed cutting into a steep mountain-side which rises vertically for about 75 feet from a point about 150 feet above a narrow terrace or bench, on which a cabin is built for the mining camp, at an elevation of about 2,500 feet. Beyond the summit the mountain continues to rise to much higher elevation, and forms the watershed between Deer and Tranquill creeks.

In the vicinity of the cabin there is a wide zone of contact-metamorphic rocks in which are several lenses of chalcopyrite associated with some pyrrhotite, iron pyrite, and magnetite, in a gangue composed of garnetite, epidote, limestone, and breccia.

Characteristics of the Ore-deposits.—The most extensive outcrops of ore occur in the vicinity of the cabin, and it is a question whether all of the outcroppings are in-place or have resulted from a slide from the steep mountain above, in which occurs the fissuring already referred to under the heading "Geology."

The ore-deposits belong to the contact-metamorphic type, but occur in the zone of contact metamorphism at some distance from the actual contact. Samples taken from two of the so-called lenses in the vicinity of 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. The property certainly merits thorough prospecting, as it has good indications and promising possibilities.

Development-work.—The development-work consists of several open-cuts within an area of about 120 feet long and 10 to 15 feet wide, a short adit and surface stripping representing two years' assessment-work. In addition, the owners, aided by the Department of Mines, have constructed an excellent trail about a mile and a half long and built a cabin.

CENTRAL WEST COAST SECTION.

Bedwell Sound Subsection.

The Bedwell sound is an arm of Clayoquot sound and penetrates into the west coast of Vancouver island for a distance of about twenty-five miles. There has never been any prospecting done in the mountains adjacent to the shores of the sound itself, but about twenty years ago there was a good deal of prospecting-work done in the mountains near the head of the sound and along Bear river, which has its source in the Big Interior range and flows westerly into Bedwell sound at its head.

There were quite a number of mineral claims staked in this section of the Clayoquot Mining Division previous to 1899, several of which were sold about that time and furnished the prospectors with good stakes. The section was quite active until about 1900, when for various reasons, chiefly lack of capital and in some instances disappointment in the actual results from

partial development, all activity ceased. The owners of mineral claims that had not been Crown-granted continued to hold on by doing assessment-work or restaking, while the owners of Crown-granted claims allowed them to remain idle.

About 1913 a revival of the old days of activity was brought about through the purchase of the *Ptarmigan* group of mineral claims at the head of Bear river by the representatives of the Earl of Denbigh, who proposed continuing the development-work commenced by the original stakers, and who purchased the old aerial tramway that had been in use at the *Tyee* mine on Mount Slicker from the Tyee Copper Company. The Ptarmigan Copper Mines, Limited, was organized, the trail up the Bear River valley was repaired, a new bridge built across that river at the canyon, and a camp erected in the mountains near the mine-workings. The declaration of war in 1914 resulted in the enlistment of practically every man in the employ of the company, the abandonment of operations, and the return of idleness of the section.

During 1918 the writer visited the Bedwell Sound section and examined the *Empress* mineral claim. It was his purpose to also examine the *Ptarmigan* group, but the snow was too low on April 24th, the date of his visit, to permit of reaching the elevation of that group, which is about 5,000 feet above sea-level.

This mineral claim, owned by J. W. McIntosh, of New Westminster, is located **Empress.** on Bear river about four miles above its mouth. The mouth of Bear river is reached by gasoline-launch, rowboat, or canoe, starting from either the Clayoquot or Tofino settlements near the entrance to Clayoquot sound and about thirty miles distant from the *Empress* mineral claim. As there is no post-office or store at the mouth of Bear river or on Bedwell sound, there is no port of call for the West Coast steamers nearer than the settlements mentioned. The Canadian Pacific Railway Company's steamer calls at both of these points three times each month, usually on the 3rd, 12th, and 22nd.

The occurrences of ore on the *Empress* mineral claim occur on the east side of Bear river and about one mile above the bridge, which is located near the 3-Mile post on the wagon-road which has been built from the mouth of the river up the valley for about five or six miles. This wagon-road was built in 1913 by the Ptarmigan Mining Company, which was operating the Ptarmigan group of mineral claims, situated at the summit of the range of mountains that separates the Bear River valley from the Great Central lake, locally known as the Big Interior range of mountains.

Geology.—The country-rock in the vicinity of the ore-body on the *Empress* claim is granodiorite, sheared, fractured, and altered. Its general strike is N 15° W. (mag.) and dip 75 degrees to the north-east. There is a system of local cross-fracturing, the joint-planes of which strike north-east and dip 50 degrees north-west. There is also another system of fracturing or fissuring in the sheared zone, the joint-planes of which strike S. 60° E. and dip vertical. The country-rock occurs as steep bluffs or cliffs along the side of the wagon-road, and it was during construction that the sheared zone with the occurrences of copper ore were exposed. There has not been sufficient work done to determine the extent of the mineralized zone, but apparently it exceeds 25 feet in width and is of undetermined length.

Characteristics of Ore-body.—Copper ore in the form of chalcopyrite is found occurring on the cleavage-planes of the sheared country-rock. It is in narrow stringers and does not appear to be disseminated through the country-rock which forms the gangue in which the ore occurs. If the ore can be mined separately from the country-rock it would give good values in copper, but unless close sorting is done it is questionable whether satisfactory operations could be carried on, although it is possible that if systematic prospecting was done the shear-zone which carries the mineral might be found to be of sufficient extent to warrant the installation of a concentrating-mill.

An open-cut has been made in the roadway since the road was constructed which has exposed a width of the shear-zone about 25 feet, striking nearly at right angles to the course of the wagon-road, and several small piles of ore are piled up on the roadway. A general grab sample from some of these piles assayed: Gold, trace; silver, trace; copper, 5.1 per cent.

The writer did not observe any wide fissures filled with ore, nor could he find where any development-work had been attempted, except where a few shots had been put in on the road-bed. No well-defined lead or lode bearing mineral was seen, except a portion of the shear-zone which has been described.

Conclusions.—The ore occurrences on the *Empress* mineral claim are sufficiently promising to warrant further prospecting to ascertain the extent of the mineralized zone. It would appear, so far as one can judge from an examination of such work as has been done, that there is a possibility of developing an ore-body of the shear-zone type that might be operated on a commercial scale.

The present transportation facilities would not permit of carrying on mining operations unless the extent of the ore-deposits is very considerable or the ore quite high in grade, because there is at present a wagon-haul of four miles to the mouth of Bear river, where an approach about a mile long is necessary to reach a depth of water sufficient to accommodate any vessel larger than a small launch.

Ahousat Subsection.

The Ahousat section of the Clayoquot Mining Division contains several prospects in the vicinity of Cat Face mountain, also on Flores island and Herbert arm of Clayoquot sound, but except on Flores island there has been no activity in this section for several years past.

This group of mineral claims contains nine claims and is owned by James Beck, **Ormond Group.** of Victoria. The property was quite fully described in the Annual Report for 1916, pages 334-336; therefore it is not necessary to repeat that description in this report. Since then the owner has done considerable additional development-work, which has improved the possibilities of the property.

It is stated that a bond has been taken on the group of claims by the Ladysmith Smelting Corporation, of Ladysmith, and that engineers will examine the property early in the season of 1919, and if satisfactory will commence active operations by extending the development-work to block out ore.

Sidney Inlet Subsection.

The Sidney Inlet subsection of the Clayoquot Mining Division has the distinction of containing the site on which is built the only concentrating-mill by the flotation method on Vancouver island, but this has been idle for the greater portion of 1918. This inactivity is owing to a reorganization of the Tidewater Copper Company, Limited, for which the mill was erected, and the desire to inaugurate the policy of the new management to thoroughly prospect and develop the *Indian Chief* group of mineral claims previous to attempting to stope and mill ore. It is also proposed to develop a water-power on Indian creek, which flows into Sidney inlet about half a mile north of the mill building, and thus do away with the cost of coal fuel.

This group, containing eight claims, was fully described in the Annual Report for 1917, pages 248-254, but is mentioned in this report because of the additional development-work that has been done in the mine during the past season. The property is owned by the Tidewater Copper Company, Limited, of Victoria, which was reorganized during 1918 and is now registered in British Columbia, with H. B. Price as manager.

Development-work.—The new development-work carried on during the past season has been confined to driving the No. 2 adit toward the workings on the north side of the mountain in which the ore-deposits occur, and driving a new crosscut adit on the *Scotlet* mineral claim. It is reported that this work has been quite satisfactory and has developed a considerable tonnage of copper ore of a commercial grade.

The preliminary work toward the development of the water-power on Indian creek has been done, and if the development-work in the mine continues satisfactory it is proposed to enlarge the concentrating-mill during the coming season.

QUATSINO MINING DIVISION.

The Quatsino Mining Division was examined by Victor Dolmage, of the Canadian Geological Survey, during 1918, who is preparing a geological map in detail, and whose report will be published in due course.

For convenience and to assist in locating the various mining properties in the Quatsino Mining Division, it has been subdivided in this report into the following sections, as follows: South-east Arm and West Arm.

Reference to a map of the Quatsino Mining Division shows that the above-named sections cover only a comparatively small portion of the Mining Division, which is accounted for because

of the fact that prospecting for metalliferous minerals has been confined almost entirely to the sections mentioned, and that the rocks in a considerable area of the Mining Division are sandstone, shales, and conglomerates, with coal, which has, however, so far not been found in commercial quantity. The coal-measures occur at Coal harbour near the junction of Rupert and West arms, also at Winter harbour near the entrance to the main Quatsino sound.

The coast-line northerly from Nootka island to Cape Scott, the most northerly point on Vancouver island, is extremely rough and inhospitable, with but comparatively few sheltered harbours, so that small launches or sailboats are not well adapted for use by prospectors; and, as there are no trails or roads in that portion of Vancouver island, prospecting on this part of the west coast has been neglected, except in the sections referred to.

SOUTH-EAST ARM SECTION.

Elk Lake Subsection.

The Elk Lake subsection embraces that portion of Vancouver island lying easterly and south-easterly of the South-east arm of Quatsino sound, which might be termed the Lakes section, as there are four lakes, each of considerable size, which form a chain with the waters flowing from one to another, and eventually into the Quatsino narrows at the entrance of Rupert arm of Quatsino sound. These lakes are called Victoria, Elk, Kathleen, and Alice. Victoria lake forms the south-easterly arm of the chain and flows into a mountain stream called Amazon creek, which empties into Alice lake. Elk lake forms the south-westerly arm of the chain and flows into a creek which empties into the head of Kathleen lake. Kathleen lake flows into a fair-sized stream called the Benson river, which empties into Alice lake. Alice lake flows into an unnamed river about seven miles long which empties into Quatsino sound at the Narrows. Although the lakes form a chain, there is no opportunity to navigate even a canoe through the streams which form the connecting-links, but there is a good pack-trail on the portages and the Coast Copper Company maintains good gasoline-launches on Alice and Kathleen lakes for carrying the men and supplies. There is a good pack-trail from June Landing on the South-east arm of Quatsino sound to the boat-landing on Alice lake, so that the trip to the mining camp of the Coast Copper Company is a comparatively easy one.

Old Sport Group. This group of mineral claims is the only property that has been actively operated during 1918 in the Elk Lake subsection. This group of mineral claims was quite fully described in the Annual Reports for 1916 and 1917, so that a repetition is unnecessary. During 1918 the development-work underground has been extended under the superintendence of Wm. Clancy, who has been manager of the property continuously since it was acquired by the Bacon Syndicate, of Spokane, which transferred it to the Coast Copper Company, a subsidiary of the Consolidated Mining and Smelting Company, of Trail, B.C.

South-east Arm Subsection.

Quatsino King Group. This group of mineral claims on the Teta river, which flows into the South-east arm of Quatsino sound on the westerly side, was prospected by diamond-drilling by the Granby Consolidated Mining, Smelting, and Power Company in 1917. The bond held by that company was cancelled in 1918 and the group has reverted to the original owners, the Teta River Mining Company, of Quatsino.

Yreka Group. This group was quite fully described in the Report for 1916, pages 337-339. Since that year the property has remained idle, but during the winter of 1918-19 it has been bonded by the Tidewater Copper Company, of Victoria, and Mr. Price, the manager, proposes making a thorough examination as early during the coming season as the conditions with regard to the snow will permit, with the view of operating the mine in connection with the *Indian Chief* on Sidney Inlet.

WEST ARM SECTION.

In the past the West Arm section of the Quatsino Mining Division has appeared to have been almost neglected by prospectors so far as metalliferous minerals, except iron ore, are concerned, and has only been noticeable on account of the old workings for coal and bog-iron ore, but about 1916 some prospectors located mineral claims near the head of the arm, on which they found copper ore, chiefly bornite.

During the late fall of 1918 development-work has been done on two groups of mineral claims known as the *Bowerman* and *Millington* by D. Spooner and associates, of Holberg. These properties have not yet been examined by the writer, but it is his intention to do so early in 1919.

NANAIMO MINING DIVISION.

For convenience in locating the various mining properties in the Nanaimo Mining Division, it has been subdivided in this report into the following named sections: Strathcona, Salmon River, Quadra Island, Phillips Arm, Texada Island, Redonda Island, Cumberland, and Nanaimo.

The Nanaimo Mining Division is by far the largest of the Divisions included in the Western Mineral Survey District of British Columbia, and includes not only the eastern part of Vancouver island north of the town of Ladysmith, but nearly all of the islands lying between Vancouver island and the Mainland, as well as that part of the Mainland north-westerly from Powell lake to the southerly side of Seymour inlet, Queen Charlotte sound, and west of the Coast range of mountains.

There is practically very little known of the easterly part of the district on the Mainland, and except a small section at the head of the Klinaklina river, where a deposit of hematite iron ore occurs, there appears to have been no prospecting done in the interior; at least, no occurrences of metalliferous minerals have recently been reported.

Transportation facilities by water are excellent up all of the inlets, but beyond the heads there are no transportation facilities. In fact, the prospectors who staked the iron-ore mineral claims on the West fork of the Klinaklina river gained access to that section from the Chilcotin country to the east of the dividing line between the Western Mineral Survey District and the Central District.

STRATHCONA SECTION.

Buttle Lake Subsection.

The Buttle Lake subsection includes that part of Vancouver island reserved for Strathcona Park, which from about 1910 until 1918 was closed against prospectors. In the latter year this section was thrown open and during that year was prospected to some extent on Myra creek near the southerly end of the lake, where an occurrence of copper ore had been discovered some years ago.

Black Bear Group.

This group of mineral claims contains the *Black Bear*, *Cariboo*, and *Beaver* claims, owned by J. D. Breeze, James Cross, A. F. Breeze, and J. L. Kerr, of Vancouver. The claims have not yet been examined by the writer, but are mentioned in this report as an encouragement to prospectors to explore the mountains in the vicinity, as it is claimed that the *Black Bear* group is a property of very promising possibilities.

Nanaimo River Subsection.

The Buttle Mountain district of the Nanaimo Mining Division is also locally known as the South Fork of the Nanaimo River section, because it is drained by that river, and the mineral claims that have been located in the section are mostly in the vicinity of or at no considerable distance from the headwaters and tributaries of the river.

The Buttle Mountain district is reached from Nanaimo by way of the South Fork wagon-road to the city dam across the South fork of the Nanaimo river, a distance of about sixteen miles. From there a pack-trail is travelled in a westerly direction about four miles to the ford across Boulder creek; after crossing Boulder creek the trail follows up the Jump river for a few miles, then crosses a divide between the Jump and Green rivers. Green river heads in Buttle mountain and flows into the second Nanaimo lake.

The mineralized zone of the Buttle Mountain district appears to lie along the divide between the heads of the Jump and Green rivers. Some years ago there was considerable prospecting done in that section and several mineral claims were located, but during recent years there has been but little attention paid to mining in this vicinity, where operations are handicapped by lack of transportation facilities and consequent excessive costs.

The *Patterson* and *Jubilee* groups of mineral claims are amongst the oldest locations and have been the most extensively developed, but the workings at both of these properties have been idle for so long that no satisfactory examination can be made until the old workings are cleaned out and unwatered.

This group of mineral claims contains four claims, known as the *Britain*, *Allies Group*, *France*, *Japan*, and *Serbia*, owned by Archie Cowie and associates, of Nanaimo.

The group of claims is located on the northerly slope of Buttle mountain, with the *Japan* claim covering a part of the summit of the mountain, and the *Britain* the most northerly of the locations. The *France* claim adjoins the *Britain* on the southerly side and the *Serbia* claim adjoins the *France*. The claims are grouped as the *Allies* group, and practically all of the work has been done on the *France* and *Serbia* claims. The mining camp is near the head of Green river at the foot of Buttle mountain, and is reached by a newly constructed pack-trail about a mile and a half long which branches off from the Jubilee trail at the crossing of Jubilee creek.

Geology.—The prevailing country-rock on the *Allies* group is granitic, some of it having a gneissic structure. The granitic rocks are considerably fissured, with the fissures being filled with quartz. There appears to be at least two, if not three, series of fissures, which occur almost paralleling each other. The dimensions of the fissures have not been determined. The granitic rocks are very badly altered and metamorphosed.

Characteristics of the Ore-deposits.—The ore-deposits on the *Allies* group occur in quartz veins which are enclosed by granitic walls and vary in width from a few inches up to 5 feet at one place. The mineralization in the quartz is chiefly molybdenite, occurring in flakes and sometimes lumps of from about the size of coffee-beans to as large as a man's fist. Associated with the molybdenite there is generally a little chalcopyrite, but so far as assays of samples show there are no values in the precious metals.

The following is a list of assays of samples taken from various points from several veins, the relationship between which, if any exists, has not been determined by work:—

Sample.	Molybdenite.	Gold.	Silver.	Copper.
	Per Cent.	Oz. per Ton.	Oz. per Ton.	Per Cent.
Grab from dump.....	...	Trace.	Trace.	0.3
Selected	1.2	"	"	0.15
From outcrop.....	0.3	"	"	1.0
Vein 12 inches wide.....	0.96	"	"	Trace.
Vein 18 inches wide.....	0.96	"	"	Nil.
Specimen selected	23.1	....	....	....

All of the above samples were taken from the *Serbia* claim.

Development-work.—The development-work consists of an old incline shaft (full of water) on the *Serbia* claim; an adit on the *France* claim 30 feet long, close timbered; and several prospect-holes, most of which are on the *Serbia* claim.

Conclusions.—At present the property is badly handicapped by lack of good transportation facilities. Had further development-work been done early in the war, and transportation provided to haul sorted ore to Cowichan lake, which is the logical route for a road, it appears as though a production of molybdenite could have been assured. The possibilities of the deposits are quite promising, while the distance to Cowichan lake appears to be only about eight miles, where water transportation to the branch of the Esquimalt & Nanaimo Railway can be utilized.

If there is any substantial demand for molybdenite in future, this property is sufficiently promising to warrant systematic development as a concentrating proposition and with a view of treating the crude ore in a plant on the claims, where apparently a good supply of water for concentrating purposes can be obtained from Green river.

Float carrying good copper and silver values is found on Buttle mountain near the summit, but no thorough prospecting-work has been done to locate the source of this float.

Quinsam Lake Subsection.

The Quinsam Lake subsection contains that portion of the Division lying southerly and easterly of the Upper Campbell lake and drained by the Quinsam and Campbell rivers. At the present time the only occurrences of metalliferous minerals reported are deposits of magnetite. These occur south of Upper Quinsam lake, also on Iron river, a tributary of the Quinsam river.

The Upper Quinsam lake deposits are reached by a trail which branches off from the Campbell River-Buttle Lake wagon-road at Gooseneck lake, about twelve miles from the Campbell

River Post-office. The Iron River deposits are reached by a trail which branches off from the same wagon-road at the mouth of Iron river, about three miles easterly from Gooseneck lake.

Quinsam Lake Iron-ore Deposits.—These deposits of magnetite were fully described in Bulletin No. 3, 1917, Bureau of Mines Report, on the "Iron-ore Deposits of Vancouver and Texada Islands"; consequently it is unnecessary to repeat the description here. The deposits are mentioned here because they occur on a parcel of land covering 25,000 acres on the Esquimalt & Nanaimo land grant, which is under contract to the British America Timber Company, Limited, of Seattle, Wash.; also because, owing to the recent agitation regarding the establishment of an iron and steel industry, the situation of these deposits is an important consideration.

There are also immense deposits of limestone in the immediate vicinity of the iron ore, while the unimproved water-power on the Campbell river is only a few miles distant.

SALMON RIVER SECTION.

The Salmon River section is so named because, although there have been no occurrences of metalliferous minerals reported from the immediate vicinity, yet the wharf at the mouth of Salmon river is the point of debarkation to reach the Adams river, on which mineral deposits occur.

This group contains three mineral claims known as the *Lucky Jim*, *Lucky John* and *Marjorie*. The group is located on Adams river, which flows into Johnstone strait about fifteen miles north-westerly from the mouth of the Salmon river. The property is reached by means of a poor trail from the junction of the Salmon and White rivers, about seven miles from the Salmon River wharf. The trail follows the east bank of the White river for about half a mile; then takes a south-westerly direction across a comparatively flat country, with several small lakes, beaver meadows, and swamps, for a distance of about ten miles to the headwaters of the Adams river. The property is owned by Alec and Walter McKay, of Vancouver.

Geology.—The rocks on the *Lucky Jim* group are granodiorite and limestone, and occur in a zone of metamorphism in which shearing action has been very pronounced. Several narrow quartz stringers are noticeable in the shear-planes, but none of them appear to carry any mineral.

Characteristics of the Ore-deposit.—The deposit of ore which occurs on the *Lucky Jim* claim of the group belongs to the contact-metamorphic type, with copper minerals occurring at the contact of granodiorite and limestone. The mineralization consists of pyrrhotite, iron pyrite, marcasite, and chalcopyrite in a breccia gangue containing much hornblende and some calcite. Apparently the ore occurs as a partial replacement of the metamorphic rocks in the contact-zone.

The main outcroppings occur in the bed and along the bank of the river, where they show for about 10 feet wide and 50 feet long. The line of strike is north-easterly and dip from 64 degrees to nearly vertical to the south-east. A sample taken from the workings assayed: Gold, 0.9 oz.; silver, 1.8 oz.; copper, 5.35 per cent.

Development-work.—The work on the *Lucky Jim* group of mineral claims is confined to the *Lucky Jim* claim, and consists of a series of prospect-adits driven into the outcrops in the river-bank. The longest is about 70 feet long; the others are each about 10 feet long. The short adits are crosscuts and the long one is presumed to be a drift.

Conclusions.—The examination of this property suggests that, if the transportation facilities were good, instead of being quite difficult, the possibilities are promising, and warrant further development-work, which might result in proving up a mining property of commercial value.

QUADRA ISLAND SECTION.

The Quadra Island section comprises the area of that island, which is the largest of the Valdes group of islands on the east side of Seymour narrows and Discovery passage. The only portions of the island where any activity has been apparent in the mining industry during 1918 have been on the *Copper Mountain* group at the head of Gowland harbour and on the *Santa Anna* group near Bold point, on the easterly side of the island.

The various groups of mineral claims in the vicinity of Granite bay, north of Seymour narrows, have been idle for several years past, except so far as assessment-work having been done on some of the claims that are not yet Crown-granted, but most of the claims in this vicinity have been Crown-granted for some time.

This group of mineral claims was reported on in the Annual Report for 1916 and 1917, but is again reported on after another examination made early in November, 1918, which was made because of the reported discovery of deposits of copper ore unknown at the time the examinations were made in 1916 and 1917. The following description of the recent mine-workings on the new discoveries shows that more thorough prospecting is necessary on properties, especially where the shear-zone type of ore-deposits occur, than is often done. This group of claims is one of the oldest locations on the Coast, but it has never been thoroughly prospected until recently.

Location and Area.—The *Copper Mountain* group of mineral claims is located at the head of Gowland harbour, on Quadra island, about 120 miles north-westerly from Nanaimo. The property contains nineteen mineral claims and fractions, named as follows: *Y.Z., Tyee Copper, Ingersoll No. 2, Hiyu Copper Fraction, Ingersoll No. 2 Fraction, Senator, Hiyu Copper, Copper Bluff, Copper Dyke, St. Lawrence, Ingersoll, Skookum Copper, Copper Mountain, Copper Flat, Copperopolis, Anaconda, Copper King, Copper Queen, and Copper Queen Fraction*. The group covers an area of about 730 acres. It is located from near the shore-line of Gowland harbour in a northerly direction towards the summit of a range of mountains which reach an elevation of about 2,000 feet above sea-level.

Ownership.—The *Copper Mountain* group of Crown-granted mineral claims is owned by the Valdez Island Copper Company, Limited, of Victoria.

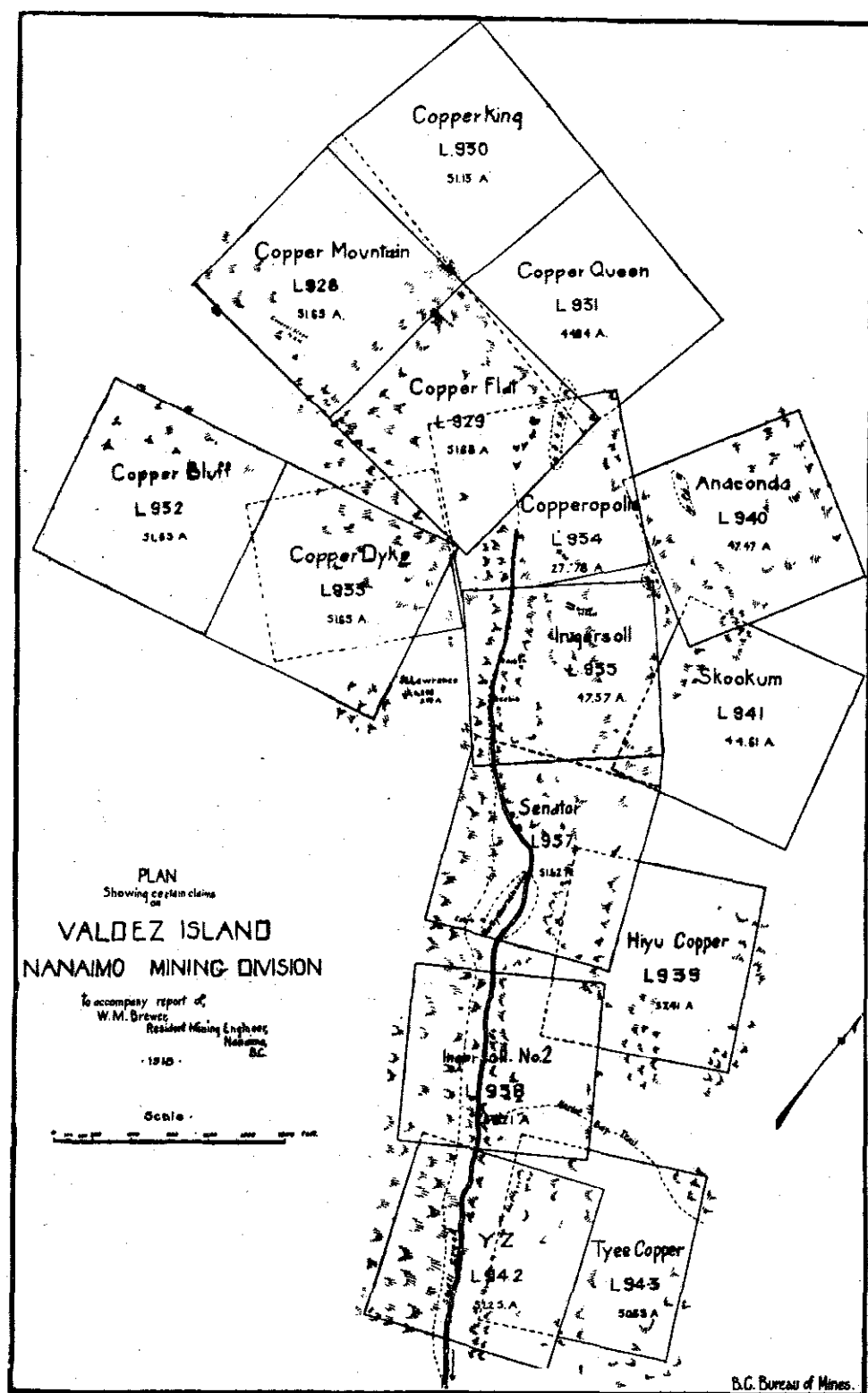
Accessibility.—The property can be reached by three routes, viz.: Esquimalt & Nanaimo Railway from Nanaimo to Courtenay; thence by automobile to Campbell River Post-office and about three miles by launch across Discovery passage to Gowland harbour, Quadra Island. Steamer from Vancouver to Campbell River Post-office and launch across Discovery passage. Steamer from Vancouver to Heriot Bay, a port of call on the east coast of Quadra Island, and wagon-road across the island about four miles in distance to Gowland Harbour.

Geology.—The rock formation on the *Copper Mountain* group of mineral claims belongs to the Valdes group of volcanic rocks, consisting of greenstone, andesite, and basalt, with the greenstone generally predominating. These rocks are generally compact and fine-grained to cryptocrystalline in texture; but there are considerable areas where the structure of the rock is amygdaloidal, the amygdules being filled with secondary minerals, such as quartz, chalcedony, epidote, chlorite, calcite, and zeolites. Chalcocite, chalcopyrite, bornite, native copper, and azurite also occur within the amygdules.

The rocks are very much weathered, sheared, fissured, and faulted. The cleavage-planes are generally slickensided and show the effect of much movement. The surfaces of the weathered rocks are usually rounded and hummocky, with many rounded cliffs and bluffs having steep sides. There is a noticeable system of ridges on the *Copper Mountain* group which trend from the shore towards the north and north-west, and on the surfaces of which the outcroppings of copper minerals found on the property usually occur.

Characteristics of Ore-deposits.—Copper ores, chiefly chalcocite and bornite, occur on several of the mineral claims in the *Copper Mountain* group along joint-planes and shear-zones apparently as isolated deposits of lenticular structure. The deposits that were the most thoroughly prospected in the past have the appearance of blanket or flow structure, and were generally considered by mining engineers as not likely to maintain continuity beyond shallow depths. The outcroppings so prospected showed considerable superficial extent and contained copper ore of high grade. However, during the past season, under the supervision of T. H. Kerruish, other deposits of copper ore have been found which occur on the *Senator* claim. Development-work on this claim shows indications of the ore maintaining continuity on the dip of 38 degrees towards the west to deeper levels than heretofore has been the case. The dip of this ore-body is steeper and in an opposite direction to those mined previous to the past season.

These later discoveries show indications that the origin of the mineralization is from copper-bearing solutions that have ascended along joint-planes and shear-zones in the volcanic rocks, and impregnated those rocks with copper sulphides, especially where amygdaloidal structure occurs in the country-rocks. While the most recent development-work appears to indicate the possibility of the ore having ascended from deep levels, the work had not been carried sufficiently far at the time of the writer's visit during the early part of November to fully determine the question.



During 1916 this group of mineral claims was under option to parties who prospected to some extent with diamond-drill, but the boring, so far as the writer can ascertain, with the exception of one flat hole, was done on the blanket deposits, where the mineral-bearing zone appeared to dip towards the east, instead of on the deposits recently found on the *Senator* mineral claim, where the ore-body has a decided dip towards the west, so that the results from the diamond-drilling done at that time have no bearing on the possibilities of the recently found deposits.

The development-work done previous to the summer of 1918 has been confined almost exclusively to the *Ingersoll* claim, with the exception of shallow open-cuts and stripping on the *Copperopolis* and *Copper Mountain* claims. During 1918 most of the work has been done on the *Senator* and *Ingersoll No. 2* claims.

The outcroppings of copper ore on *Ingersoll No. 2* claim are situated about half a mile from the beach on the easterly side of the skid-road at the summit of a rugged ridge, the axis of which trends north-westerly conformably with the strike of the joint-planes in a shear-zone along which copper minerals occur. The outcroppings are found within an area about 100 feet square, where shallow stripping has been done, exposing ore in several places to an average depth of about 4 feet. The cuts were full of broken ore and country-rock. Grab samples taken from two points in the stripped surface assayed as follows: No. 1 sample, where the surface stripped is about 20 feet square, assayed: Gold, trace; silver, 0.4 oz.; copper, 3.2 per cent. No. 2 sample, about 60 feet southerly from sample No. 1, where the stripping is about 30 feet long, 5 feet wide, and 4 feet deep, assayed: Gold, trace; silver, 0.4 oz.; copper, 2.9 per cent.

The outcroppings of copper ore on the *Senator* claim, where the chief development-work has been recently done, occur on a ridge on the westerly side of the skid-road about 1,500 feet in a north-westerly direction from the stripped surface sampled on the *Ingersoll No. 2* claim.

The development-work on November 2nd, 1918, consisted of a deep incline open-cut about 70 feet long, 10 feet wide, and averaging 5 feet deep, but with its maximum depth at the south-easterly end of the cut. About 150 tons of shipping-ore had been mined from the cut previous to the examination. The maximum width of ore is 7 feet.

The ore-body lies between well-defined walls dipping 38 degrees to the westerly and striking nearly true north. The bottom of the cut was still in ore. A grab sample taken from the dump containing about 50 tons of ore sorted for shipment assayed: Gold, trace; silver, 0.4 oz.; copper, 5.6 per cent.

The ore-body is traceable on the surface for some distance south-easterly from the present end of the open-cut, and the superintendent proposes to sink a shaft to test the conditions at depth and abandon the present work of underhand stopping in the open-cut, where water from rain-storms handicaps the mining operations.

On the same mineral claim, but on the opposite side of the skid-road, a narrow seam of copper ore occurs along a fault-plane striking north-easterly and dipping north-westerly about 20 degrees. An open-cut about 10 feet deep and 75 feet long was made on this occurrence of ore by a former management, and all the ore mined was shipped to the Ladysmith smelter. Further prospecting is necessary on this ore-body to determine conditions at depth.

On the *Copperopolis* mineral claim open-cut work and stripping have been done over an area of about 75 feet long and 20 feet wide at a point about 200 feet north-westerly from the old workings on the *Ingersoll* claim. The material blasted out when this stripping was done has been sorted once and the best ore shipped to smelter, but there is a considerable quantity of broken ore mixed with the greenstone country-rock still in the open cuts.

The cuts are so full of broken rock and ore that it is practically impossible to determine the strike and dip of the ore-body, but apparently the strike is north-westerly and dip quite flat, except at the south-easterly end of the open-cut, where the dip appears to be steeper. The width of the ore in the bottom of the trench at that end is only about 12 inches, but the grade is good. A sample assayed: Gold, trace; silver, 0.4 oz.; copper, 8.4 per cent.

Development-work.—The older development-work on the property consists of open-cuts and stripping over considerable areas on the *Copperopolis*, *Ingersoll*, *Copper Mountain*, and *Copper Flat* mineral claims, which was described in the Annual Report for 1916, on pages 346 and 347. The more recent development-work is that done on the *Senator* and *Ingersoll No. 2* claims, described under "Characteristics of Ore-deposits" in this report.

During 1916 a skid-road was built from the beach to the *Ingersoll* claim about a mile and a half long, and a camp built at the beach to accommodate about ten men. It is proposed to extend the skid-road about a mile and a half to facilitate transportation of ore from the *Copperopolis* and *Copper Mountain* claims, also to build cabins on those claims for camps.

Shipments of Ore.—Copper ore has been shipped from the *Copper Mountain* group at irregular intervals since 1917. The transportation facilities when the skid-road is repaired and extended will be excellent. The freight rates to Coast smelters by scows are extremely low, so that even with the decline in the price of copper the property should be worked advantageously.

PHILLIPS ARM SECTION.

To the north and east of Quadra Island there lies a very extensive area composed of small islands and several inlets which penetrate the mainland, as has been already mentioned. Reference to the geological map which accompanies the report of J. Austen Bancroft, issued as Memoir No. 23, "Geology of the Coast and Islands between the Strait of Georgia and Queen Charlotte Sound, B.C.," Canada Department of Mines, 1913, shows the extent of several occurrences of metamorphosed sedimentary rocks which have been intruded by the granite rocks of the Coast range. Such bands of altered sedimentaries are mentioned by Camsell, and described as a series of more or less continuous roof pendants which were not destroyed at the time of intrusion nor removed by later erosion.

Prospecting has proven that gold and copper are found to occur in connection with several of the bands of altered sedimentaries; consequently the section is recommended to the attention of prospectors and investors.

This section is called Phillips arm because of the central location of that arm, as well as because there has been more activity during 1918 in that vicinity than at other points along that part of the coast. The section is intended to include the coast-line from the east side of Bute inlet to the west side of Knight inlet.

During 1918 a syndicate of Victoria men have been operating in the vicinity of Fanny bay, Phillips arm, and a syndicate of Vancouver men are interested in groups of mineral claims on Knight inlet.

Unfortunately the writer was unable to visit these mineral claims during last season while the work was being done; therefore the following particulars were obtained from G. F. Monckton, who superintended the work for the syndicate. The *Monte Cristo* and *Amethyst* mineral claims adjoin, and are near Fanny bay, on the west side of Phillips arm. The property is reached by one of the Union Steamship Company's steamers which stops at Shoal bay, from which point a launch or rowboat can be taken to the shore of Fanny bay.

Characteristics of the Ore-deposit.—With regard to the occurrence of ore on the property, Mr. Monckton says: "The ore-body worked on the boundary of these two claims occurs close to the contact of marble, an andesite dyke, which is in places very schistose. The ore is within a few inches of the marble."

Geology.—Bancroft's description of the geology of this section states that the prevailing rocks in the vicinity of Fanny bay include metamorphosed equivalents of the Marble Bay, Open Bay, Valdes, and Parson Bay formations, in which are included crystalline limestone, argillite, tuff, chert, quartzite, schist, greenstone, andesite, and basalt.

Development-work.—Monckton describes the work done last summer as being a series of open-cuts in the ore-body. One of these is 30 feet long, from 10 to 25 feet deep; another, 18 feet long, 10 feet deep; and a third cut about 7 feet long. These cuts are made partly on the *Monte Cristo* and partly on the *Amethyst* claim.

Monckton further states that while doing this work he has accumulated a dump on which is about 95 tons of ore ready for shipment. With regard to values, he states that "assays from samples carefully taken when there was about 25 tons of ore on the dump gave: Gold, \$3; silver, \$3." He further states that "an assay from the hanging-wall (right-hand) vein by the Granby Company returned: Copper, 8.4 per cent.; gold, 0.04 oz.; silver, 2.2 oz."

Extent of Ore-deposit.—Monckton's description of the extent of the ore-deposit is as follows: "All of the workings are on the ore-body, which consists of a right- and left-hand ore-streak with mineralized rock intervening, which is usually about 3 feet wide, some of which is sufficiently good to sort out. At the present time the only valuation of it as a whole which can be quoted

is a test of 600 lb. from 6 feet across, made at the Tacoma smelter in 1916, which gave 2.7 per cent. in copper."

This group of mineral claims contains five claims known as the *Princess Agnes*, *Princess Group*, *Princess Margaret*, *Princess Charlotte*, *Princess Ethel*, and *Princess Jessie*.

The *Princess* group is located on Knight inlet about twenty miles easterly from Minstrel island, near Glendale cove. The Princess Copper Mines, Limited, of British Columbia, is the owner, with John Walker and John Carmichael, of 714 Dominion Building, Vancouver, representatives.

Owing to the inability of the writer to arrange to visit this property when the operators were at work in 1918, no examination has been made of it, but arrangements have been made for an early visit in 1919. Specimens of the ore said to have been obtained from the claims show that it is chiefly bornite in a garnetite and limestone gangue.

TEXADA ISLAND SECTION.

Texada island has been described so frequently in former reports, as well as in the memoirs and summary reports of the Geological Survey, that it is unnecessary to give any detailed description in this report.

During the past season the mining operations on the island have been confined to those at the *Marble Bay*, *Loyal*, *Retriever*, *Davies Bay*, and *Good Hope* metalliferous properties, and the Blubber and Marble Bay limestone-quarries. The island was visited for about a week from November 8th.

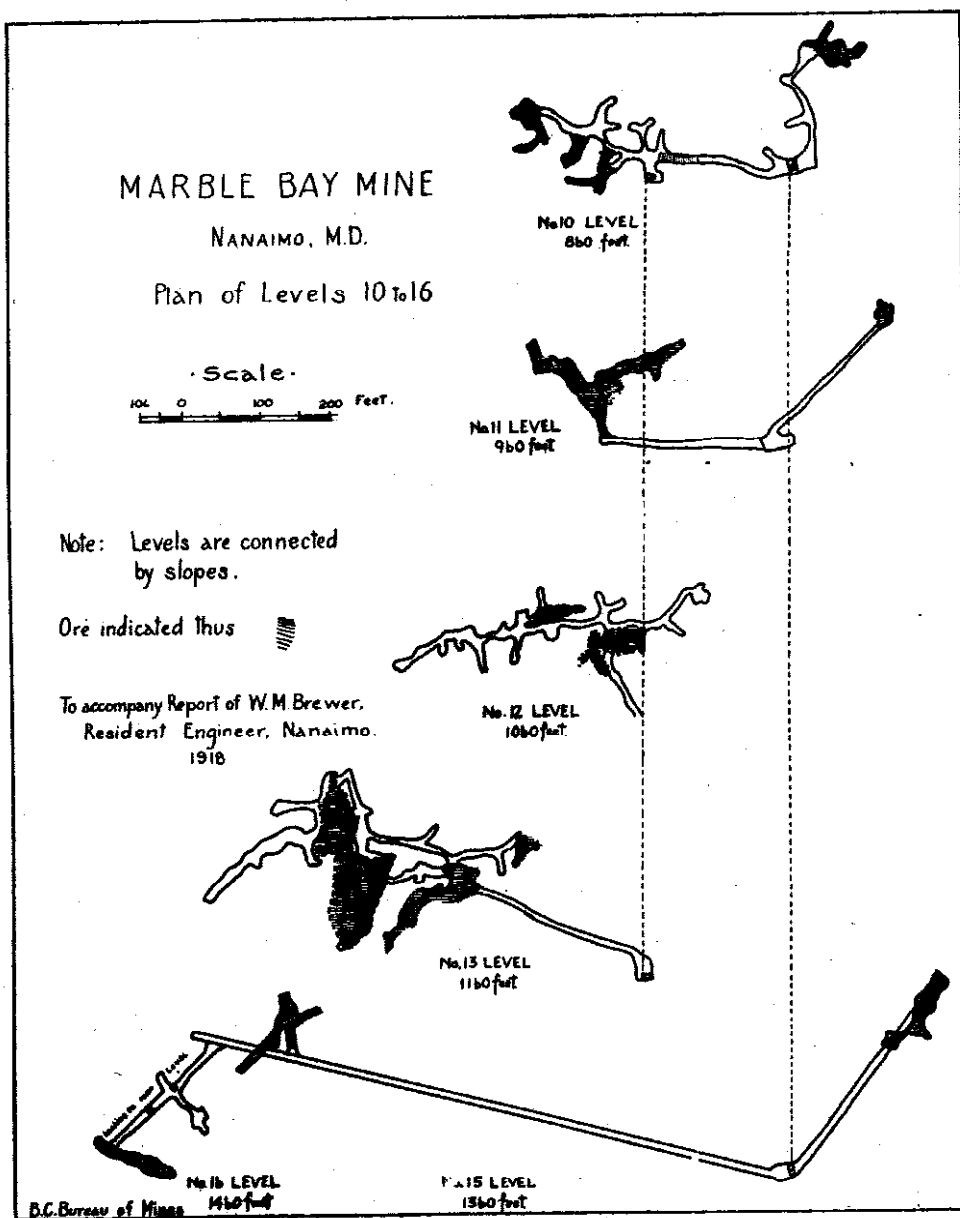
Mining operations have been carried on continuously at this mine during **Marble Bay.** 1918, and regular shipments of copper-gold ore have been made to the Tacoma smelter approximating 10,000 tons.

Development-work.—The development-work during 1918 has been confined almost entirely to opening-up the 1,600-foot level, which is about 1,500 feet vertically below the surface and about 1,400 feet below sea-level. Diamond-drilling has been done to explore the ground below the 1,600-foot level on the westerly side of the incline winze from the 1,500-foot level. These drill-holes show large bodies of garnetite; one of these bodies is shown by the drill-core to be persistent for about 100 feet in a hole bored on a 26-degree angle from the floor of the 1,600-foot level. The core also shows some narrow stringers of bornite in the garnetite, which is considered by the management as quite encouraging, because in the upper levels in the mine this variety of copper ore is nearly always found in association with garnetite or tremolite. Another hole is being bored at an angle of 40 degrees, and other holes will be bored at varying angles, as it has been found by the management, in locating the ore-bodies on the upper levels that it is advisable to bore several holes spread out like a fan from a common centre in order to determine as closely as possible whether the ore exposed in the drill-holes is of sufficient extent to warrant driving working openings.

August 8th, 1918, was the date on which a start was made to draw ore from the stope on the 1,600-foot level, and at the time of examination the top of the stope was about 40 feet above that level by vertical measurement, with some high-grade bornite in the roof of the stope. Since that examination the writer is advised that the stope has been mined out, and that the ore did not extend through to the floor of the 1,500-foot level. This ore-body was 110 feet long and averaged from 8 to 12 feet wide. At one part of the stope the ore showed a maximum width of nearly 45 feet. The dip of this ore-body is 35 degrees to the north-westerly, but it shows in the roof and floor of the 1,600-foot level dipping much flatter.

The collar of the incline winze from the 1,500-foot level is near the face of the north-west drift, 700 feet from the main shaft. The winze is 125 feet deep on a 45-degree angle.

The main shaft is sunk vertical from the surface to the 1,500-foot level, with stations about 100 feet apart down to the tenth level, but with no stations between that level and the fifteenth. The reason for this is that the ore-body on the north-westerly side of the shaft below the tenth level has pitched or dragged so far from the shaft that it was deemed advisable to sink a vertical winze from the tenth level and hoist the ore through the winze; then tram it to the main shaft and hoist to the surface. This course was pursued until it was found that the ore-body was persistent below the thirteenth level, when it was considered more economical to sink the main shaft to the fifteenth level and hoist all ore from that level to the surface direct instead of making a transfer on the tenth.



On the fifteenth level there is a drift toward the south-east 300 feet long to the ore-body in that direction from the main shaft, which is persistent from the ninth level almost to the fifteenth, or to what is known as the "1,502" stope. There was no ore in the face of this drift on the fifteenth level, nor was any ore exposed in the drift itself.

The accompanying sketch shows how erratic the ore-bodies have been in their occurrence, and yet when the formation is carefully studied there is a certain regularity and indications which when followed result in the discovery of extensions of the known ore-bodies or in finding new ones.

This group of mineral claims has been worked spasmodically since the discovery of ore occurrences in 1900, when the mine was opened by the Van Anda Copper and Gold Company, but since that company stopped operations work has only been done at intervals by lessees, and during 1918 it has been operated by Thomas Davis, of Seattle.

Development-work.—The development-work done on the property previous to the past year consisted of five shafts, the deepest being 300 feet, known as the No. 1 shaft, which is sunk near the south-east face of a deep open-cut from which ore was quarried when the mine was first opened. The No. 2 shaft is about 220 feet south-easterly from No. 1 and is about 200 feet deep. The No. 3 shaft is about 180 feet distant from the No. 2 and is about 220 feet deep, on an incline toward the west. The other two shafts are shallower and were sunk for prospecting at points between Nos. 1 and 3. All of these shafts are sunk in a mineralized zone made up of altered felsite and garnetite, which contacts with limestone on both the easterly and westerly sides, and in which occurs outcroppings of bornite and some chalcopryite in the garnetite gangue.

During 1918 the lessee has renewed the gallows-frame over the No. 1 shaft and installed a compressor plant and pump, and began prospecting the underground workings from that shaft. Finding that the pump was unable to handle the water below the 200-foot level, a bulkhead was constructed to hold the water back and the ground above that level prospected.

On the 200-foot level there is a drift toward the north about 300 feet long. An upraise was made in ore by the lessee from this drift to the 100-foot level, but the ore was a pipe about 10 feet long that extended up to and above the 100-foot level. This pipe was stoped out in making the upraise and yielded about 70 tons of ore that assayed: Gold, trace; silver, 5.0 oz.; copper, 4.5 per cent.

After this work was done the lessee closed down work for the winter, and proposes to resume next spring and prospect on the 100- and 200-foot levels in a southerly direction from the No. 1 shaft under the mineralized zone which outcrops on the surface. No prospecting has ever been done in that direction in the underground workings, although it would appear as though such prospecting ought to result in exposing ore-bodies similar to those which outcrop. In a northerly direction from the No. 1 shaft there are no outcroppings on the surface, where the prevailing rock is limestone which has been intruded by a series of dioritic dykes. One of these dykes occurs about 80 feet northerly from the No. 1 shaft, striking N. 80° W. (mag.) and dipping 80 degrees to the south (mag.).

This mineral claim on Raven bay, on the east coast of Texada island, owned by H. Walbran, of Vananda, was examined in 1917 and described in the Report of the Minister of Mines for that year, but during 1918 it has been operated and about 1,000 tons of magnetite shipped to the blast-furnace at Irondale, State of Washington. When examined in November, 1918, the miners were quarrying the ore from an open-cut about 20 feet deep at the face, 20 feet wide, and 22 feet long. This open-cut was made diagonally across the strike of the ore, which is south-easterly, with the dip 81 degrees toward the east.

The working force consisted of an average of eight miners, who quarried about 50 tons a day and loaded it on scows at the rate of about 40 tons an hour. The quarry is connected with the shore by a gravity-tramway 140 feet long to ore-bins 17 feet high, 16 feet wide, and 24 feet long. From the bins there are two trestles branching off, each 150 feet long and 14 feet high, to permit scows to lie on two gridirons, each 80 feet long and 34 feet wide, so that two scows can be loaded at once. A grab sample of the ore being shipped assayed: Iron, 60 per cent.; phosphorus, 0.08 per cent.; sulphur, 0.03 per cent.; silica, 5 per cent.

This mineral claim, which is owned by W. H. Lee and Wm. McDonald, of Vananda, and is on Surprise mountain, on the westerly coast of Texada island, was actively operated during 1918. This property was described in the Report

Retriever.

of the Minister of Mines for 1917, page 258, but since then there has been a concentrating-mill built on the shore at the terminus of the 1,850-foot aerial tramway. The mill is equipped with an ore-crusher, two sets of rolls, two Faust jigs, and concentrating-table with a capacity to handle about 50 tons of ore a day. In November, at the time of the writer's visit, the mill had not been started owing to the lack of water because of the extremely dry season.

There was about 60 tons of ore in the bunkers from the vein known as the "sulphide" vein. A sample was taken from a new shaft started on the silver-lead vein, about 100 feet north-easterly from the old shaft on the silver-lead vein. A grab sample from this shaft assayed: Gold, trace; silver, 0.4 oz.; copper, 0.5 per cent.; and a sample from the bottom of the old shaft on the sulphide vein assayed: Gold, trace; silver, 2 oz.; copper, 13 per cent.

This group of mineral claims is near Davies bay, on the west side of Texada island, and is owned by Wm. Stromberg, of Vananda. The group contains seven claims, known as *Edith*, *Kate*, *Deloro*, *Hill*, *Ethel*, *Boulton*, and *Big Bluff*. The property is bonded to York & Young, of Seattle, who are prospecting it by a crosscut adit which is expected to develop an ore-body at a depth of about 50 feet that outcrops on the surface.

Stromberg Group.

COMOX SECTION.

The Comox section of the Nanaimo Mining Division contains the Cumberland coalfield and is the site of some of the collieries operated by the Canadian Collieries (Dunsmuir), Limited, which are fully dealt with in the report of Henry Devlin, Inspector, on other pages of this Annual Report of the Minister of Mines. The section would not have been referred to by the writer, except on account of his having visited Cumberland on October 20th, 1918, in order to make an examination of some lode-mineral claims which had been described as possessing much merit and located near the town.

This group of mineral claims contains the *Ypres*, *Cavell*, *Somme*, and *Verdun* claims, which are owned by A. E. Howard and associates, of Cumberland.

Ypres Group. *Geology.*—A short distance south-westerly from the town of Cumberland there occurs the change from the coal-measures to the volcanic rocks that form the Beaufort range of mountains, which traverses Vancouver island nearly its entire length. It is on the north-easterly side of this range that the *Ypres* group of mineral claims is located, along a steep ridge of volcanic rocks in which occasionally can be seen a few specks of native copper. The rocks are considerably sheared and in some places fissured, but the writer could not find any defined ore-deposit, nor are the fissures filled with any gangue material.

After occupying some time around the adit, described later, in an endeavour to find a sample that would appear to carry values, one was taken of the most promising-appearing material, which assayed: Gold, trace; silver, trace; copper, trace.

Development-work.—There is an adit on the *Verdun* claim 30 feet long, 9 feet wide, and nearly 7 feet high. The course of the adit is southerly along the strike of the shearing-planes. Apparently the work had been done a long time ago. No other work could be found by James Dick, who was guide for the trip.

The *Tsaabl* river, which is also locally known as the Baynes Sound river, flows into Baynes sound about five miles southerly from Union bay and opposite to Denman island. About five miles up the *Tsaabl* river there occurs an outcrop of coal in the river-bed. The strike of the seam is northerly and the dip westerly. There is a very uniform sandstone roof to this seam of coal. The sandstone is found to occupy an area of about four miles along the strike and two miles wide.

Tsaabl River Coal.

The following is a section of the seam of coal:—

	Ft. in.
Roof sandstone.....	1 0
Black shale	1 3
Coal.....	0 2
Soft-shale parting	2 2
Coal	0 4
Soft-shale parting	3 6
Coal	
Total coal	6 11

This seam of coal occurs on the property of the Canadian Collieries (Dunsmuir), Limited, and during the autumn of 1918 that company started to construct a wagon-road from the main coast road up the Tsaabl river in order to haul in a diamond-drilling outfit to prospect the field.

During 1918 this company has made the following improvements at its No. 4 mine, Cumberland: Driven a new entrance to the main slope, the portal of the new adit being 15 feet higher than the old entrance to the slope. The new adit is driven directly over the old slope, and reduces the mining costs, because the use of tail-ropes is eliminated to haul empties back from the long flat from the top of the slopes. A new tippie with a capacity to handle 1,000 tons of coal a day and equipped with a Marcus screen is being built at the No. 4 mine.

NANAIMO SECTION.

In the Nanaimo section of the Nanaimo Mining Division there have been two new coal-mines opened during 1918. These are the No. 5 mine at South Wellington, owned by the Canadian Collieries (Dunsmuir), Limited, which has produced about 28,787 tons since the plant was completed in September, 1918, and the Wakeslah, owned by the Canadian Western Fuel Company, Limited, on which development had not progressed far enough to place it in the producing class during the past year.

The mining industry in the Nanaimo section of the Nanaimo Mining Division is confined entirely to coal-mining, except in two localities where shale is quarried for manufacturing pressed brick. The section as considered in this report includes the Nanaimo collieries proper, the South and East Wellington collieries, and the Gabriola shale-deposits.

The Nanaimo collieries, which include the No. 1 Esplanade shaft in the city of Nanaimo, the Harewood and Reserve mines within a short distance from the town, produced during 1918 about 731,922 tons of coal, the greater proportion of which was mined from the No. 1 shaft. Although this mine has been producing for many years and is the oldest regular producing coal-mine in the Province, it still retains the position of leader in production over any other single mine in the entire Province, although the aggregate production from all of the mines of the Canadian Collieries (Dunsmuir), Limited, exceeded that from the Nanaimo group.

The oldest coal-mine in the Province is at Squash, near the north-easterly end of Vancouver Island. This mine was opened by the Hudson's Bay Company about two years before coal was discovered at Nanaimo, but has not been actively operated, except intermittently, since that company suspended operations. It is at present owned by the Pacific Coast Coal Mines, Limited, of Victoria, but has not been operated during 1918.

The Nanaimo collieries have been the means of building up the second largest city on Vancouver Island and about the fourth in the Province.

This company is opening a new mine called the "Wakeslah," on the Wellington seam. This mine is located on the company's farm, about a mile and a half from the Esplanade shaft. A main shaft and an air-shaft have been sunk to coal, and connection made between the two shafts. Coal is reached in the main shaft at a depth of about 325 feet. The estimated cost of the plant at the mine, railway connecting the mine with the wharves, bunkers on the water-front at Nanaimo, and initial development is about \$200,000.

Prospecting for coal with a diamond-drill has been done by the Canadian Western Fuel Company, Limited, near Chase river, also on the company's farm, West Nanaimo, and at other points.

Except for the epidemic, which was very serious during the last quarter of 1918, the Canadian Western Fuel Company, Limited, would have established a record during that year, but owing to the influenza there was not more than two-thirds of the normal force of miners working from early in October and for about six weeks afterwards.

In the old coal-mines the development-work has been carried on as extensively as circumstances permitted. The chief improvements made during the past year are as follows:—

The Canadian Western Fuel Company, Limited, installed a new power-engine (1,300-kw. direct-current generator) at the No. 1 Esplanade mine to replace the generator formerly in use. At the Harewood mine the same company installed the following additions to the former plant: 1,200-kw. generator, two 150-horse-power boilers, and new screening plant. The total estimated cost of the above improvements is about \$42,000.

Canadian Collieries (D.), Ltd. This company, after having completed the preliminary work commenced in September, 1917, opened the No. 5 mine at South Wellington down to the Douglas seam, and began producing coal during the summer of 1918. Coal was first exposed by a prospecting-shaft 5 x 5 feet, 90 feet deep. A slope was later enlarged to 10 x 12 feet for a ventilating-shaft. A slope has been driven 2,200 feet, which intersects the coal-seam 60 feet south of the prospecting-shaft. Levels to the north and south have been driven at 300 centres. The coal, which is of very good quality, varies in thickness from 2 to 12 feet. The estimated capacity of the mine is about 90,000 tons of coal per annum.

Gabriola Is. Shale-deposit. The Gabriola Island Shale Product Company, Limited, has succeeded the Dominion Shale Product Company, Limited, and with D. W. Campbell, of Victoria, as superintendent is manufacturing a high-class pressed red brick, which finds a ready market in Vancouver and other points. The Gabriola Island shale is not referred to at any length by Ries and Keele in their report on the clay and shale deposits of the western Provinces, published by the Canada Department of Mines in 1912, but is mentioned by Chas. H. Clapp in Memoir No. 51, "Geology of the Nanaimo Map-area," Canada Department of Mines, 1914.

Clapp classifies the shale on Gabriola island as belonging to the Northumberland formation of the Nanaimo series, underlying the Gabriola formation, which is the uppermost formation of the Nanaimo series. The Northumberland formation consists of shales, sandstones, and conglomerates, with shales occurring at the top and bottom of the formation and virtually confined to those horizons. The shale-deposit which is being worked by the Gabriola Island Shale Product Company belongs to the bottom part of the Northumberland formation, and occurs on the north-easterly shore of False narrows, near the south-westerly end of Gabriola island.

Gabriola island is east of Nanaimo harbour and separated from Vancouver island by Northumberland channel. The island is a synclinal ridge about eight miles long and from two to three miles wide. Clapp calculates the thickness of the bottom bed of shale in the Northumberland formation, together with thin beds of sandstone, as being 510 feet, and describes the shales as "grey, sandy"; but from the fact that the shales on the property of the Gabriola Island Company are bluish and brownish in colour, and in actual commercial practise show good plasticity, it would appear that his examination was confined chiefly to the north-westerly end of the island around Descanso bay.

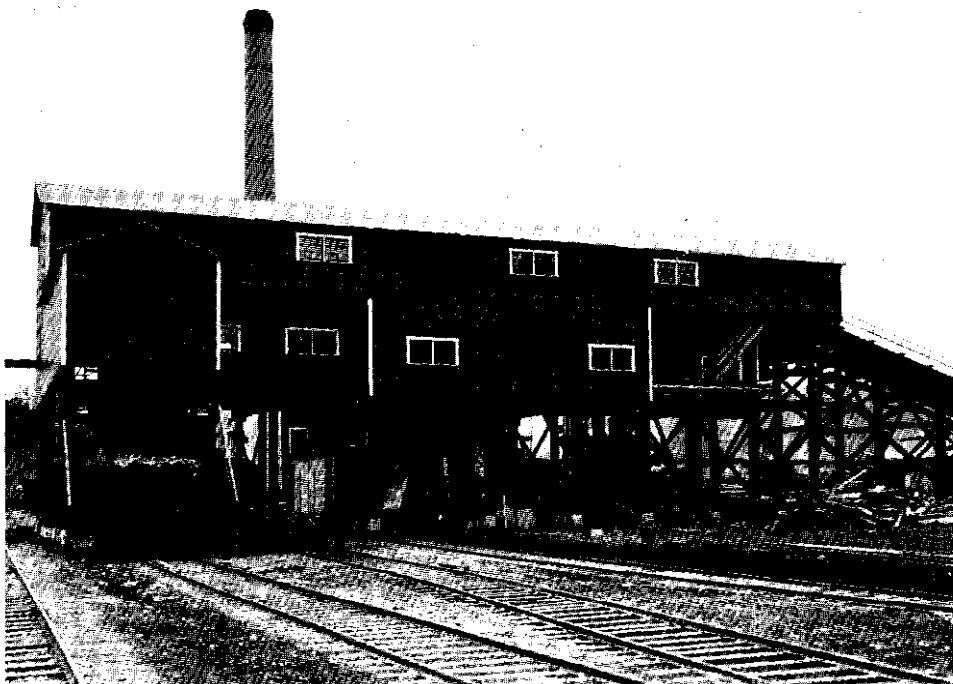
The quarry, which is partly an open-cut and partly an incline pit from which the shale is being mined by the Gabriola Island Shale Product Company, Limited, is about 125 feet long, extending back into a ridge, with the face about 35 feet high at the north-easterly end of the quarry, which is the widest part and where the floor is practically level. The south-westerly end of the quarry is a pit about 20 feet deeper than the floor at the other part. This end of the quarry is not being worked at present owing to the accumulation of water and necessity for pumping, which is avoided at the north-easterly end.

The following analyses were made from samples of the shale used in the brick-making machines at the time the writer made an examination on December 30th, 1918:—

	Blue Shale. Per Cent.	Brown Shale. Per Cent.
Silica	55.6	56.4
Ferric oxide	10.1	9.37
Alumina	20.0	20.1
Lime	Trace	Trace
Magnesia	0.3	0.3
Sulphur	0.1	0.15
Alkalies	4.9	4.28
Ignition	9.0	9.4

(Suitable for paving-brick, sewer-pipe, etc.)

The brick-making plant consists of a Bird press, capacity 20,000 bricks a day; a Bird dry-pan crusher and fan of the 50-inch Sheldon type, which revolves 300 revolutions a minute and is used to provide artificial ventilation in the semi-continuous kiln, 148 feet long, 42 feet wide, and 10 feet high. The kiln has horizontal draught and is divided into ten chambers, each chamber having a capacity to hold 22,500 bricks. There is a dryer 100 feet long divided into five chambers in which the bricks are placed after leaving the press, and in this dryer the bricks are dried. The heat



Side View of Tiptle, Cassidy Colliery.



End View of Tiptle, Cassidy Colliery.

in the dryer is transmitted from fire-boxes at the north end through cast-iron pipes 12 inches in diameter. The machinery in the plant is driven by steam generated in a 100-horse-power boiler.

The transportation facilities are admirable owing to the fact that the plant is on the shore in a perfectly sheltered harbour, where scows can lie for loading at all seasons, and the further fact that the deposit of shale is close to the plant. Tugs must tow scows from the wharf at high tide, because the shore on this part of Gabriola island has such a gradual slope that it is a considerable distance to water sufficiently deep to accommodate vessels of deep draught.

The Nanaimo Pressed Brick and Terra Cotta Company, Limited, is located at **E. Wellington** East Wellington, and was organized to work the shale-deposits which occur in **Shale-deposit.** that part of the Nanaimo section of the Nanaimo Mining Division. These shales are referred to in Clapp's Memoir No. 51 as belonging to the Haslam formation, locally called "Marine shales," of the Nanaimo series, which overlies the Benson conglomerates. The Benson conglomerate is the basal conglomerate of the Nanaimo series. The shale mined by the company at East Wellington is found in the upper part of the Haslam formation. The pressed brick made by the company is excellent in quality, but the location of the works is a handicap, because of the product having to be shipped over two railroads and the high freight rate charged by each of these, which makes competition with brickyards more favourably located very difficult.

Cassidy Subsection.

The Granby Consolidated Mining, Smelting, and Power Company, Limited, which started the preparatory work of opening a coal-mine at Cassidy, about eight miles southerly from Nanaimo, in 1917, by prospecting with a diamond-drill, was satisfied with the results and started sinking the main slope on March 7th, 1918. The mine is now opened by three slopes—the manway, hoist, and return airway—and a limited quantity of coal is being hoisted daily, but the proposed plant is not expected to be completed for about a year and a half. The estimated cost of the completed plant, including railway connection with the Esquimalt & Nanaimo Railway, coal-washer, houses for staff, miners, and workmen, is approximately \$1,000,000, when the capacity of the plant will reach about 250,000 tons of coal per annum. The maximum thickness of the coal-seam is 12 feet.

The model town that has been built by the Granby Company at Cassidy is a very noticeable feature of the improvements made by the company during the past year. About 50 acres are cleared for the site of the company's camp, mining plant, and tipple, as well as for residences for the superintendent, mine manager, firebosses, accountants, and storekeepers, and the large dining-room, wash, shower-bath, drying-rooms, and bedrooms for the miners.

As full details with regard to the colliery are contained in Inspector Devlin's report for 1918, published in the Annual Report of the Minister of Mines for that year, it is needless to repeat the details here.

The equipment in all of the buildings is of the most modern character and nothing has been left undone that can possibly tend to add to the comfort of the employees.

REDONDA ISLAND SECTION.

The Redonda Island section of the Nanaimo Mining Division includes the group of islands of that name situated near the entrance of Toba Inlet, about 110 nautical miles north-westerly from the city of Vancouver. So far as this report is concerned, the island known as West Redonda is the only one of the group examined in 1918, because it is the only one on which any occurrences of mineral deposits have been reported.

In order to reach the part of the island on which mineral occurs it is necessary at present to travel by private launch from Vancouver, as although one of the Union Steamship Company's vessels calls at Decelt Bay Cannery, about three miles from the mineral deposits, the calls are only made once a week, and it is difficult to secure transportation from the cannery around to Pryce channel, the western boundary of the island and the starting-point to the deposits of magnetite.

Pryce channel has very deep water to within a short distance from its steep rocky shore; consequently the anchorage is insecure and landing from small boats is often difficult and sometimes almost impossible.

Elsie. This mineral claim was staked many years ago, and a shipment of about 600 tons of magnetite ore was made to an iron blast-furnace in Oregon. The claim was worked and Crown-granted about 1885. The claim is located on the west side of West Redonda island, on the slope of a very steep mountain which reaches an elevation of about 3,000 feet within quite a short distance from the shore. The claim is staked from the shore in a southerly direction, starting from the mouth of a small torrential unnamed stream which flows through a box canyon for a considerable distance. The trail up the mountain-side has a grade of nearly 45 degrees. The claim is owned by the estate of the late John Hendry, of Vancouver, the trustee of which is the British Columbia Milling, Timber, and Trading Company, of Vancouver.

Geology.—The rock formation on the *Elsie* claim is principally a green igneous rock that may be called a greenstone until properly classified from a microscopical examination. Intruding the greenstone are well-defined dykes of a blackish-coloured igneous rock. One of these dykes forms a prominent geologic feature on the shore at the mouth of the creek referred to. Associated with the greenstone are contact-metamorphic rocks, indicating the occurrence of a belt of limestone within a short distance, but no actual contact between limestone and greenstone could be found. The greenstone is considerably sheared and altered, with the strike of the shear-planes being in a southerly direction, conforming with the strike of the intrusive dykes, and the dips usually nearly or quite vertical, with any incline being at about an 80-degree angle towards the east (mag.).

Characteristics of Ore-deposits.—Two deposits of magnetite ore are reported as occurring on the *Elsie* claim, but owing to lack of trails the writer was only able to find one of these, which occurs on the northerly slope of the mountain at an elevation of about 400 feet, and by horizontal measurement about 700 feet from the shore. The deposit examined apparently fills a wide fissure in the greenstone country-rock and is continuous up the mountain-side an undetermined distance. This deposit belongs to the replacement type in a fissure in a shear-zone in a greenstone gangue, where the magnetite replaces altered rocks in the contact-metamorphic zone which appear to carry much limestone.

The deposit of magnetite is about 30 feet wide in the face of an old open-cut from which the shipment of ore, made several years ago, appears to have been mined. The open-cut itself is about 50 feet long, crosscutting the ore-body from east to west, and the face of the open-cut is about 30 feet high. On both the east and west sides of the open-cut there are about 10 feet where the ore is mixed with country-rock, while the remaining 30 feet is practically solid ore. A grab sample taken from the face of the open-cut assayed: Iron, 60.6 per cent.; phosphorus, trace; sulphur, trace; silica, 5 per cent.; titanium, nil.

Development-work.—The open-cut referred to is the only development-work that could be found. It is said that a cabin was built on the claim, also an ore-chute was constructed from the mine-workings to the beach, but no evidence of either cabin or chute remains to-day, except an occasional piece of timber and a platform that apparently was the upper terminal of the chute.

This group contains the *Eagle*, *Iron Cliff*, *Black Warrior*, *Homestake*, and **Black Warrior Group.** *Bonanza* mineral claims. The group is staked from the shore of Pryce channel easterly from the *Elsie* mineral claim, including about 4,500 feet along the shore-line in an easterly direction, and extending up the northerly slope of the precipitous mountain range for about 3,000 feet horizontal measurement.

Geology.—The rock-formation on the *Black Warrior* group is chiefly igneous, but with a belt of limestone on the easterly portion of the group, as well as zones of contact-metamorphic rocks in which occur much epidote and garnetite.

There are two creeks, *Eagle* and *Homestake*, which have their sources near the summit of the mountain range, with its elevation about 3,000 feet. These creeks flow down the northerly slope of the mountains with an average grade of about 30 degrees, and steeper in many places. Both of these creeks flow for considerable distances through box canyons with banks 100 feet and more high.

The igneous rocks vary from a light-coloured rock with close-grained porphyritic structure to a deep green massive rock resembling the greenstone on the *Elsie* claim already referred to. All of the rocks show much alteration, shearing, fissuring, and fracturing, and favourable conditions for the deposition of ore.

Characteristics of Ore-deposits.—There are at least two prominent deposits of magnetite occurring on the property, one close to the No. 1 post of the *Black Warrior* mineral claim and the other near the westerly boundary of the *Homestake* mineral claim. There are other outcroppings of magnetite occurring near the deposits referred to, but apparently these possess but little commercial value as compared with the two first mentioned, which appear to contain very considerable tonnages of ore immediately available for mining.

The *Black Warrior* deposit is about 1,300 feet from the shore at an elevation of about 300 feet. It outcrops in the steep bank of Eagle creek, where a short prospecting-adit has been driven along the west wall of the ore-body and an open cut made across the outcropping. This work shows that the solid ore is 14 feet wide, nearly 50 feet high, and apparently maintains continuity into the mountain an undetermined distance, which cannot be ascertained until stripping the surface has been done. The deposit belongs to the contact-metamorphic replacement type, where the magnetite has replaced the metamorphic rocks. A sample chipped across the width of the face of ore 14 feet wide assayed: Iron, 64.8 per cent.; silica, 5 per cent.; phosphorus, trace; sulphur, trace; titanium, *nil*.

The deposit of magnetite on the *Homestake* mineral claim is exposed in the bed as well as on the precipitous banks of Homestake creek, which was filled with a snowslide at the time the examination was made, and the most of the outcroppings were covered by about 10 or 12 feet of snow; consequently no particulars as to extent of the deposit could be obtained, neither could any samples of the ore be taken.

Apparently the deposit belongs to the contact-metamorphic replacement type, although the ore-body, where it outcrops, does not occur at the actual line of contact between limestone and igneous rocks, but at some little distance away. The country-rock on the creek-banks, where not covered with snow is seen to be highly metamorphosed and indicates the occurrence of a zone of contact metamorphism of considerable extent. From information received from N. Humphreys, B.C.L.S., who surveyed the group, the outcrop of magnetite covered by snow on the *Homestake* claim is about 60 feet wide.

NEW WESTMINSTER MINING DIVISION.

The New Westminster Mining Division occupies an area on the Mainland roughly triangular in shape, with its southern boundary extending along the International Boundary-line, along the 49th parallel from the Strait of Georgia on the west, to the range of mountains forming the watershed between the Chilliwack and Skagit rivers on the east; its eastern boundary is formed by the western boundary of the Yale Mining Division to the point where that Division adjoins the Lillooet Mining Division near Skookumchuck, on the Lillooet river, about twenty-five miles north of Port Douglas; its northern boundary adjoins the southern boundary of the Lillooet Mining Division to the summit of the range of mountains easterly from Green lake, on the Pacific Great Eastern Railway; its western boundary follows the summit of that range of mountains southerly to the head of Burrard Inlet, thence south-westerly to the 49th parallel and point of beginning. The area contained within the boundaries is occupied principally by the Coast range, except that part of the Mining Division which forms the delta of the Fraser river and the narrow valleys of the Pitt, Stave, Chilliwack, and Lillooet rivers.

The Division has been comparatively only scratched over so far as prospecting for lode minerals is concerned, but this condition is accounted for to a great extent by the fact that the granodiorite of the Coast range has not been considered a favourable formation by the average prospector in which to find occurrences of the precious or base minerals. The fact that bands and belts of metamorphosed sedimentaries occurred, which had not been removed or destroyed when the plutonics intruded into the older sedimentary formation, has not been generally recognized by the average prospector until within a quite recent time.

The New Westminster Mining Division for convenience has been subdivided in this report into three sections, as follows: Cheam Range, Agassiz, and Stave River sections.

CHEAM RANGE SECTION.

The Cheam Range section is so called because the mineral claims in this section of the New Westminster Mining Division are located in the range of mountains known by that name and which form the divide between the Fraser and the Chilliwack rivers. There are several peaks in this range of mountains which reach elevations as high as 6,000 feet above sea-level, and it is near some of those peaks that the most important groups of mineral claims, so far as

at present known, are situated. Several quite extensive glaciers have formed along the summit of the Cheam range, especially on the north slopes, and these have necessarily retarded prospecting and made development-work difficult to do, as well as interfering with the construction of transportation facilities.

The transportation facilities at present provided is the Canadian Northern Pacific Railway, which is built along the northerly base of the mountain range; but on the southerly slope there are no up-to-date transportation facilities, except an old wagon-road along the bank of the Chilliwack river, which is so located as to be a costly road to keep in good repair, as well as increasing the distance to rail from the mineral claims by about fifteen miles. This latter route, though, can be vastly improved and the distance reduced, which will permit of commencing work much earlier each season than is possible by the route on the northerly slope from the railway to the groups of claims.

**Lucky Four
Group**

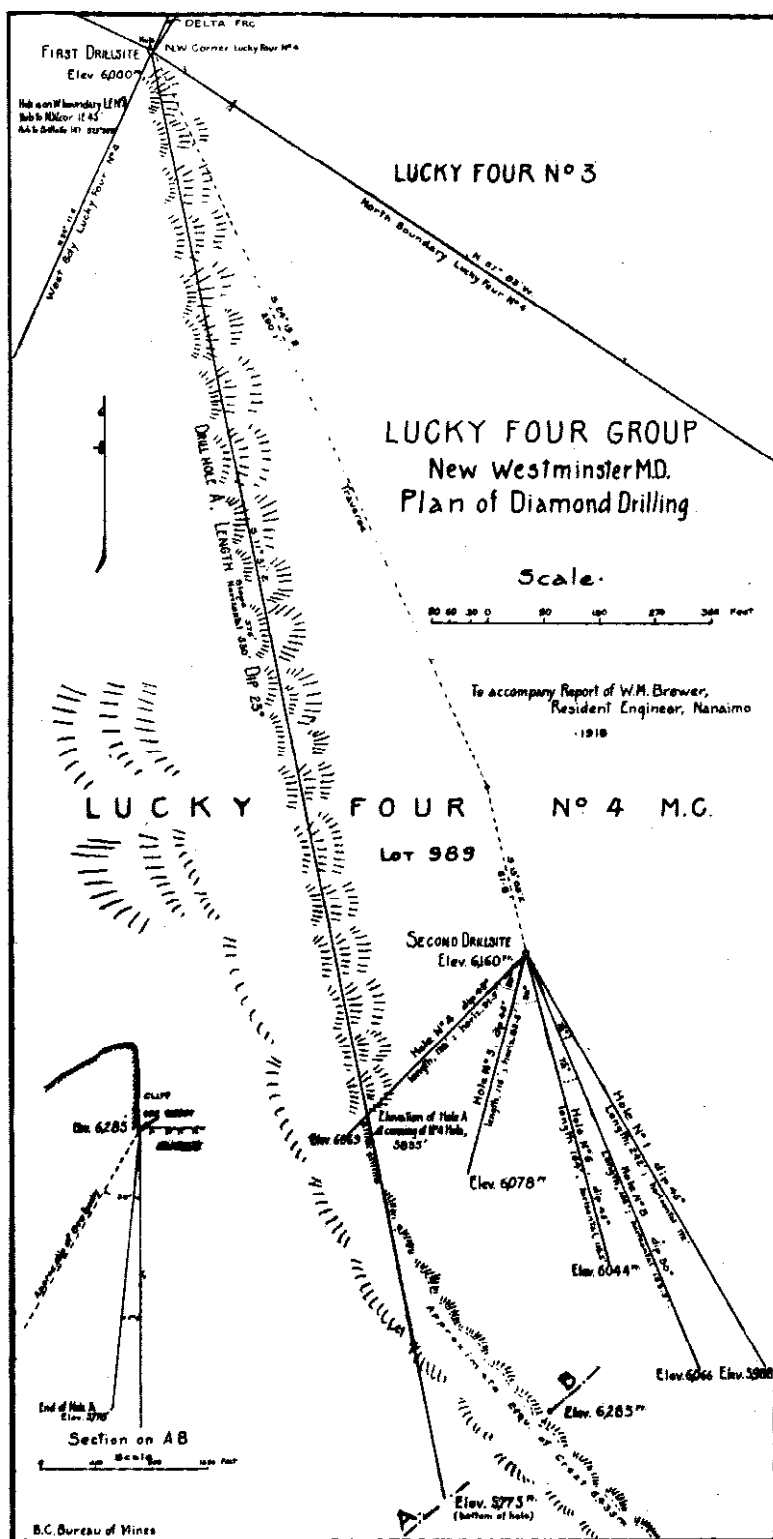
This group of mineral claims is located at the summit of the Cheam range of mountains overlooking Wahleach (Jones) lake and creek to the north, and Ford creek, a tributary of the Chilliwack river, to the south. The elevation is from 5,000 to 6,000 feet above sea-level. There are eleven mineral claims and seven fractional claims in the *Lucky Four* group, named as follows: *Lucky Four No. 1, No. 2, No. 3, No. 4, No. 5, No. 6; Lucky Jack No. 1, No. 2, No. 3, No. 4; Alpha, Phoe Fraction, Pi Fraction, Gamma Fraction, Epsilon Fraction, Beta Fraction, Delta Fraction, and Viny Fraction.* These occupy an area of about 700 acres. The group is owned by White & Sperry, of Seattle, who acquired the property by purchase from the original locators in 1916.

History.—Some years ago one of the caretakers employed by the British Columbia Electric Railway in connection with the water-power on Wahleach creek found many lumps of almost pure chalcopyrite, as float, in the bed of Wahleach creek between the head of Wahleach lake and a big glacier on the northerly side of the Cheam range of mountains, but was unable to locate the source. During the summer of 1915 a party of prospectors left the town of Hope to prospect the mountains westerly from the head of Silver creek towards Mount Cheam. This party found outcroppings of chalcopyrite near the foot of the glacier, as well as near the summit of the range, and staked the *Lucky Four* group of mineral claims, to which the other claims now included in the property were later added. The attention of mining engineers was attracted by the high grade of the samples that were brought to Hope. Some of these visited the locations, and their reports were followed by the bonding of the claims by A. S. Williamson, of North Vancouver, for his principals, Sperry & White, of Seattle.

In order to prospect the ground it was decided to install a diamond-drilling outfit on the glacier and bore through the ice in an endeavour to ascertain whether ore occurred under the glacier. A pack-trail was constructed from near the mouth of Wahleach creek, on the Canadian Northern Pacific Railway, during the early spring of 1917, when the depth of snow was very considerable, and the diamond-drill and gas-engine were hauled into position on the glacier. The prospecting-work resulted satisfactorily, but the difficulties that would attend carrying on mining operations under the glacier were practically insurmountable, so Mr. Williamson, who had superintended the trail-work and drilling, commenced a thorough prospecting for a continuation of the mineralized zone over the summit of the glacier and down the southerly slope of the mountain range. He succeeded in locating chalcopyrite-outcroppings near the summit and down the mountain-side on the *Lucky Four No. 6* mineral claim, and located the site for a camp and for the portal of an adit about 1,200 feet below the summit. During the past summer a good log cabin was built and arrangements made to drive the adit during the present winter.

Geology.—The Cheam range of mountains belongs to the Coast mountains, and while the prevailing rock formation is granodiorite, there also occur on the *Lucky Four* and adjoining properties belts of metamorphosed argillites and schists which remained as roof-pendants after the intrusion of the batholith of granodiorite. At and near the contact of these altered sedimentaries and the granodiorite are found occurrences of copper ores. The granodiorite usually near the contacts has a gneissic structure and sometimes is quite schistose.

Instead of the geology in the Coast mountains in this vicinity being simple and merely represented by a great batholith of eruptive rocks, it is complicated in a very similar manner to which attention is called by Chas. Camshell in Summary Report, 1917, "Reconnaissance along the Pacific Great Eastern Railway, between Squamish and Lillooet," published by Canada Department of Mines.



Ore-deposits.—Copper ore, almost exclusively chalcopyrite, occurs on the *Lucky Four* group in a wide zone or stockwork of metamorphosed argillites in which occur many narrow quartz veins. The line of strike of this formation is N. 65° W. and dip nearly vertical, with high angle towards the north, so far as can be determined from the present condition of the prospecting-work that has been done. The stockwork is bounded on the northerly and southerly sides by granodiorite, which on the southerly side has a pronounced gneissic structure near the occurrence of ore. Apparently the metamorphosed argillites to a great extent form a capping covering bodies of solid ore.

This condition is shown on the southerly slope of the Cheam range at a point where an open-cut about 20 feet wide has been made on the edge of a precipitous cliff. The face of the open-cut is about 10 feet high, and a practically solid body of chalcopyrite ore is exposed, dipping almost vertical, with the hanging or northerly wall having been carried off by erosion and the apparent foot-wall made up of granodiorite with gneissic structure. The work has not determined whether or not the so-called foot-wall is a permanent wall or merely represents a horse or dyke intruded into the ore-bearing zone. A sample taken across the full width of the open-cut assayed: Gold, trace; silver, 2 oz.; copper, 7.6 per cent.

The stockwork of altered argillites impregnated with quartz veins has a very considerable length, and apparently extends across the summit of the range to the northerly slope, where it is generally hidden by glaciers. This fact is presumed from the results of diamond-drill borings into ore beneath the glacier.

The point where development-work is proposed to be done on the southerly slope of the mountain range is approximately 1,200 feet vertically below the summit of the outcroppings of the mineralized zone, and the results will determine to a very great extent the value of the property from a mining standpoint.

From such an examination of the surface as is possible under present conditions, the statement is warranted that the property bears all the indications of developing into one of the big copper-mines of the Province of British Columbia, and to rank with the Britannia and Anyox mines so far as quantity of ore is concerned, but promises to produce an ore of considerably higher grade than either of those.

In making his examination the writer was ably assisted by A. S. Williamson, the superintendent, who extended every courtesy possible, and to whom thanks and acknowledgment are due for plans of the property, as well as for photographs showing some of the difficulties that were experienced in transporting the diamond-drill outfit up the glacier.

Development-work.—The development-work comprises prospecting on the northerly slope of the Cheam range with diamond-drill; stripping and open-cut work on the southerly slope of the range; building cabin near that work; and constructing a pack-trail from the Canadian Northern Pacific Railway to the northerly summit, a distance of about fifteen miles. The proposed development-work will consist of cruising and constructing a pack-trail up Ford creek and Granite basin from the Chilliwack river to the camp, as well as driving a main adit across the ore-bearing zone near the head of Granite basin, with drifts and upraises to determine the extent of the deposits.

These mineral claims are located on Jones mountain, about two miles and a half south-easterly from Cheam View Station, on the Canadian Northern Pacific Railway, in the New Westminster Mining Division, British Columbia.

The claims are staked adjoining each other up the mountain in an easterly direction, the *Mary Jane* being at the lower elevation, with the prospecting-work at about 700 feet above sea-level, and the *Annie Lou* at higher elevation, with the prospecting-work at about 900 feet elevation. The property is reached by a good trail which branches off from the Yale wagon-road at a point about a mile and a half from Cheam View Station, and is constructed up the mountain-slope to the outcroppings of quartz carrying molybdenite, where prospecting-work has been carried on. The *Mary Jane* mineral claim is owned by D. and Angus K. MacDonald, of Chilliwack, and the *Annie Lou* mineral claim by H. L. Larson, of Chilliwack.

Geography.—Jones mountain is a high peak in the Cheam range of mountains. That range forms the divide between the Fraser and Chilliwack rivers and extends from near Chilliwack to Silver creek, near the town of Hope. The mountain-slope on which the mineral claims are located overlooks the Fraser river and is very precipitous, having suffered greatly from erosion. The mountain-side is heavily timbered with cedar, hemlock, fir, and spruce, which is being logged off to supply the saw and shingle mills in the vicinity.

Geology.—The prevailing country-rock in the vicinity of the *Mary Jane* and *Annie Lou* mineral claims is granodiorite belonging to the Coast Range batholith, and on the claims there occurs a shear-zone in the granitic rocks of undetermined extent. The zone has suffered very greatly from erosion and shows very considerable fracturing, fissuring, and alteration, with some of the fissures filled with quartz carrying molybdenite ore.

Characteristics of Ore-bodies.—The occurrences of molybdenite occur on both the *Mary Jane* and the *Annie Lou* claims under the same structural conditions; that is, the molybdenite occurs in gash-veins filled with quartz, and apparently there are no other minerals associated with the molybdenite so far as can be determined by the naked eye.

The exposures so far discovered are lenticular, and the percentage of molybdenite disseminated through the quartz is very irregular. Sometimes lumps of considerable size of practically pure molybdenite occur in the quartz, and at other times the molybdenite is disseminated through portions of the quartz gangue as flakes.

The workings where the ore is exposed show clearly the lenticular structure of the quartz-filler in the fissures, so much so that in an adit on the *Mary Jane* claim, which has been driven about 20 feet along the strike of the quartz vein, the width of the vein varies from the thickness of a knife-blade to about 15 inches, and this variation is noticeable both along the dip as well as along the strike of the vein. In the open-cut approach to the adit the foot-wall has been stripped for a length of about 20 feet on the dip of the vein, which is 36 degrees towards the west. The top of this stripping shows the vein to be very narrow, and about 10 feet below the top of the stripping the vein has widened out to about 15 inches; then it narrows down gradually to a few inches, and appears to wedge out entirely a few feet below the floor of the adit.

On the *Annie Lou* claim the prospecting done has been all open-cut work. The stripping for the open-cut was commenced where the vein is very narrow, but about 10 feet from that point the quartz, carrying molybdenite, has a maximum width of about 3 feet. This body gradually narrows down to about 12 inches, which width is maintained for about 10 or 15 feet to the face of the open-cut.

In this open-cut some molybdenite ore occurs disseminated in the granitic foot-wall near the cleavage-planes of the shearing, but to what extent in width this occurs is undetermined. The open-cut referred to has a total length of about 50 feet, but of that 50 feet the ore only occurs for a total length of about 30 feet, or as two lenses. About 15 feet below the open-cut already described another cut has been made for a length of about 10 feet. The cut is in soil nearly to the face, where solid rock is exposed, carrying some molybdenite.

The erosion has been so great that the mountain-side below the open-cut where the ore is exposed has been carried away, so that when the dip, which is 36 degrees towards the west, is considered, there cannot be much chance for any ore to be found below the present exposures, at least for some considerable depth, because if the quartz veins have maintained continuity to depth previous to the erosion they have been carried away by that action. There is, though, a good chance to expose other lenses of quartz farther up the mountain-side, which rises to a very considerable elevation above the present workings.

Along the strike of the quartz veins it is possible that continuity may be maintained through a section of the country-rock that has not suffered from erosion, and it is also possible that in the mountain-slope, below where the erosion has taken place, similar vein-structure may be discovered.

Two samples were taken from the *Mary Jane* claim and two from the *Annie Lou*. One of these samples represents a section through the vein on the *Mary Jane* claim near the portal to the adit, chipped across 15 inches. The other samples all represent grab samples from the dumps, and are selected to represent such ore as was considered of shipping grade. It is hardly possible to determine offhand what proportion this selected ore represents with regard to the entire ore body. Samples taken assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 2.5 per cent. Gold, trace; silver, trace; copper, trace; molybdenite, trace. Gold, trace; silver, trace; copper, trace; molybdenite, 0.2 per cent. Gold, trace; silver, trace; copper, trace; molybdenite, 0.6 per cent.

STAVE RIVER SECTION.

The area covered by the Stave River section of the New Westminster Mining Division lies between the Harrison lake on the east and Pitt lake and river on the west, and is drained by the Stave lake, the main Stave river, upper Stave river, and several tributaries, all of which, except

the lake, are torrential streams which rise in steep mountains where there are several glaciers and ice-fields, so that a good deal of difficulty is encountered by prospectors in exploring the section. To a great extent these conditions account for the fact that the section has been so little prospected, and that the discovery of any occurrences of minerals so far reported has been the result of work by trappers and hunters rather than the systematic work of prospectors. Up to the present time the only minerals reported as occurring in the section are molybdenite and copper-sulphide ores.

The lack of transportation facilities will prove a handicap that will interfere seriously with carrying on mining-development work at the present time, but should prospecting result in the discovery of deposits of minerals of commercial value, there does not appear to be any very serious difficulties to contend with in constructing necessary roads and trails.

Stave River Group. This group of mineral claims was examined on June 30th, 1918, and it is possible that a mine of commercial importance may be developed here, provided the vein material, which carries molybdenite, is concentrated on the ground. The extent of this material is apparently so great and the structure of the occurrence of the deposit of such character that mining operations can be carried on by quarrying, and possibly after further prospecting it will be determined that a steam-shovel could be operated to advantage. While the assay results from the samples taken by the writer do not show a high percentage of molybdenite, it is quite possible that this feature may be overcome by the low cost at which mining, concentration, and transportation can be carried on.

Penstock creek, which flows near the deposit, carries quite a considerable volume of water over a series of falls where the water at one point drops about 200 feet vertically in about 600 feet horizontal distance, and there is a natural penstock at the lower end, so that a water-power can be developed at minimum cost for installation.

Geography.—The *Stave River* group of mineral claims is located in the New Westminster Mining Division, near the upper Stave river, at an elevation of about 2,500 feet above sea-level and about six miles in a north-westerly direction from the head of Stave lake, which empties into Stave river, a tributary of the Fraser river, into which it flows near Ruskin Station, on the Canadian Pacific Railway, about thirty-five miles east of Vancouver.

There are two routes by which the group of mineral claims can be approached. The first is that followed by the writer in company with Moses and Dave Bouchir, of Hatzic Prairie, who own the property. By this route an automobile was taken from Mission Station to within three miles of an old shingle-bolt camp on McConnell creek, which empties into Stave lake near the outlet. After walking the three miles the journey was continued in a gasoline-launch down McConnell creek to its confluence with Stave lake, a distance of about two miles; thence up the lake about ten miles to a point about a mile and a half above the mouth of the upper Stave river, from which point an old logging-trail was followed on the east side of the river for about six miles to the property. The other route is to take the railway of the Canada West Power Company from Ruskin Station, on the Canadian Pacific Railway, to the power-house above the Stave River falls, and a boat from there up the lake to the end of the trail on the upper Stave river.

Geology.—The prevailing country-rock in the vicinity of the property is granitic, which shows the effects of shearing and much of it has a banded or gneissic structure. Wide fissures are noticeable in the granitic rock. The most prominent of these is filled with quartzose rock, in which occur disseminations of particles of molybdenite of varying sizes, from merely flakes to pieces of solid molybdenite about 2 inches square by $\frac{1}{2}$ inch thick.

Ore-deposits.—The occurrence of molybdenite ore in the district was first noted by hunters while climbing over an immense rock-slide, which extends from near the top of the mountain in which the ledge of quartzose rock occurs that has been already mentioned to near the upper Stave river. Mixed with boulders and debris in the rock-slide are very many pieces of rock which contained flakes and lumps of molybdenite. This float was traced up the slide to the ledge from which it had broken away, and the claims were staked in consequence. The molybdenite ore occurs disseminated irregularly through the quartzose gangue material for a very considerable distance along the apparent strike.

At one point the width of ledge-matter is nearly 75 feet, and the narrowest part of the mineralized ledge observed by the writer is about 15 feet. The strike is north-westerly, so far



Hauling Diamond-drill up Glacier, Lucky Four Group, New Westminster M.D.

as can be determined at the present time, and the dip is at a high angle towards the south-west, but development-work may determine that the strike and dip vary from the direction and angle given.

It is very difficult at present to estimate the proportion of mineralized quartzose rock in the ledge, because no cuts have been made into the vein material. The present appearance is that of a high, bare rocky wall with precipitous face, in which the lumps of molybdenite occur, resembling very much the appearance of currants in a loaf of cake.

Assays.—A grab sample taken from where the mineralized ledge-matter is about 75 feet wide assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 0.78 per cent.

A sample of the quartzose gangue taken from close to the hanging-wall granite assayed: Gold, trace; silver, trace; copper, trace; molybdenite, trace.

A grab sample taken from the ledge at a point about 500 feet south-westerly from where the first-mentioned sample was taken assayed: Gold, trace; silver, 0.4 oz.; copper, 0.3 per cent.; molybdenite, 1.5 per cent.

A selected sample taken from the big slide assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 2 per cent.

Another selected sample taken from the big slide assayed: Gold, trace; silver, trace; copper, trace; molybdenite, 1.3 per cent.

AGASSIZ SECTION.

The Agassiz section of the New Westminster Mining Division covers the area from the westerly side of Harrison lake to the easterly boundary of the Mining Division. In this section the Fraser valley is bounded on the north by a range of precipitous mountains, in parts of which the rock formation is made up of metamorphosed limestone and igneous rock resembling greenstone. The occurrence of copper-sulphide ore is the mineralization most usually found, and the deposits belong to the contact-metamorphic type, but there are also some occurrences of molybdenite on a mountain known as "Hurling's," about seven miles easterly from the town of Agassiz.

The Agassiz section has not been prospected with any degree of thoroughness beyond a comparatively short distance from the line of the Canadian Pacific Railway, which part of the section was examined by the writer in October, 1918.

This group of mineral claims contains six claims, known as *Last Chance*, *Copper Duke*, *Lone Star*, *Copper Galore*, *Acorn*, and *Copper King*. The group of claims is located one claim wide from the foot of Hurling's mountain in a northerly direction up the side of the mountain over the summit. Hurling's

mountain is about seven miles easterly from the town of Agassiz, on the Canadian Pacific Railway. The group is owned by W. Hicks, of Ruby Creek Post-office, and several associates.

Geology.—The prevailing rock formation is metamorphosed limestone, with which is associated an igneous rock very much sheared and sometimes with schistose structure. These rocks appear to form a contact-metamorphosed zone of undetermined extent. The mountain-side is very steep and the effects of erosion quite pronounced.

Characteristics of Ore-deposits.—In the cleavage-planes chiefly, but also sometimes disseminated through the metamorphosed rock, there occurs some mineralization, principally made up of iron pyrite, with flakes and sometimes lumps of molybdenite associated with the pyrite, also some chalcopyrite. The occurrence of the mineralization is quite irregular, so far as can be seen from the limited amount of work done. The chief showing of mineral is at an elevation of about 1,200 feet above sea-level on the *Last Chance* claim, about a mile and a half from the railway-track. There are also outcroppings on the *Lone Star*, *Copper Duke*, and *Copper Galore* claims, the last mentioned occurring at an elevation about 500 feet higher than those on the *Last Chance* claim. The samples taken were assayed for nickel, because one of the owners stated that an assayer had claimed he found nickel in the ore. Samples taken from several of the outcroppings assayed:—

No. 1: Nickel, *nil*; gold, trace; silver, 0.2 oz.; copper, 0.3 per cent.; molybdenite, trace.

No. 2: Nickel, *nil*; gold, trace; silver, trace; copper, *nil*; molybdenite, trace.

No. 3: Nickel, *nil*; gold, trace; silver, trace; copper, *nil*; molybdenite, trace.

No. 4: Nickel, *nil*; gold, trace; silver, trace; copper, *nil*; molybdenite, trace.

No. 5: Nickel, *nil*; gold, trace; silver, trace; copper, *nil*; molybdenite, 4.2 per cent.

Development-work.—The development-work consists of several open-cuts and prospect-pits, representing assessment-work to hold the mineral claims.

This group of mineral claims consists of several mineral claims which have been grouped for the purpose of doing all of the development-work on one claim. The group is located on the southerly side of the mountain north of the Canadian Pacific Railway track, about five miles east of the town of Agassiz, at an elevation of about 500 feet above the Fraser river. The property is held under lease by John McConville, of Vancouver, who is developing and operating on a royalty basis.

Geology.—The prevailing country-rock on the *Contact* group is crystalline limestone, which contacts with granodiorite near the western boundary of the claim on which the work is being done.

Characteristics of Ore-deposits.—The mineralization is made up of gossan, in which occur bodies of considerable size of copper carbonate and chalcopyrite of higher grade than is usually found. The gangue is made up of altered limestone, epidote, and garnetite. The ore occurs as lenses and the deposits belong to the contact-metamorphic type, although the occurrences of ore are not at the actual contact between the granodiorite and limestone.

The main outcroppings of gossan and chalcopyrite occur as a blanket, covering limestone and garnetite for a length of about 50 feet and a width of about 20 feet on an incline of 50 degrees. It appears as though the limestone forms the foot-wall of the deposit, the hanging-wall having been carried off by erosion. The thickness of ore varies from a few inches to possibly 3 feet, but when the examination was made the work had not progressed far enough to determine the maximum thickness of the outcroppings, nor whether at any point the ore occurred in a fissure in the limestone, which is possible because there is considerable shearing movement apparent.

At another point a short distance in a westerly direction and about 50 feet lower elevation there are outcroppings of copper carbonates and chalcopyrite in gossan, which apparently fill a narrow fissure in the limestone. The maximum width so far shown is about 3 feet, but the width varies considerably in a length of 18 feet, which is the maximum length determined at the time of the examination.

Samples taken from the ore exposed in the workings, assayed: No. 1: Gold, trace; silver, 4 oz.; copper, 19 per cent. No. 2: Gold, trace; silver, 4 oz.; copper, 10.2 per cent.

Development-work.—The development-work consists of open-cuts and stripping on the first-mentioned outcropping, and open-cuts and a shallow shaft on the second-mentioned outcropping. There is also an adit on the last-mentioned deposit, which is driven on the westerly side of the open-cut 25 feet long in a northerly direction.

A sleigh road is constructed about a quarter of a mile long to connect the mine-workings with the wagon-road from the *Empress* group of mineral claims, located on the same mountain, to the main road to Agassiz Station.

This group of mineral claims from which ore was shipped to smelter during *Empress Group*. a portion of 1917 has not been in operation during the past year. The group is owned by the estate of the late Barclay Bonthron, who was killed in an auto accident several months since.

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 Jarvis 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 Jarvis inlet, a distance of about thirty-five miles from Vancouver City; and the western boundary follows the watershed between Jarvis 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.

For convenience the Division has been subdivided in this report into three sections, as follows: Britannia Belt, Pacific Great Eastern Railway, and Lynn Creek.

BRITANNIA BELT SECTION.

The geologic formation locally known as the "Britannia belt" occurs as bands of metamorphosed sedimentary rocks which were not destroyed by the intrusion of the granodiorite, and the strike of which conforms generally with the direction of the axis of the Coast range of mountains. The Britannia belt reaches its maximum extent in width in the high mountains in which Britannia, Mineral, and Furry creeks rise, about three miles easterly from Britannia Beach, on Howe sound. The full length of the belt is as yet undetermined, but apparently it extends about twelve miles easterly from Howe sound and as far as the easterly side of the headwaters of the Indian river, which flows into the head of the North arm of Burrard inlet.

Britannia Mining and Smelting Co., Ltd.—During 1918 the Britannia Mining and Smelting Company, in addition to carrying on operations in the developed and productive mines owned by the company, has paid considerable attention to examinations of several prospects to the eastward of the centre of the activity around the *Fairview*, *Empress*, *Bluff*, and *Jane* mines. Several of the prospects which have been practically idle for some years back were acquired by the Britannia Company, so that at the present time that company controls the Britannia geologic belt for a length of about twelve miles and an average width of several hundred feet. The company has expended, according to the statement of J. W. D. Moodle, the general manager, nearly \$1,500,000 in acquiring properties outside of the original group of mineral claims which comprised its holdings up to about six years ago. This policy has been of great assistance to the prospector and small mine-owner who had mineral claims located in the mountains, which were inaccessible because of lack of transportation facilities and lack of capital by the owners of the claims to install such.

The operations of the Britannia Mining Company are, of course, far more important than those of any other company in the Western Mineral Survey District, and for that reason the following description of the development-work and improvements that have been carried on during 1918 are given in more detail in this report. The following shows the development-work performed in the mine: Drifts, 9,837 feet; crosscuts, 4,427 feet; raises, 8,754 feet; chutes, 1,541 feet; winzes, 36 feet; total, 24,595 feet.

Development-work.—In the *Fairview* mine drifts have been extended on previously developed veins, also new ones have been opened up to the south, on which stoping operations have started. The outside glory-holes were worked during the open season (seven months), breaking ore on top of the mountain into large transfer rock-chutes, delivering it to the underground crushers with but one handling.

The *Bluff* mine to the west and the *Empress* mine to the east of *Fairview* have been extensively developed during the year and stoping has been started. Two drifts are being driven west under the *Jane* mine on the 1,200-foot level, developing this ore-body 200 feet below any previous working-level.

During the year another connection through Britannia mountain was made, this being on the 600-foot level, making the fourth level to have portals on both the north and south side of the mountain. Two other levels, the 1,200- and 1,600-foot, are being driven through for connection, the former having approximately 1,600 feet to go and the latter 700 feet.

Work is progressing for the extension of No. 1 shaft from the 1,000-foot level to the 700-foot level, and also the extension of the Grandview shaft (No. 3 shaft) from the 500-foot to the 700-foot level. This construction will in time supplement the No. 2 shaft, now operating between the 1,000-foot and 500-foot levels.

A crosscut adit, 8 x 8 feet, known as the Victoria tunnel, to the east of the present *Empress* workings, at the elevation of the 1,800-foot level, has been advanced 400 feet to prospect the extension of the veins in that section of the property. Another crosscut, 8 x 8 feet, known as the Hillside tunnel, is being driven at a point west of the present *Jane* mine at the elevation of the 1,000-foot level. This has advanced approximately 200 feet.

Considerable diamond-drilling has been done during the year, prospecting new areas and also to prove the extension of known ore-bodies. The footages driven in the different mines are as follows: *Fairview*, 15,062 feet; *Empress*, 4,897 feet; *Bluff*, 2,404 feet; *Jane*, 2,071 feet; 3,100-foot tunnel, 690 feet; 2,700-foot tunnel, 1,558 feet; total, 28,682 feet.

The 4,100-foot level tunnel, the portal of which is about the level of the roof of the mill, was advanced 1,735 feet during the year, making the total length 4,220 feet. This tunnel will eventually be used as the main haulage adit. A raise has been started at this level and driven a distance of 100 feet. This raise will be continued to the 3,100-foot level, a distance of 1,130 feet, and from there to the 2,700-foot level, 370 feet. This raise is 7 x 12 feet and is being driven on a 65-degree slope.

The 3,100-foot level east drift was advanced 659 feet, and from this drift another drift 260 feet long has been driven to the location of the proposed raise from the 4,100-foot level, from which point it is proposed to raise to the Armour crosscut, 2,700-foot level, at the westerly end of the tunnel railway. The Armour crosscut has been driven a distance of 502 feet.

The raise from the 4,100-foot level to the 2,700-foot level will be used to transfer the mine ore to the 4,100-foot level, and thence a distance of about 5,000 feet by railway to the mill.

The 2,200 Daisy tunnel was advanced 910 feet, making the total length 1,309 feet, and a crosscut 106 feet long driven to the south.

The Harp tunnel was advanced 811 feet to completion during the year. This tunnel is 2,246 feet long and will be used to divert water for power purposes.

The following tunnels driven for development-work were advanced during the year: Lantz tunnel, advance for year, 60 feet; footage to date, 890 feet. Lloyd tunnel, advance for year, 71 feet; footage to date, 134 feet. Copper Mountain tunnel, advance for year, 152 feet; footage to date, 324 feet.

Equipment.—Four Westinghouse 3½-ton storage-battery mine locomotives were added to the previous equipment of eight, in addition to which there are in the mine one 8-ton General Electric trolley locomotive and two 3½-ton Westinghouse trolley locomotives.

Fifty-four 2-ton automatic side-dump cars were added to the mine equipment, making a total of approximately 150 cars of this type. Besides these, twenty cars of the same type and size, but built for a 3-foot gauge, were added to the equipment for handling ore broken on the 2,200-foot level and for outside tunnels having a 3-foot gauge.

The present equipment of the tunnel railway consists of ten 20-ton bottom-dump cars; twelve 20-ton side-dump cars; two flat cars; four 15-ton electric locomotives; one 8-ton electric locomotive; and one 40-ton electric locomotive. The 40-ton locomotive was added during the year.

The present equipment of machine-drill sharpeners, including those located at outside tunnels, as well as at the mine proper, consists of nine Leyner machines, four Sullivan, and one Waugh. A 3,600-cubic-foot-per-minute compressor, driven by a 600-horse-power output motor, was installed in the Beach power-house.

No new buildings were erected at the mine, with the exception of a concrete storage or root house; outside dimensions 38 x 30 feet, with an inside height of 9 feet at the crown of the arched roof. This is located at the tunnel cook-house and affords an excellent place for the storage of winter vegetables.

This group contains fourteen mineral claims, named as follows: *Covenanter*, **Attorney Group.** *Alastor*, *Attorney 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*, *Imperator*. The group is located in the mountains adjacent to Alberta bay, Howe sound, about half-way between Point Atkinson and Britannia Beach, and is reached by a trail from Alberta bay. The property is owned by the Attorney Copper Gold Syndicate, of Vancouver, of which Wm. Savage is trustee and J. C. Fisher is superintendent.

Owing to the fact that this property was only brought to the attention of the writer too late in 1918 for an examination to be made, no report is made of it, but it will be examined at the earliest opportunity in 1919.

This group, which contains three Crown-granted mineral claims—*Emerald*, **Bowena Group.** *Emerald No. 1*, and *Bowena No. 1*—is located on the east side of Bowen island, a short distance southerly from Snug cove, where one of the vessels owned by the Terminal Steam Navigation Company, Limited, calls daily en route to Squamish. The property is owned by the Bowena Copper Mines, Limited, 417 Rogers Building, Vancouver, but is at present under lease to Clarence W. Tipping, of Bowen island, who is preparing to install a concentrating plant in the near future and to extend the development-work. The writer has arranged to examine the property after the installation of the plant, when it is being actively operated.

LYNN CREEK SECTION.

The Lynn Creek section of the Vancouver Mining Division comprises that portion of the Division which includes the mountains in the vicinity of Lynn creek and North Vancouver. Until 1918 this section has received very little attention for several years past, but interest was revived in the spring of 1918 by the operations of W. F. Dunphy, who bonded several groups of mineral claims on which copper-sulphide ore occurs, and also because of rumours that the work on the group of mineral claims at the head of Lynn creek, on which ore occurs carrying values principally in zinc, was to be reopened.

So far as the last-mentioned rumours are concerned, they proved to be groundless and no operations were carried on at the so-called zinc-mines. The property of the Lynn Creek Zinc Mines, Limited, was fully described in the Report of the Minister of Mines for 1917, on page 280; consequently it is unnecessary to repeat the description in the present report.

This group of mineral claims, on the east side of Lynn creek, near North Vancouver, was operated during a part of the past year by W. F. Dunphy under bond from the Lynn Valley Copper Gold Mining Company, Limited. The old workings were reopened and some additional development-work was done. It was proposed to ship the ore on the old dumps via an automobile-road constructed up the creek from the intake by the Cotton Contracting Company, of Vancouver, for the Cedars Company, Limited, which built a sawmill about a mile and a quarter above the intake and about a mile below the *Mountain Lion* group.

Mr. Dunphy also bonded the Crown-granted mineral claims owned by the Lynn Creek Gold-Copper Mining Company, Limited, which are situated on the west side of Lynn creek, and he proposed working this group in connection with the *Mountain Lion* group. Ore-bins and a camp were constructed at the last-named property, to which the auto-road is to be built. The ore on the dumps at the *Mountain Lion* is chiefly chalcopyrite in a gangue made up of epidote, garnet, and hornblende. Grab samples assayed from 3.8 per cent. up to 16.4 per cent. in copper, with traces in gold and about 2 oz. in silver. Operations were discontinued during the summer, when Mr. Dunphy met with a serious automobile accident, and have not been since resumed.

PACIFIC GREAT EASTERN RAILWAY SECTION.

The Pacific Great Eastern section of the Vancouver Mining Division is so named because the mineral claims examined are tributary to that line of railway, and are situated in the mountains adjacent to the headwaters of the Cheakamus river and the chain of lakes on the divide between the Cheakamus and Green rivers, which is the boundary between the Vancouver and Lillooet Mining Divisions.

This section was examined by Chas. Camsell for the Canada Geological Survey in 1917, and is referred to in his Summary Report for that year. He draws especial attention to the rather complicated geologic conditions and to the bands of metamorphosed sedimentary rocks which occur as roof-pendants in the intrusive granodiorite batholith.

The section was examined by the writer during the latter part of September, 1918, when his attention was attracted by the conditions referred to by Mr. Camsell and to the opportunities that presented themselves for thoroughly prospecting the neighbourhood, which until the railway was completed was badly handicapped by lack of transportation facilities.

This group contains five full-sized mineral claims and one fractional claim, all of which are Crown-granted. The claims are named as follows: *Yellow Jacket*, *Blue Jacket*, *Last Chance*, *Sunrise*, *All Up*, and *Leona Fraction*. The group was staked in 1901 and Crown-granted in 1911. In 1918 the property was bonded to the Consolidated Mining, Smelting, and Power Company, of Trail, on the recommendation of M. E. Purcell, one of that Company's mining engineers. The group is located about three miles from the railway-track, but about four miles from Mons Station and about forty miles from Squamish, the ocean terminal of the railway. The property is reached by a good pack-trail from the railway. Fitzsimmons creek, which empties into Green lake, flows across the southerly end of the *Last Chance* claim, which is the most southerly one of the group.

Geology.—The country-rock on the *Fitzsimmons* group is chiefly metamorphosed sedimentary rock, including limestone, very much altered, fractured, sheared, and fissured, and intruded by a number of narrow porphyry dykes. The extent of the band of altered sedimentaries has not been determined.

Characteristics of the Ore-deposits.—The most prominent occurrence of ore on the *Fitzsimmons* group is on the *Yellow Jacket* mineral claim near the north-east corner, where a face of mineralized rock occurs in a high bluff made up of contact-metamorphic rocks. The mineralization is an association of copper carbonates, with some chalcopyrite and iron pyrite. An open-cut has been made about 50 feet long, along the strike of the ore in a south-easterly direction, and about 40 feet wide across the ore-body, which dips nearly vertical. A sample from this exposure assayed: Gold, trace; silver, trace; copper, 2.5 per cent. Another exposure of low-grade ore occurs on the *Sunrise* mineral claim at a point about 400 feet in a south-easterly direction from the open-cut on the *Yellow Jacket*, where along the top of a ridge there are three smaller open-cuts in which ore is exposed containing a small quantity of galena associated with zinc-blende, chalcopyrite, and iron pyrite in a quartzose gangue in which there is considerable epidote. A sample from these open-cuts assayed: Gold, trace; silver, trace; copper, 1.2 per cent.

This group contains eight Crown-granted mineral claims and a fractional claim, known as: *Good Luck*, Land Lot No. 3405; *Summit*, Land Lot No. 3404; *Morning Star*, Land Lot No. 3403; *Iron King*, Land Lot No. 3402; *Iron King No. 2 Fraction*; *Vulcan No. 2*, Land Lot No. 3411; *Vulcan*, Land Lot No. 3406; *Empress*, Land Lot No. 3407; *Cougar*, Land Lot No. 3408. The group is located near the north end of Alta lake, about two miles northerly from Mons Station, on the Pacific Great Eastern Railway, and about forty miles from the terminus at Squamish. The property is held under bond by Dr. Davidson and associates, of Vancouver, from the owners F. S. Keith, J. H. Thompson, and C. Wilber Smith, of Vancouver.

Geology.—Chas. Camsell, of the Canadian Geological Survey, in his Summary Report for 1917 refers to the geologic formation in the vicinity of the *Cougar* group as a part of the Mons band of stratified rocks of the Jura-Triassic age, which probably at one time covered all of the region between Anderson lake, in the Lillooet Mining Division, and Howe sound, on the Coast. At present, however, owing to intrusion of the Coast batholith and subsequent erosion, only a few isolated bands of these stratified rocks remain, one of which is traversed by that part of the Pacific Great Eastern Railway in which the *Cougar* group is located, and is designated by Camsell as the Mons band, which is traversed by the railway from the Cheakamus river to Green lake.

Characteristics of Ore-deposits.—The principal exposure of limonite ore occurs about half a mile west from the north end of Alta lake and outcrops on the westerly edge of a large swamp at the foot of a thickly wooded hillside. Starting from this point and following a general north-westerly direction up the hill, several outcroppings occur within an area of about 450 feet in length and about 250 feet in width. The extent of the deposits has not been fully determined, but the ore is exposed in several open-cuts within the area mentioned.

The surface outcroppings are usually loose and earthy, but a few feet below the ore is more compact and solid. Apparently the ore is underlaid with bluish clay in places, which shows stratification. To the westerly from the outcroppings of limonite the mountain rises abruptly to a very considerable height. The rock formation is schistose in structure and carries a high percentage of iron pyrites, from the oxidation of which apparently the limonite derives its origin.

Development-work.—The development-work on the *Cougar* group of mineral claims consists of several open-cuts varying in extent from about 39 feet long, 12 feet deep, by 8 feet wide to a prospect-hole 4 feet long, 4 feet deep, by 4 feet wide. These show the ore to vary from about 1 foot to 12 feet in thickness, but the work has not been done so as to determine the extent.

A steam-shovel and equipment was installed in September last and a spur track built to connect the mine-workings with the Pacific Great Eastern Railway, about half a mile northerly from the Rainbow Lodge flag-station.

Samples and Assays.—Samples were taken from five exposures of limonite ore in open-cuts. These assayed:—

	Iron.	Phosphorus.	Sulphur.	Silica.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
From open-cut near north-easterly boundary of ore-zone....	51.8	2.9	1.19	4.2
From open-cut near south-westerly boundary of ore-zone...	43.4	2.2	0.94	4.0
From open-cut on Iron King Fraction claim up hill from above samples.....	43.0	3.3	1.3	1.3
From solid ore in largest open-cut on Iron King Fraction...	50.0	0.5	0.89	1.9
From open-cut on Morning Star mineral claim.....	26.5	2.5	0.76	39.5

Available Ore.—The work has not been done in a method such as permits of a reliable estimate being formed of the available tonnage of ore in the deposits. In addition to the area mentioned as being covered by the limonite ore, of about 450 x 250 feet, there are several outcroppings of this ore farther up the hillside which apparently represent isolated occurrences and on which but very little work has been done, so that it is not possible to estimate any tonnage.

With regard to the main deposit, Charles Camsell in his report estimates about 12,000 tons of ore in that deposit, but since he made his examination the development-work has been carried farther, so that at the time the writer made his examination the indications pointed to the probability that Mr. Camsell's estimate is too low.

The occurrences of the ore are, however, so erratic in structure that it is not safe to form an estimate. In considering tonnage of limonite ore in-place in the Southern States, the experienced ironmen will never commit themselves, and the same rule should be applied to the ore occurrences which are the subject of this report.

This mineral claim is on Sproat mountain, about three miles by trail westerly from Mons Station, on the Pacific Great Eastern Railway, and is reached by travelling for about half a mile along the old tote-road, which at this point nearly parallels the railway-track; then taking a mountain trail toward the west which crosses a part of a group of twenty-two claims owned by McGilvray & McDonald, on which several adits have been driven in the schistose country-rock, apparently with a view of exposing ore-bodies at depth, which are indicated by outcroppings of mineralized rock in which occur stains from copper carbonates and a little chalcopyrite in a quartz gangue. After leaving the McGilvray & McDonald claims, the trail continues up the mountain-slope to near the summit of Sproat mountain, some distance above timber-line and to an elevation of nearly 6,000 feet above sea-level. The claim is owned by Horstman & Archibald, Alta Lake, B.C.

Geology.—The rock on Sproat mountain consists of interbedded slates, limestones, and some volcanic rocks cut by intrusive dykes of granodiorite. The limestone often occurs as lenses of various dimensions and altered to garnetite, epidote, and other contact-metamorphic minerals. The general line of strike of the altered limestone is north-westerly and dip almost vertical, with the incline, if any, toward the southerly. Shearing movement has been very pronounced, many of the rocks having a schistose structure with considerable talcose material in the cleavage-planes. Slickensides occur frequently, especially in the neighbourhood of ore-bodies, where movement has been the most pronounced.

Characteristics of the Ore-deposits.—Occurrences of copper and iron minerals are found on the Callander claim in a ridge near the summit of Sproat mountain and a short distance north of Sproat creek. The ridge is made up of altered limestone that has been intruded by an igneous dyke, and at and near the contact between these rocks there occur outcroppings of gossan of varying extent, in which is found chalcopyrite, iron pyrite, magnetite, and apparently a little arsenopyrite. These bodies of ore are enclosed by walls of granodiorite.

The ore-bodies have been opened up by the annual assessment-work and partially developed by open-cuts and one adit about 22 feet long. A sample taken from the workings assayed: Gold, trace; silver, 2.2 oz.; copper, 4.3 per cent.

Blue Grouse Group. This group contains two mineral claims—*Blue Grouse* and *Nita*—and is located on Sproat mountain at an elevation of about 3,600 feet above the track of the Pacific Great Eastern Railway, and is reached by a branch trail in a south-westerly direction from McGilvray & McDonald's camp, about a mile and a half westerly from Mons Station, on the Pacific Great Eastern Railway. The group is owned by H. J. Blurton, of Mons, B.C.

Geology.—The rocks in the vicinity of this group of claims are mostly granitic, with gneissic structure, which contact with altered limestones and interbedded slates. All of these rocks are very much sheared and fractured.

Characteristics of the Ore-deposits.—Occurrences of copper and iron minerals occur in deposits of the contact-metamorphic type, which up to the time of examination had not been sufficiently developed for an unqualified opinion to be formed as to the future possibilities of the property. Ore is exposed in some shallow open-cuts, a sample of which assayed: Gold, trace; silver, trace; copper, 1.6 per cent.

This group contains four mineral claims—*King Solomon*, *Hidden Treasure*, *King Solomon* *Maple Leaf*, and *Lucky John*—and is located in a pass between the head of Fitzsimmons creek and Cheakamus lake, about eleven miles from Alta Lake Station, on the Pacific Great Eastern Railway. The property is reached by a poor trail from the easterly side of Alta lake. There is some question as to whether this property is in the Vancouver or Lillooet Mining Division. The group is owned by J. Findlay, J. Wilson, J. Bailiff, and L. M. Wilson, of Alta Lake, B.C.

Owing to the lateness of the season and a heavy storm prevailing on the day the writer proposed visiting the *King Solomon* group on September 30th, 1918, no examination was made, but in the Summary Report for 1917, Part B, Canada Department of Mines, the group is referred to in the notes made by George Hanson, assistant to Charles Camsell, geologist in charge, as follows:—

“The *King Solomon* group is situated at the head of Fitzsimmons creek, on the divide overlooking Cheakamus lake. A tunnel 45 feet in length has been driven to cut a bed of argillaceous limestone, mineralized by pyrite and magnetite, which outcrops on the hillside above and in which an open-cut has been made about 85 feet higher up. The limestone is in contact with sheared granodiorite near by, which is probably the cause of mineralization. The values are in gold, but are apparently low for that location.”

Other Claims.—There are quite a large number of mineral claims located along Fitzsimmons creek and in the mountains adjacent which belong in the Lillooet Mining Division, but very near the dividing line, which have been partly developed by the owners doing the necessary annual assessment-work, but until the Pacific Great Eastern Railway was in operation this section of country was badly handicapped through lack of transportation facilities, and consequent difficulty in obtaining capital for development purposes.

At the end of September, 1918, the owners of practically all of the mineral claims were absent from the district, many of them being on service overseas; consequently it was not possible to make examinations, chiefly because of not being able to secure guides acquainted with the locations and position of the workings.

PROSPECTING FOR OIL.

During 1918 there has been more drilling done in prospecting for oil in the Fraser River delta than has been in the past, but so far no commercial results have been obtained. The most recent work is being carried on by the Spartan Oil Company, Limited, near Still creek, which flows from Burnaby lake. A diamond-drill is being used for boring, and at the end of 1918 a depth of about 1,100 feet had been reached and the drill was in shale. The prospects of finding oil in this district are discussed by Chas. Camsell in the Summary Report of the Geological Survey for 1918, page 22b.

VICTORIA MINING DIVISION.

For convenience the Victoria Mining Division has been subdivided into the following named sections: Cowichan Lake, East Sooke, Jordan River, and Saltspring Island.

COWICHAN LAKE SECTION.

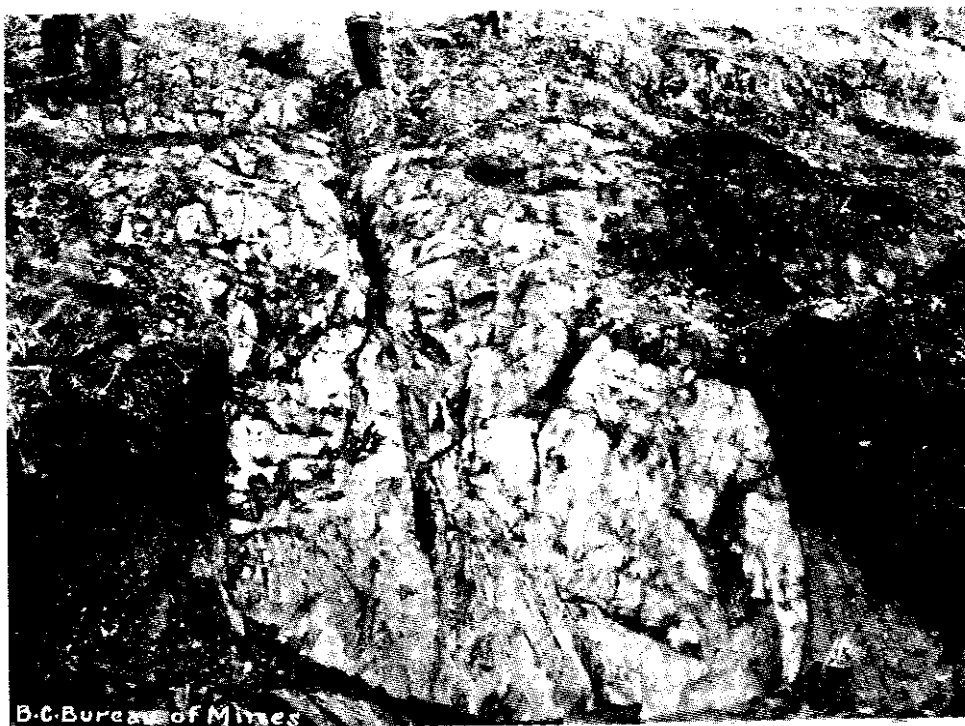
The Cowichan Lake section of the Victoria Mining Division includes that part of the Division lying in the vicinity of the lake extending in a north-westerly direction from near Sahtlam Station, on the Cowichan Lake branch of the Esquimalt & Nanaimo Railway, to the Nitinat river, or about ten miles westerly from the head of Cowichan lake. This section is traversed by the grade of the Canadian Northern Pacific Railway, which, when steel is laid, will afford additional transportation facilities and help to develop the region between Cowichan lake and Alberni canal, in which there occur deposits of copper and galena ores that have never been developed.

One of the important developments during 1918 was the discovery of deposits of manganese ore near Cowichan lake, which promises to open up a new industry in British Columbia.

This group of mineral claims contains the *Hill 60*, *Hill 60 No. 2*, and *Hill 60 Hill 60 Group*. No. 3, which were staked during the summer of 1918. The group is located near the summit of a mountain about 2,000 feet above sea-level and about five miles easterly from the foot of Cowichan lake. The location is about four miles by trail from the Cowichan Lake branch of the Esquimalt & Nanaimo Railway. It is reached by following a



Contl Prospect No. 1, Tsanbl River.



Outcrop of Manganese Ore, "Hill 60," Victoria M.D.

trail from the Cowichan-Duncan wagon-road which branches off from the road about fifteen miles from the town of Duncan, near Sahtlam Station. The property is owned by C. H. Dickie and T. A. Wood, of Duncan; T. W. Service and M. L. Douglas, of Riverside, Cowichan Lake.

Geology.—The deposits of manganese ores occur in a belt of cherty jasperized rock which is said to be continuous from Mount Sicker to the northerly end of Cowichan lake, a distance of some forty miles, and is included in the Mount Sicker series of rock formation.

Characteristics of Ore-deposits.—Sufficient work has not yet been done to determine whether the deposits of manganese ore are residual or whether they occur as replacement deposits in the jasperized rock and occupy fissures in the sheared portion of the belt of rocks. The latter theory would appear, from the conditions at present shown by the shallow work that has been done, to be the more tenable, and if such prove to be the case it is reasonable to presume that the ore-deposits may possibly maintain continuity to some considerable depth, as the shearing movement appears to be widespread and deep-seated.

Development-work.—Up to the present time the development-work has been confined to the *Hill 60 No. 2* claim and consists of surface-stripping and open-cut work. At one point a short distance north-westerly from the No. 1 post on *Hill 60 No. 2* claim the outcropping has been stripped for a distance of 55 feet and an average horizontal width of 15 feet, but over 20 feet on the incline and to a depth of about 14 feet. Other open-cuts have been made both easterly and westerly from the main work, which demonstrates that the probable length of the deposit at this particular point is about 100 feet and the width about 15 feet.

In addition to this work there has been some prospecting done at a point about 250 feet lower level than the surface outcroppings and about 1,300 feet north-westerly from the main workings, but there is no actual evidence of any connection between the outcroppings exposed by the stripping and the last outcropping mentioned. The exact line of strike is quite difficult to determine, but it appears to be about N. 67° E., with a dip on the hanging-wall side of 70 degrees to the south.

Samples and Assays.—On August 1st, 1918, before any work had been done, a general sample of the outcrop taken by the writer assayed 37.5 per cent. manganese. Other samples taken by the Provincial Mineralogist and Mr. Mackenzie across one section of the outcropping that had been stripped assayed as per the following table:—

Sample No.	MANGANESE.		SILICA.		IRON.		PHOSPHORUS.		SULPHUR.		Length of Sample on Incline.
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	
1.....	16.75	15.88	64.3	62.82	..	2.82	..	0.048	..	0.073	2 6*
2.....	23.05	23.15	50.0	49.60	..	2.80	..	0.046	..	0.058	2 6
3.....	40.05	52.25	14.5	13.20	..	0.84	..	0.058	..	0.056	5 0
4.....	55.34	57.15	11.0	10.09	..	0.87	..	0.047	..	0.075	5 0
5.....	50.62	52.20	17.2	16.88	..	0.90	..	0.041	..	0.167	5 0
6.....	52.60	53.50	17.2	16.92	..	1.17	..	0.041	..	0.107	3 0
7.....	44.60	45.90	29.2	25.66	..	1.83	..	0.048	..	0.122	2 0†

* Bottom.

† Top.

Analyses A were made by British Columbia Bureau of Mines and analyses B by Department of Mines, Ottawa.

This group of mineral claims was examined on August 3rd, 1918, and while the recent discoveries of deposits of manganese in this locality are of very considerable importance, for one reason because the ore occurs in the same cherty jasperized rock as it is found in on the *Hill 60* group, about twenty-five miles in a south-easterly direction, but apparently there is not such a quantity of high-grade manganese ore on the *Black Prince* as occurs on the *Hill 60* group. It would appear from the results of assays of samples taken from the *Black Prince* group that it would be necessary to concentrate this ore in order to obtain a commercial product.

There appears to be an excellent opportunity to install concentrating-works on the property, as the middle branch of Shaw creek, which flows through a portion of the property, could furnish ample water for concentrating purposes, and possibly water-power could be developed on the main Shaw creek sufficient to drive all the necessary machinery connected with such a plant.

Assays of the samples taken by G. C. Mackenzie, as well as by the writer, show that the ore on the *Black Prince* group varies between 22.2 and 40.8 per cent. in manganese. The workings so far have not exposed any such high-grade manganese content as is shown across 13-foot samples by Mr. Mackenzie on the *Hill 60* group, but the quantity of ore exposed by the strippings and open-cuts on the *Black Prince* group appears to be greater than the quantity exposed on the *Hill 60* group.

The *Black Prince* group of mineral claims is located on a prominent ridge overlooking the middle fork of Shaw creek and about a quarter of a mile from the creek. The location is about six miles by survey-line from the head of Cowichan lake and approximately 1,000 feet elevation above sea-level. The property is reached by following a good trail from the grade of the Canadian Northern Pacific Railway up Shaw creek. The group consists of three mineral claims, called the *Black Prince*, *Black Prince No. 2*, and *Black Prince No. 3*, and is owned by C. H. Dickie, of Duncan; John Noble, John Anderson, and Thos. Service, of Riverside, Cowichan Lake.

Geology.—Deposits of manganese ore on the *Black Prince* group occur in a belt of cherty jasperized quartzose rock of undetermined extent, apparently similar and probably a continuation of the belt in which the ore-deposits on the *Hill 60* group occur.

Characteristics of Ore-deposits.—So far as the work done on the property up to the time it was examined shows, it would appear as though a portion of the deposits of manganese ore are of residual occurrence, while at one point in particular the ore appears to fill a fissure in the sheared zone of cherty rock. It is difficult to determine the exact line of strike, but apparently it is north-westerly, conforming with the general strike of the shearing in the belt of rock in which the ore-bodies occur. The dip where it is exposed is about 30 degrees toward the south.

Development-work.—Development-work consists of stripping and open-cut work at four different points within an area of about 10 acres. At one point the ore is exposed by stripping about 50 feet in length along the strike and 10 feet wide and about 5 feet deep; at another point about 60 feet south-east from the open-cut just mentioned the ore-body is stripped for about 50 feet at a crosscut, the work being nearly at right angles to the stripping and open-cut first mentioned. About 75 feet north-westerly from the first-mentioned cut manganese ore is exposed in a shallow open-cut, and between these showings there is a hollow or depression with indications that ore may occur under the detritus which forms the overburden. At another point about 100 feet north-easterly from the crosscut stripping an open-cut has been made about 80 feet long and about 10 feet wide on a bluff.

Samples and Assays.—The following are the assay results from samples taken by G. C. Mackenzie:—

Sample.	MANGANESE.		SILICA.		IRON.		PHOSPHORUS.		SULPHUR.		Length of Sample on Horizontal.
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	
11.	22.2	22.9	55.9	57.24	..	1.03	..	0.031	..	0.148	Feet.
12.	26.6	28.1	50.8	49.40	..	1.08	..	0.029	..	0.172	10*
13.	26.8	27.0	52.0	51.86	..	0.86	..	0.029	..	0.162	10
14.	35.2	35.6	39.0	37.36	..	1.14	..	0.031	..	0.206	10
15.	37.2	40.8	32.2	30.18	..	0.80	..	0.029	..	0.140	7†

* Upper end of dip. † Lower end of dip.

Analyses A were made by British Columbia Bureau of Mines and analyses B by Department of Mines, Ottawa.

The following are assay results of samples taken by the writer:—

No.	Manganese.	Insoluble.	Iron.	Phosphorus.	Sulphur.
	Per Cent.	Per Cent.	Per Cent.		
1.	34.0	48.0	2.1	Trace.	Trace.
2.	29.6	46.8	1.5	"	"
3.	38.0	41.7	2.0	"	"
4.	27.6	54.9	1.8	"	"

This group contains several mineral claims, known as the *Panther*, *Panther Panther Group*. Nos. 1 to 7, inclusive, which were staked by the late Ike Holman, of Riverside, Cowichan lake, in the late fall of 1916. The group was examined on August 9th, 1918. The location of this group of mineral claims is on a creek tributary to the Nitinat river, about two miles in an easterly direction from the grade of the Canadian Northern Pacific Railway, about eight miles from the head of Cowichan lake. The claims are at an elevation of about 1,600 feet above sea-level in a rugged mountain range. The property is owned by the Nitinat Copper Company, Limited, of Victoria, B.C.

Geology.—There is a zone of contact metamorphism on the *Panther* group of undetermined extent. The rocks are limestone and igneous rocks, with a zone of metamorphism developed where the limestone contacts with hornblende igneous rocks, in which the crystals of hornblende are quite well defined and prominent, as well as several well-defined intrusive dykes, one of which has apparently intruded through a body of mineral composed chiefly of pyrrhotite. On the northerly side of a creek tributary of the Nitinat river there occurs a belt of garnetite, but this does not appear to extend across the creek, nor has its dimensions been determined.

Characteristics of Ore-deposits.—The main outcropping of copper minerals occurs on the *Panther No. 1* claim and is a deposit belonging to the contact-metamorphic type of ore occurrences. It is exposed by an open-cut about 35 feet long which crosscuts a mineralized zone about 3 feet wide from east to west (mag.). The mineralized zone strikes north and dips 37 degrees to the west. This outcrop has been stripped for about 20 feet long. A sample from this open-cut assayed: Gold, trace; silver, 0.4 oz.; copper, 3.8 per cent. A second sample from the garnetite portion of the zone assayed: Gold, trace; silver, trace; copper, 0.2 per cent.

This group of three mineral claims was described in the Reports of 1915, 1916, **Blue Grouse** and 1917, so that it is unnecessary to repeat the description in detail in **Group.** this report. The property was examined on August 7th, 1918. During 1918 development-work has been carried on continuously under the management of C. H. Kilbourne. This work has included both the extension of working openings underground and borings by diamond-drilling. The copper ore mined during 1918 from the underground development has been shipped to the Trail smelter for treatment. This has amounted to about 500 short tons. The results from diamond drilling are reported as fairly satisfactory, and it is expected that further development-work will be done in 1919 with the view of placing the property in the ranks of regular shippers.

SALTSPRING ISLAND SECTION.

Saltspring Island, section of the Victoria Mining Division includes all of the area covered by the island of that name, which is one of the largest islands lying between Vancouver island and the mainland of British Columbia.

Portions of Saltspring island were examined by J. A. Allan, of the Canadian Geological Survey, during 1909. His report is published in the Summary Report for that year. In this he states that the examination was largely from a boat traverse around the shore.

Chas. H. Clapp also refers to the south end of Saltspring island in Memoir 36, "Geology of the Victoria and Saanich Map-areas, Vancouver Island, B.C.," Canadian Geological Survey, 1913, but there appears to have been no detailed report made as to the geologic conditions on the northern part of the island. Clapp describes an occurrence of iron ore on Saltspring island on the north-western slope of Mount Sullivan, opposite Sansum narrows, at an elevation of about 825 feet above sea-level.

This is, so far as has been reported, the only occurrence of metallic minerals on the island. It was examined by the writer on March 31st, 1918, and is described as follows:—

This group contains two mineral claims, known as the *Mesabi* and *Gogebic*, **Mesabi Group.** and is located on the north-westerly slope of Mount Sullivan and contains the same occurrence of iron ore as referred to in Clapp's report. It is reached by boat from either Maple bay, on the east coast of Vancouver island, or Vesuvius bay, on Saltspring island, to a point on the east shore of Sansum narrows, from which a poor trail is travelled up the side of Mount Sullivan to near the summit where the outcroppings of iron ore occur. The group is owned by C. H. Dickie and T. A. Wood, of Duncan.

Geology.—The rocks on the westerly slope of Mount Sullivan belong to the Sicker series, which, according to Clapp, include andesitic volcanic flows and tuffs, with interbedded tufaceous, slaty, and quartzose sediments metamorphosed into schists and intruded by quartz, feldspar, and

gabbro diorite 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 occurrence of iron ore on the *Mesabi* group of mineral claims occurs as a representative of the impregnated schist type of ore-deposits. (See Clapp's report on "Southern Vancouver Island.") The iron ore occurs in the Sicker schists as bands or streaks and lenses, some of which are masses of fair extent, such as about 150 feet long and 20 feet wide, of practically solid iron ore. The occurrences seen by the writer occur in a contact between green schist typical of the Sicker schist and a dark-red jaspery schist which Clapp refers to as having been converted from the typical Sicker schist. The strike is easterly (mag.) and dip 70 degrees to the south.

The impregnated zone is about 100 feet wide, but the width of solid iron ore in the zone varies from streaks a few inches wide to masses about 20 feet wide. From one of these lenticular masses a sample assayed: Iron, 30 per cent.; sulphur, trace; phosphorus, 0.2 per cent.; silica, 53.3 per cent.; titanium, *nil*. A second sample from an open-cut at a level about 150 feet lower than the sample referred to assayed: Iron, 39.5 per cent.; sulphur, trace; phosphorus, 1.02 per cent.; silica, 39 per cent.; titanium, *nil*.

Some of the ore in this deposit is partly altered from magnetite to hæmatite, which accounts for the red streak that can be seen by scratching some samples of the ore.

There are other outcroppings exposed by smaller open-cuts in which the mineralization is composed principally of pyrrhotite, with a very little copper sulphide ore associated. It has not yet been determined whether there is any relationship between the several outcroppings. The property shows possibilities sufficiently promising to warrant thorough prospecting, especially since rails are being laid on the Canadian Northern Pacific Railway, which in the near future will furnish excellent transportation facilities.

JORDAN RIVER SECTION.

The Jordan River section of the Victoria Mining Division includes all of the Coast region of Vancouver Island to north-westerly of the mouth of the Sooke river, at Sooke harbour, to the Lost river, which flows into the strait of Juan de Fuca about twelve miles north-westerly of the mouth of the Jordan river. The region is included in Clapp's report on "Southern Vancouver Island." In the description of the geologic conditions it is referred to as being made up of a wide belt of the Metchosin volcanics, a subdivision of Dawson's Vancouver series, which is at least from five to seven miles wide in the Jordan River section, and separated from the rest of the members of the Vancouver group by the Leech River formation. The Metchosin volcanics are composed of ophitic basalt flows, tuffs, and agglomerates, with intrusive diabase dykes, and are less metamorphosed than the rest of the Vancouver group.

Up to the present time development-work in the Jordan River section of the Sunloch and Victoria Mining Division has been confined to the *Sunloch* and *Vulcan* groups of mineral claims, owned by the Sunloch Mines, Limited, of Vancouver, which were described in the Report for 1917, pages 265 to 267. The development-work on these groups of claims is shown on the accompanying sketch. The property was examined several times during 1918 and the progress of the development watched with great interest, because as the work progressed it became more evident that the property promised to develop into a big mine.

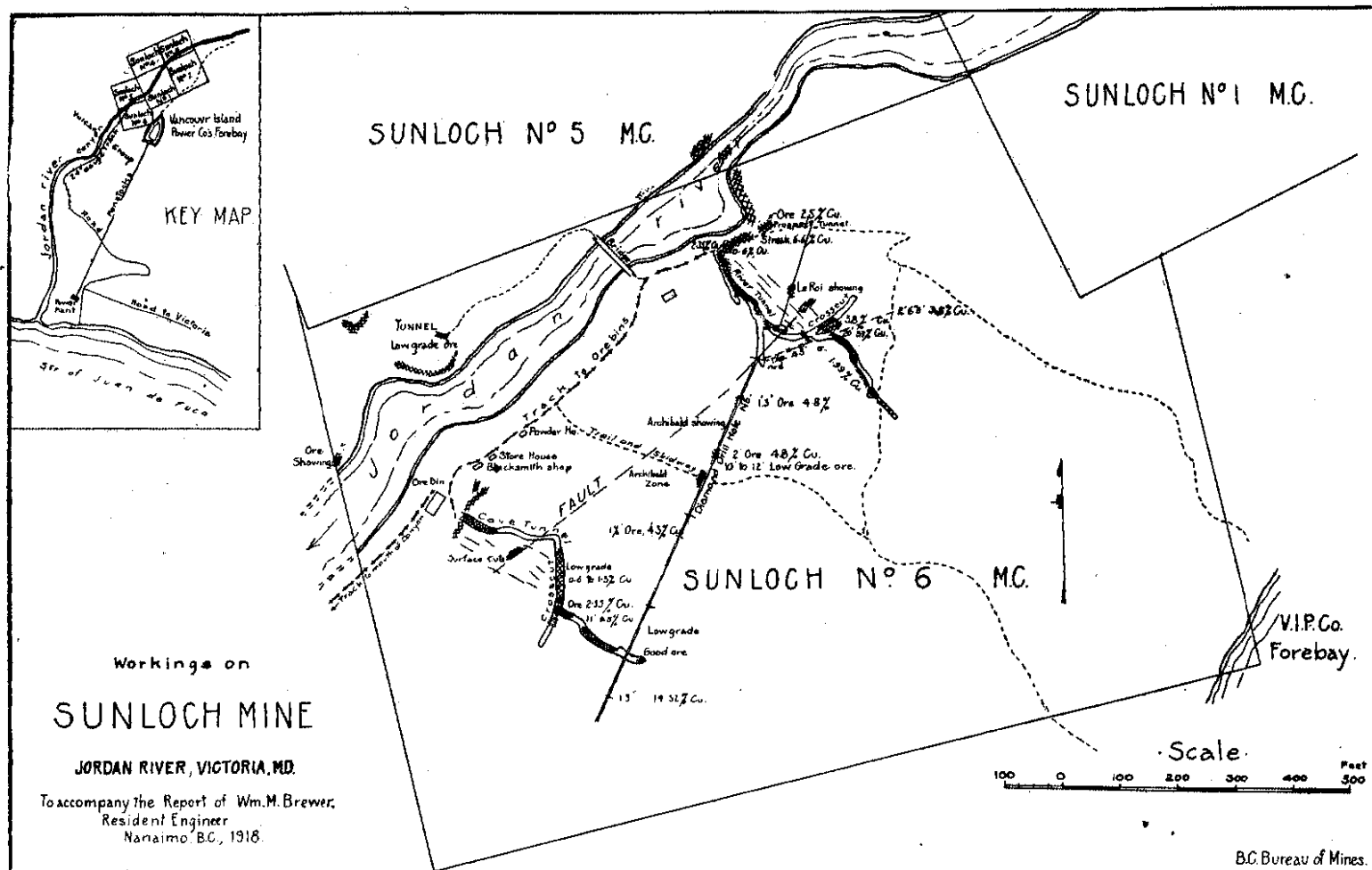
Characteristics of the Ore-deposits.—There are three well-defined ore-bearing zones, which are known as the River, Cave, and Archibald zones, and the work on these is fully described in the following extracts from the report of the managing director, R. H. Stewart, as follows:—

"*River Zone.*—Owing to the difficulty in following the ore-deposit, the tunnel ran out of the ore-zone for a short time. We went back to where the ore was lost and attempted to follow ore which was there visible, finding only disconnected stringers which did not appear to be directly in the ore-zone. After following these for some distance a crosscut was started across the zone and opened up:—

"First: Five to six feet of ore assaying 1.9 per cent. copper.

"Second: A low-grade area with one or two narrow streaks of ore of fair grade.

"Third: Twenty feet of the crosscut averaged 3.7 per cent. copper. As the crosscut is apparently not quite at right angles to the line of the ore, this probably represents 15 or 16 feet of vein.



"Fourth: A band of waste 6 feet wide.

"Fifth: About 3 feet of ore averaging 3.8 per cent. copper. From this point on the crosscut is in waste for 40 feet, but owing to the surface showing will have to be continued at a later date.

"In the meantime a drift which was started in the zone just west of the high-grade ore has been extended to 60 feet beyond the crosscut. The drift is now in good ore, averaging to date over 4 per cent. copper. The development-work on this zone has therefore opened up partially 280 feet of vein, the end of the drift being probably from 230 to 250 feet vertically below the surface.

"The nature of the higher grade ore encountered is such that it could, to a very great extent, be sorted and shipped, leaving a certain amount which would have to be milled. Should this ore prove to be continuous from the mouth of the tunnel, which seems to be quite likely, a very considerable tonnage is available.

"In addition to this ore, the prospect-tunnel shown on the map about 100 feet east of the main River tunnel exposed another zone of ore averaging in the prospect-tunnel about 2.5 per cent. copper. This has apparently not been reached by the crosscut, but will be prospected for further with the diamond-drill at an early date.

"*Cave Zone.*—In this zone the tunnel also left the ore at about 60 feet from the mouth, getting into a low-grade area with a few stringers of high-grade ore in it, the first 60 feet of the tunnel having been in ore averaging about 4 per cent. At 180 feet in a crosscut was started, to the south, and after going through one section of about 60 feet of low-grade material averaging 0.9 per cent., of which 10 feet averages 1.3 per cent., the crosscut encountered 20 feet of waste; then 36 feet of ore averaging 2.58 per cent., of which one section of 11 feet averaged 5.1 per cent.; from this point to the end of the crosscut being in low-grade material averaging 0.64 per cent. The crosscut is being continued. The point at which the high-grade ore was encountered is 240 feet horizontally from the surface, and very nearly the same vertically.

"In addition to this development, a horizontal diamond-drill hole was run from a point in the River tunnel to crosscut both this zone and a third zone lying between the Cave and River zones, known as the Archibald zone. This diamond-drill hole at a depth of about 500 feet meets the Cave zone about 150 feet farther in than the crosscut, and encounters first a section of low-grade ore with one small streak of 6 inches carrying 7.9 per cent. copper; then 4 feet averaging 1.19 per cent.; then 5 feet of 3.48 per cent., $3\frac{1}{2}$ feet of 0.65 per cent.; then 2 feet of 3.8 per cent. ore, corresponding possibly to the 11 feet of high-grade ore shown in the crosscut. Unfortunately after this the drill-hole encounters faulted and broken ground, and with the exception of $4\frac{1}{2}$ feet of ore which has not yet been sampled, there is not much except low-grade material in the remainder of the hole. It is quite probable that this is due to the faulting.

"The net result is that this zone is partially proved to a distance of nearly 400 feet from the surface, both horizontally and vertically: (1) By open-cutting at the mouth of the tunnel and by the first 60 feet of the tunnel; (2) by a crosscut at 220 feet from the surface; (3) by the diamond-drill hole 400 feet from the surface. In all of these places ore of good width and grade has been found. The prospects of this zone, therefore, may be considered to be good.

"*Archibald Zone.*—On this zone there is an open-cut on the surface showing some good-grade ore about 260 feet above the level of the River and Cave tunnels. What is presumed to be the same zone is crosscut below by the diamond-drill hole and shows 2 feet of ore running 4.87 per cent. copper, in addition to 10 or 12 feet of low-grade material, the drill-hole being on the level of the tunnels. This zone may therefore be considered to have fair possibilities.

"In addition to this ore, the drill-hole encountered two small streaks of about $1\frac{1}{2}$ feet each, averaging in one case 4.8 per cent. copper and in the other 4.3 per cent.

"*General.*—On the opposite side of the Jordan river some open-cutting has been done on the Cave zone, showing that it crosses the river into the *Vulcan* group of claims. On this side of the river there is a short tunnel on the Archibald zone showing some low-grade ore, and there are outcrops on the River zone which have not been prospected to any extent.

"The work on the narrow-gauge railroad exposed two other ore-zones, in one case on the edge of a rock-cut, and in the other case the grade merely passed beside an excellent outcrop of good width; this latter on the *Vulcan* group, on which it will be advisable to do some work as soon as possible.

"On the dump and in the bins are about 1,000 tons of ore which should average better than 3 per cent. copper. The greater part of this can be sorted to a much higher grade for shipment.

In a general way the ore so far exposed is of such a nature that a large part of it can be sorted to a high enough grade for shipment independently of milling, so that the property should be able to get returns from mining even before a mill can be built.

"Summing up the possibilities of the above, should the ore in the River zone prove to be continuous to the inner end of the drift from the surface, a tonnage of from 35,000 to 50,000 tons is possible of ore between 2.5 and 4 per cent., with a probable addition of some ore of lower grade, without including any ore which is shown in the little prospect-tunnel and without including ore beyond or underneath the tunnel. In the Cave zone, measuring similarly, there is a possibility of 80,000 to 120,000 tons of ore running from 3½ to 5 per cent., and of a further considerable tonnage between 1.7 and 2.5 per cent. This is, of course, not yet entirely proven; but, on the other hand, it will be understood that the development so far done only covers a very small part of the possible ore-bearing area of the property, and that in addition to this area, which is all above the level of the river, further prospecting will eventually be done below the level of the river.

"In general, therefore, the prospects of the property are very good, and it well warrants further development."

EAST SOOKE SECTION.

The mining industry in the East Sooke section of the Victoria Mining Division was not as progressive during 1918 as has been the case during the previous year. Some shipments of copper ore were made from the *Margaret* or *East Sooke* group, as well as from the *Willow Grouse* group, but development-work on both of these properties was suspended subject to the negotiations that were pending relative to change of ownership.

ALBERNI DISTRICT.

ALBERNI MINING DIVISION.

A. G. FREESE, 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, 1918.

Monitor Group.—This group, situated on the west shore of the Alberni canal, has been continuously worked during the year up to September 15th, when the mine was closed down. The development-work consisted of 284 feet of drifting, 50 feet of crosscutting, and 110 feet of raising, all done on what is known as the "New Discovery ore-body," which is situated close to tide-water on the *Monitor No. 1 Fraction*. This ore-body has an approximate width of 50 feet and is proven for a length of 400 feet. From the above development-work a shipment of 126 tons of ore was made to the smelter at Tacoma, which gave promising results. A water-level trail was also constructed from the camp buildings to the New Discovery tunnel, a distance of 4,500 feet.

Beyond the keeping-up of the yearly assessment-work on a number of claims and the above-mentioned work on the *Monitor* group, very little actual mining development has taken place during the year.

OFFICE STATISTICS—ALBERNI MINING DIVISION.

Free miners' certificates issued	31
Certificates of work recorded	29
Mineral claims recorded	22
Bills of sale recorded	2
Total revenue	\$742.10

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, 1918.

Assessment-work has been recorded as follows:—

Copper Ledge.—Situated on the north end of Vargas island and owned by Donald Macintosh. Blasted about 500 tons of rock and made an open-cut 14 x 4 feet by 3 feet deep on strike about 60 yards south-east of discovery post.

Lucky Jim.—Situated on Elk river and owned by William Spittal. Stripped about 70 x 2 x 4 feet of earth and logs, cleared out the trail, and other necessary work, including 2 feet of solid rock 4 x 6 feet.

White Mine and Norman.—Situated at Deer creek and owned jointly by William Walton and Duncan McMillan. Two hundred feet of surface work and half a mile of trail and other prospecting-work.

Crown.—Situated on Lone Cone mountain and owned by Stuart Stanley Stone. Driving tunnel and opening up face of mineral at location post.

Contact.—Situated at Muchalet arm and owned by T. T. Gardhouse and W. F. Poole. Sunk shaft 6 x 8 feet by 15 feet deep at face, partly rock-work.

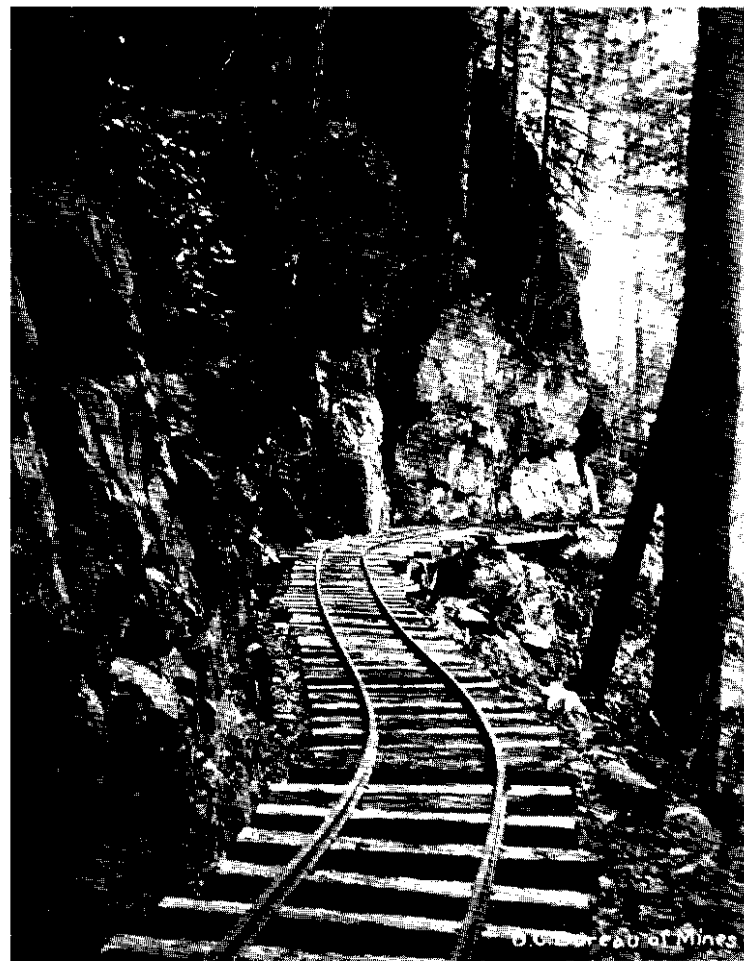
Northern Crown.—Situated at Kennedy lake and owned by J. E. Martin. Eight feet of shaft-work and open-cut; about 50 feet of loose rock.

Lucky Jim.—Situated at Bear river and owned by J. D. McLeod. Eight feet of tunnelling, all rock-work, 4 x 6 feet.

Wanderer Group.—Situated at Elk river and owned by Lachlan Grant. Open-cut 20 feet long, 12 feet wide, loose rock, and some drilling; about 8 feet of open gap and 5 x 6 x 4 feet of tunnel; 12 x 14 feet of solid rock removed; tunnelling, 8 feet.



Bunk-house, Sunloch Mine, Victoria M.D.



Narrow-gauge Railway, Sunloch Mine, Victoria M.D.

OFFICE STATISTICS—CLAYOQUOT MINING DIVISION.

Free miners' certificates (individual)	30
Mineral claims recorded	24
Certificates of work recorded	12
Other receipts issued	1

Revenue.

Free miner's certificates	\$137 25
Mining receipts, general	90 25
Total	<u>\$227 50</u>

QUATSINO MINING DIVISION.

REPORT OF O. A. SHERBERG, 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, 1918.

The *Old Sport* property has been developed continuously during the year, with an average crew of about thirty men. The principal work consisted of sinking and running crosscuts to block out the ore. It is reported that they are to start the working-tunnel of about 3,000 feet that will bring them to a level of 700 feet. The railroad from June Landing to the mine is to be started this winter.

During the summer and fall a party with a diamond-drill has been working on the *Old Sport*; the report of the result is good.

OFFICE STATISTICS—QUATSINO MINING DIVISION.

Mineral claims recorded	56
Certificates of work	61
Powers of attorney, transfers, etc.	14
Certificates of improvements	44
Free miners' certificates	152

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, 1918.

During the past year the *Marble Bay* group, situated on Texada island, shipped regularly copper-gold-silver ore from the 1,600-foot level. The company employed throughout the year an average of thirty-five men in connection with the operations.

Retriever Wm. McDonald and W. Lee reorganized the company working the *Retriever* group, Texada island. Considerable development-work has been done, including the building of a tram-line from the beach to the mine, a distance of about three-quarters of a mile; also constructing wharf and bunkers at the beach and a concentrating-mill.

The *Little Billie*, *Copper Queen*, *Cornell*, and *Loyal* have been leased by a Seattle syndicate, which did some development-work on the *Loyal*.

The Valdes Island Copper Company is developing the *Copper Mountain* group on the south end of Valdes island, near Quathlaski cove, and made several shipments of ore, most of which was taken from the *Senator* claim.

The *Santa Anna* group, situated on the south end of Valdes island, near Bold point, had a little development-work done during the year, and will likely have considerable work done during the ensuing year by capitalists who have leased the property.

Prospecting-work was done on the *Amethyst* and *Monte Cristo* claims, Fanny bay, Phillips arm, which resulted in mining of about 90 tons of ore of commercial grade, but owing to the conditions with regard to shipping and smelting this ore was left on the dumps.

During the year Wm. M. Brewer, Resident Engineer for 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 work has been done, other than the annual assessment-work, which has been recorded on a large number of claims, as shown by the accompanying office statistics.

OFFICE STATISTICS—NANAIMO MINING DIVISION.

Mineral claims recorded	128
Certificates of work	164
Bills of sale, etc.	35
Free miners' certificates	235

Revenue.

Free miners' certificates	\$1,344 00
Mining receipts, general	2,411 75
Total	\$3,755 75

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, 1918.

LODE-MINING.

There has been considerable activity in mining in this Division during this past year, with already some material shipments, and if one can judge from the success met with by several of the companies in their development-work, there should be within the next few years an output of copper ore which will place this Division in the list of important copper-producing districts.

In the Cowichan Lake district the *Blue Grouse* shipped approximately 500 tons of ore averaging nearly 5 per cent. copper, while the *Sunnyside*, in the same locality, also made some small shipments.

The *Blue Grouse* has been acquired by the Consolidated Mining and Smelting Company, of Trail, and is now being worked by that company. On this group of mineral claims the work done during the past season has been extending the old underground workings and doing very extensive prospecting by trenching and diamond-drill boring. The ore shipped has been such as was mined from the prospect openings and the underground extensions.

Manganese Ore.—The discovery of deposits of manganese ore in the mountains adjacent to Cowichan lake during the past summer attracted considerable attention. These deposits occur in a zone of jasperized cherty rock, and were discovered at three distinct points within a distance of about twenty-five miles; the most south-easterly occurrence, known as *Hill 60*, is about four miles from the foot of Cowichan lake, and the most north-westerly is about eight miles above the mouth of Shaw creek, which empties into the lake about five miles from its head. A limited amount of prospecting-work was done on the various claims by the locators, who propose to do further development in the coming season and place the properties on a shipping basis. The property is controlled by C. H. Dickie, of Duncan.

In the Sooke district, the *Margaret*, operated by a Victoria company, shipped some 130 tons of 5-per-cent. copper ore, and the indications are that during the coming year regular shipments will be made.

The *Willow Grouse* made shipments this year of 550 tons while bonded to the Ladysmith Smelting Corporation.

Both these properties are sufficiently near the navigable waters of Sooke harbour to permit of shipments being made by scows.

The geological formation upon which both the *Willow Grouse* and *Margaret* are located has been found to extend at least to the Jordan river, where the Sunloch Mines, Limited has been opening up what promises to be a very extensive low-grade copper property within two miles from the power-station of the British Columbia Electric Company. The work on this property has been confined to development in a systematic manner. There has been about 800 feet of drifting and crosscutting and about 400 feet of diamond-drill boring done on this property, in addition to the construction of about 6,000 feet of automobile-road, the installation of a 4-drill compressor plant, and construction of new camp buildings.

As the Victoria Mining Division is included within the Western Mineral Survey District, and the Resident Engineer, W. M. Brewer, is making a very detailed report thereon, it will be unnecessary for me to enter into further particulars.

PLACER-MINING.

I am not aware of any placer-mining having been carried on in the Division this past year, although it is possible some small amount of gold may have been taken out from the Leach, Jordan, and Sooke rivers which has not been reported.

 NON-METALLIC MINERALS.

The non-metallic minerals in this section have chiefly been utilized in some form of building material, and, as the building trade and allied industries have been nearly dormant for the past two years, this branch of the mineral industry has been seriously depressed.

Cement.—There are two large and well-equipped cement plants in the Division, both situated on Saanich inlet. The Vancouver Portland Cement Company, of Tod inlet (R. P. Butchart, president, Board of Trade Building, Victoria), made an output of Portland cement, of a value of nearly \$300,000. This company also manufactured for the Associated Cement Company, whose works at Bamberton were not operated this past year. It was reported about the close of the year that these two companies had been amalgamated into one.

Lime.—The Rosebank Lime Company (W. F. McTavish, manager), Esquimalt, produced burnt lime to a value of about \$6,000, which is about the same as last year's output. The Lime Producers, Limited, made almost \$5,000 worth of lime.

Of pottery, tile, etc., there was produced, this past year, material valued at about \$40,000, chiefly by the British Columbia Pottery Company, whose plant is situated in Victoria district, but has recently been discontinued.

In normal times there is a large number of red brick, etc., made in this Division, but this past year the production did not exceed in value \$20,000, produced chiefly by the Victoria Brick Company and the Sidney Island Brick Company.

OFFICE STATISTICS—VICTORIA MINING DIVISION.

Free miners' certificates issued	401
Free miners' certificates issued (special)	1
Mineral claims recorded	118
Placer claims recorded	6
Certificates of work recorded	101
Bills of sale recorded	39
Certificates of improvements issued	7

Revenue.

Free miners' certificates	\$2,791 75
Mining receipts, general	977 58
Total	<u>\$3,769 33</u>

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, 1918:—

The following list gives the number and localities of the recorded claims in this Division:—

MINERAL CLAIMS.

McNab creek	4
Nelson island	2
Lynn creek	4
Hotham sound	1
Howe sound (west side)	9
Howe sound (east side)	24
Indian river	116
Half-moon bay	2
Capilano	2
Cheakamus and Pacific Great Eastern Railway	17
Bargain harbour	1
Jervis inlet (west side)	27
Jervis inlet (east side)	19
Gambier island	8
Seymour creek	16
Cypress creek	5
Mamquam river	1
Narrows arm	1
Staamus river	2
Mount Wrottesley	17
Total	278

The Britannia Mining and Smelting Company, Limited, having extended its operations to the Indian River district, accounts for the large number of claims located there.

Jervis Inlet district is being prospected to quite an extent, and the owners of the groups already located are keeping their claims in good standing.

The Red Jacket Development Company states that owing to the high price of labour and supplies the work was confined chiefly to prospecting and assessment work. The work done on the *Red Jacket* group proved the existence of a higher grade of ore than was previously known to exist, and, judging from the surface indications, it is expected that the vein will prove to be from 20 to 50 feet wide. The company intends to diamond-drill the property extensively during the coming season.

The Baramba Mining Company has kept its claims in good standing, but owing to war conditions very little other development-work has been done.

The *Alta Lake* group of claims, situated near Mons, has had a spur built in from the main line of the Pacific Great Eastern Railway and had about twenty men employed for a time getting out bog-iron ore. Mr. Thompson, one of the owners, states that the company has shipped about 900 tons of dry bog-iron ore (equal to about 1,200 wet tons) to the Irondale smelter at Port Townsend. This shipment gave an average of 46 per cent. metallic iron. The shipment was sent for experimental purposes and was used with magnetite ore and mill-sinter. After the working by steam-shovel was stopped and the work done by hand-labour, the percentage of iron increased from 43 to 49 per cent. The company is now in a position to ship up to 150 tons a day.

E. J. Donohue, secretary-treasurer of the *Britannia* mines, has given me the following information concerning the company's operations for the year ending December 31st, 1918. He states:—

"On account of the delay in receipt of settlement sheets from the smelter, final figures covering production are not yet available, but the year's results are contained in the following approximations:—

	Tons.
Ore mined	731,000
Ore transported	729,000
Ore milled	730,000
"The ore milled produced:—	
Copper	18,250,000 lb.
Gold	3,040 oz.
Silver	98,100 oz.
"Classification of the development-work done in the mine appears below:—	
Drifts	9,837 Feet.
Crosscuts	4,427
Raises	8,754
Chutes	1,541
Winzes	36

Total 24,595

"In the Fairview mine drifts have been extended on previously developed veins, as well as on new ones opened to the south, on which we have commenced stoping operations.

"The outside glory-holes were worked during the open season, approximately seven months, the ore being broken on the top of the mountain into large transfer rock-chutes, from whence it is delivered to the underground crushers with but one handling.

"More extensive operations were carried on in the *Bluff* mine to the west and the *Empress* mine to the east of the *Fairview*, and two drifts were driven west on the *Jane* mine 1,200-foot level, developing this ore-body 200 feet below previous working-level.

"We completed during the past year another connection through *Britannia* mountain, this being on the 600-foot level, and making the fourth level to have portals on the north and south side of the mountain. The 1,200- and 1,600-foot levels are now being driven for connection, and this work will be completed during 1919.

"The *Victoria* tunnel, 8 x 8 feet, to the east of the *Empress* workings at the elevation of the 1,800-foot level, has been advanced 400 feet, prospecting the extension of the veins in that section of the property.

"The *Hillside* tunnel, 8 x 8 feet, is being driven at a point west of the *Jane* mine at the elevation of the 1,000-foot level. This advanced approximately 200 feet.

"The 4,100-foot level tunnel is now in a distance of 4,220 feet, showing an advance for the year of 1,735 feet. A raise has been started at the face of this tunnel and advanced a distance of 100 feet. It is the intention to continue this raise to the 3,100-foot level, a distance of 1,130 feet, and from there to the 2,700-foot level, 370 feet. The raise is being driven on a 65-degree slope, its dimensions being 7 x 12 feet.

"The 3,100-foot level east drift advanced 659 feet. From this drift another drift 260 feet long was driven to the location of the proposed raise to the *Armour* crosscut, known as the 2,700-foot level, at the west end of our electric transportation system. The *Armour* crosscut was advanced 502 feet.

"Under the proposed system of tunnels and raises, the mine ore will be handled from the 2,700- to the 4,100-foot level by gravity; thence by railway to the mill, a distance of approximately 5,000 feet, thus eliminating outside haulage and consequent interference by snow.

"In connection with the water developments in *South valley*, the *Harp* tunnel, 5 x 6.5 feet, was driven 811 feet to completion, the total length being 2,246 feet.

"In order to prospect new territory and prove the extension of known ore-bodies, considerable diamond-drilling was done during the period under review, footages covering which work are as follows:—

	Feet.
Fairview mine	15,062
Empress mine	4,897
Bluff mine	2,404
Jane mine	2,071
3,100-foot tunnel	690
2,700-foot tunnel	1,558
Total	26,682

"Four additional Westinghouse 3½-ton storage-battery mine locomotives were placed in service during the year, making a total of twelve of this type of locomotive now in operation in the mine, in addition to one 6-ton General Electric trolley locomotive and two 3½-ton Westinghouse trolley locomotives.

"We also added to our mine-haulage equipment fifty-four 2-ton automatic side-dump cars, this making a total of 150 cars of this type. In addition to this, twenty cars of the same size and type, but of 3-foot gauge, were purchased for handling ore broken on the 2,200-foot level and for service in tunnels outside of the mine proper.

"To supplement our equipment on the outside electric-haulage system, we placed in service one 40-ton General Electric locomotive and one 8-ton, making the present equipment in this service: One 40-ton locomotive (electric trolley); four 15-ton locomotives (electric trolley); one 8-ton locomotive (electric trolley); ten 20-ton bottom-dump cars; twelve 20-ton side-dump cars; two flat cars.

"One 8-room dwelling-house was erected at the Townsite camp, replacing similar structure destroyed by fire earlier in the year. We also constructed a concrete root-house, the outside dimensions being 38 x 30 feet, with inside height of 9 feet, to provide accommodation for vegetables, etc., at the Tunnel boarding-house.

"Considerable development-work in the nature of diamond-drilling and tunnels was done on our Indian River District purchases, and this work is being vigorously carried on at the present time.

"In conclusion, would add that our operation was seriously interfered with during the months of October and November on account of the Spanish influenza epidemic."

C. M. Oliver, secretary of the Bowena Copper Mines, Limited, states:—

"During the early part of the year 1918 no development-work was done at the *Bowena* mine, Bowen island. In July the property was leased for a term of five years to C. W. Tipping, the lessee to erect a concentrating plant of at least 100 tons a day capacity. Mr. Tipping has had the building completed and in readiness for the reception of the machinery since October, and expects to have plant installed and in operation by March 1st. In the meantime a dam has been built to increase the water-supply for camp and mill purposes; an electric-lighting plant is being installed and ore blocked out in preparation for milling operations."

The *Bulliondale* group of claims, situated on the westerly side of *Indian* river and adjoining the *Belle* group, has been Crown-granted this year by the owner, Robt. Mungall, of Vancouver.

The *Belle* group, owned by Herres & Habrich, of Squamish, has been kept in good standing, the owners continuing the tunnel on the *Irish Molly* claim for the group.

A large number of transfers have been made of other claims in the Indian River district, and the fact that the new owners wished to test out these properties is to some extent responsible for the large number of certificates of work issued in excess of previous years.

The Lynn Creek Zinc Mines Company, Limited, has done the necessary assessment-work on its claims not yet Crown-granted, and are preparing to Crown-grant them all shortly.

On Potato creek, Jervis Inlet, nine placer leases were issued to L. F. Green, of Vancouver, and his associates. Four of these leases have been assigned to the Four-twenty Gold Bar Placer Mining Company, Limited. All of these leases were consolidated and development-work recorded for the same.

The following is a statement of work done in this office during the year, and the revenue received shows an advance of \$3,356.35 over the previous year:—

OFFICE STATISTICS—VANCOUVER MINING DIVISION.

Free miners' certificates issued	1,799
Special free miners' certificates issued	15
Company free miners' certificates issued	43
Claims recorded	278
Abandonments recorded	25
Certificates of work issued	856
Surveys recorded as work	35
Receipts issued for money in lieu of work	34
Notices filed	79
Conveyances recorded	146
Certificates of improvement recorded	68
Powers of attorney recorded	15
Placer leases issued	9
Placer conveyances recorded	8
Crown grants applied for	68

Revenue.

Free miners' certificates	\$10,741 70
Mining receipts	8,971 25
Total	\$19,712 95

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 1918:—

The list below gives the number and vicinities of claims recorded in this Division during the past year:—

Chilliwick lake	9
Harrison lake	26
Sumas lake	6
Chilliwick river	4
Jones lake	3
Stave river	6
Pitt lake	30
Total	84

As will be seen by the accompanying office statistics, the mining industry has not shown much activity during the past year; in fact, in almost every case the statistics show a decrease of business done.

The operations were confined to annual assessment-work only, with the exception of the *Lucky Four* group, on which sufficient work was done to enable the owners thereof to obtain certificates of improvement on the group, consisting of twelve claims. As the New Westminster Mining Division is included within the Western Mineral Survey District, and the Resident Engineer, W. M. Brewer, is making a report thereon, I assume it is unnecessary for me to enter into particulars.



Cheam Range, Highest Peak.



Cheam Summit, New Westminster M.D.

OFFICE STATISTICS—NEW WESTMINSTER MINING DIVISION.

Free miners' certificates issued (individual)	130
Free miners' certificates issued (company)	1
Free miners' certificates issued (special)	1
Mineral claims recorded	84
Certificates of work issued	97
Conveyances, etc., recorded	9
Grouping notices filed	9
Receipts issued for money in lieu of work	5

Revenue.

Free miners' certificates	\$ 693 00
Mining receipts	1,138 85
Total	<u>\$1,831 85</u>

INSPECTION OF MINES.

REPORT OF GEORGE WILKINSON, CHIEF INSPECTOR.

I have the honour to submit my second annual report as Chief Inspector of Coal and Metalliferous Mines covering the year ending December 31st, 1918.

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.

Geo. Wilkinson	Chief Inspector, Victoria.
James McGregor	Inspector, Nelson District.
H. H. Johnstone	Temporary Inspector, Nelson.
Robert Strachan	Senior District Inspector, Fernie.
Wm. Lancaster	Inspector, Fernie District.
John Newton	Inspector, Nanaimo District.
Henry Devlin	Inspector, Nanaimo District.
J. H. McMillan	Inspector, Prince Rupert District.

Instructors, Mine-rescue Stations.

John D. Stewart	Instructor, Mine-rescue Station, Nanaimo.
J. T. Puckey	Instructor, Mine-rescue Station, Fernie.
John Thomson	Instructor, Mine-rescue Station, Cumberland.

Organizer and Instructor, First Aid.

Dudley Michell	Instructor, Victoria.
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CHANGES IN THE INSPECTION STAFF DURING THE YEAR 1918.

There have been no changes in the inspection staff during the year. The vacancy in the Nicola-Princeton District made by the transfer of Robert Strachan to the Crowsnest Pass District has not yet been filled. The coal-mines in the Nicola-Princeton District have been inspected during the year alternately by Inspectors Newton, Strachan, and Lancaster, and the metalliferous mines by Inspector McGregor.

At the end of August Charles O'Brien resigned his position as Instructor at the Fernie Mine-rescue Station, and J. T. Puckey was appointed to fill the vacancy.

TONNAGE OF COAL PRODUCED.

The total gross tonnage produced by the coal-mines of the Province for the year ending December 31st, 1918, was 2,578,724 long tons, an increase of 180,009 long tons over the production of 1917.

The output would have been considerably larger had not the production been cut down by the following causes: On September 4th a strike was called at the mines of the Crows' Nest Pass Coal Company demanding a single shift, the demand being based on alleged dangerous conditions in the mines due to working two shifts. The strike lasted five weeks; then the mines were ordered opened by Commissioner Armstrong on a single-shift system, pending an investigation into mining conditions by a Royal Commission to be appointed by the Hon. the Minister of Mines, who will report on conditions and determine if any, or all, of the mines should be worked on the single-shift system. The ravages of the influenza epidemic were responsible for a large loss in

output. The East Wellington mine was closed down for the first eight months of the year on account of a fire in the workings. There was also a serious shortage of labour. With the exception of Vancouver Island District, all the others showed an increase.

The Vancouver Island collieries had a decrease in their production from 1,695,721 tons in 1917 to 1,666,211 tons in 1918, a decrease of 29,510 tons.

The Nicola-Princeton District increased its production from 151,243 tons in 1917 to 179,179 tons in 1918, an increase of 27,936 tons.

The Crowsnest Pass collieries increased their production from 551,751 tons in 1917 to 732,864 tons in 1918, an increase of 181,113 tons.

A new mine opened at Telkwa, in the Northern Inspection District, produced 470 tons during 1918.

ACCIDENTS IN COAL-MINES.

The fatalities in and around the coal-mines during the year totalled twenty-eight, of which number sixteen were killed in one accident caused by the breaking of an hoisting-cable on Protection shaft on the morning of September 10th, 1918, which is dealt with in a separate report.

The other fatal accidents which occurred during the year totalled twelve, and were from various causes.

There were 5,427 persons employed in and around the coal-mines.

The ratio of fatal accidents per 1,000 persons employed was 5.159, compared with 8.51 for 1917 and 5.53 for 1916. The ratio for the last ten-year period was 5.089.

The following table shows the collieries at which fatal accidents occurred during 1918, and their relation to accidents which occurred at the colliery for 1917:—

Name of Company.	Name of Colliery.	1918.	1917.
Canadian Collieries (D.), Ltd.	Comox Colliery	2	8
Canadian Collieries (D.), Ltd.	Extension Colliery	1	..
Canadian Western Fuel Co.	Nanaimo Colliery	18	1
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	..	..
Merritt Collieries, Ltd.	Merritt Colliery	..	..
The Fleming Coal Co.	Coal Hill Colliery	2	..
Princeton Coal & Land Co.	Princeton Colliery	..	..
Coalmont Collieries	Coalmont Colliery	..	..
Crow's Nest Pass Coal Co.	Coal Creek Colliery	2	34
Crow's Nest Pass Coal Co.	Michel Colliery	3	1
Corbin Coal & Coke Co.	Corbin Colliery	..	..
Telkwa Collieries	Telkwa Colliery	..	..
Totals		28	44

The following table shows the various causes of fatal accidents and their percentage of the whole, with corresponding figures for the previous year:—

Cause.	1918.		1917.	
	No.	Per Cent.	No.	Per Cent.
Fall of rock	6	21.428	3	6.818
Fall of coal	1	3.572	..	..
Haulage	4	14.286	2	4.545
Explosion (none), rope breaking, and cage falling in shaft	16	57.143	38	86.364
Falling timber	1	3.571	..	..
Miscellaneous (electrocution)	..	..	1	2.273
Totals	26	100.000	44	100.000

The following table shows the number of tons of coal mined for each fatal accident in their respective classes in the years 1918 and 1917:—

Cause.	1918.		1917.	
	No. of Fatal Accidents.	No. Tons mined per Fatal Accident.	No. of Fatal Accidents.	No. Tons mined per Fatal Accident.
Fall of rock	6	429,687	3	799,572
Fall of coal	1	2,578,724	..	.....
Haulage	4	644,681	2	1,199,357
Explosion .....	..	.....	..	.....
Rope breaking and cage falling down shaft	16	161,170	38	60,493
Falling timber	1	2,578,724	..	.....
Miscellaneous .....	..	.....	1	2,398,715

The number of tons of coal mined per fatal accident during 1918 was 92,098, compared with 54,539 tons for 1917 and 76,529 tons for the last ten years.

TONNAGE OF METALLIFEROUS MINES.

The output from the metalliferous mines for 1918 was 2,892,849 tons, being an increase of 131,270 tons over the tonnage for 1917. This tonnage was produced from 175 shipping mines, of which eighty shipped over 100 tons.

ACCIDENTS IN METALLIFEROUS MINES.

There were twelve fatal accidents in and around the metal-mines during the year, causing the death of twelve persons, being a decrease of three in number of accidents and a decrease of five in number of fatalities compared with the figures of 1917.

There were 4,390 persons employed in and around the metalliferous mines, a decrease of 1,098 persons compared with the figures of 1917.

The ratio of fatal accidents per 1,000 persons employed was 3.66, compared with 3.23 for 1917. The ratio for the last ten-year period was 3.899.

The mines at which the fatalities occurred are:—

Mining Division	Mine.	No. of Accidents.
Nass River	Anyox	4
Similkameen	Copper Mountain	1
Greenwood	Motherlode	2
Greenwood	Granby	1
Ainsworth	Florence	1
Trail Creek	Le Roi	1
Skeena	Surf Inlet	1
Slocan City	Eastmont	1
Total .....	.....	12

The following table gives the cause and percentage to the whole of the fatal accidents, with corresponding figures for 1917:—

Cause.	1918.		1917.	
	No.	Per Cent.	No.	Per Cent.
Falls of ground	6	50	6	35.294
By falling into chutes, raises, winzes, stopes, etc.	4	33.334	2	11.764
By cage in shaft	1	8.333	1	5.883
By mine-car and haulage	1	8.333	1	5.883
Picking or drilling into unexploded powder	1	8.333	2	11.764
Material falling in shaft	1	8.333	1	5.883
Premature blast	1	8.333	3	17.646
Killed while unloading timber from wagon on surface	1	8.333	1	5.883
Totals	12	100.000	17	100.000

The falls of ground caused six deaths, or 50 per cent. of the whole, which is an increase in percentage of 14.7 over last year, but being the same number of deaths from the same cause.

There were no accidents from the use of explosives during 1918, compared with five fatal accidents from this source during 1917.

Chute accidents caused the loss of four lives, or 33.333 per cent. of the total this year. There is an increase of two deaths over the number for last year, but an increase in percentage of 21.569.

Falling material in shafts was the cause of one death, being the same number of lives as last year, but an increase in percentage of 2.45. There were no accidents in shafts from any other cause.

During the year the production of minerals was greater in tons than 1917.

There was a general scarcity in labour, and that obtainable generally was less experienced than usual, considerably increasing the risk of accidents.

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 Permitite	"	
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. 7	"	"
Viking No. 1	"	"

The following table shows the quantity of explosives used in coal-mines during the year 1918, 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 explosives 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	481,562	1,666,211	577,397	3,142	580,539	3.46	0.82
Nicola-Similkameen	35,793	179,179	48,585	450	49,035	5.00	0.72
East Kootenay	18,841	732,864	12,884	2,946	15,830	39.37	1.19
Northern District .....	.....	470	.....	.....	.....	.....	.....
Totals	536,196	2,578,725	638,866	6,538	645,404	4.82	0.83

The production of coal per pound of explosive used is 0.48 tons greater than that of the previous year.

The Crowsnest Pass District showed an increase of 1.01 tons per pound of explosive used, the yield being 39.37 tons, compared with 38.36 tons for 1917.

The Nicola-Princeton District showed a decrease of 0.64 ton per pound of explosive used, the yield being 5 tons, compared with 5.64 tons for 1917.

The Vancouver Island mines showed an increase of 0.15 ton per pound of explosive used, the yield being 3.46 tons, compared with 3.31 for 1917.

MACHINE-MINED COAL.

During the year mining-machines produced 190,887 tons of coal, or 7.4 per cent. of the whole. This is a decrease under the figures of 1917, when the percentage of machine-mined coal was 10.94 per cent.

Of the total machine-mined coal, the Canadian Western Fuel Company produced 91,359 tons, or 47.86 per cent.; the Canadian Collieries (D.), Limited, 57,867 tons, or 30.32 per cent.; the Princeton Coal and Land Company, 38,673 tons, or 20.26 per cent.; and the Crow's Nest Pass Coal Company, 2,988 tons, or 0.0156 per cent.

The following table gives the district, number of machines, how driven, tons of coal produced, and types of machines used:—

District.	NO. DRIVEN BY		TONS OF COAL PRODUCED.		Total in Tons.
	Electricity.	Compressed Air.	Electricity.	Compressed Air.	
Nicola-Similkameen .....	..	5	.....	38,673	38,673
Vancouver Island	5	13	57,867	91,359	149,226
Crowsnest Pass .....	..	3	.....	2,988	2,988
Totals	5	21	57,867	133,020	190,887

Types of Machines in Use.

Type.	DISTRICT.			Totals.
	Crowsnest Pass.	Nicola-Similkameen.	Vancouver Island.	
"Percussive" Post	3	5	8	16
"Bar" Longwall .....	..	..	5	5
"Chain" Longwall .....	..	..	5	5
Totals	3	5	18	26

SAFETY-LAMPS.

There were 4,364 safety-lamps in use in the coal-mines of the Province, an increase of 188 over the previous year. Of this number, 1,699 were flame-lamps of the Wolf type and 2,665 were electric lamps of various makes, an increase of 1,107 of this latter type of lamp during the year.

The following table shows the distribution of lamps by districts, methods of locking, and the illuminant used:—

District.	Magnetic.	Screw or Automatic Clip.	Naphtha.	Electricity.
East Kootenay	140	1,015	140	1,015
Nicola-Similkameen.....	168	125	168	125
Vancouver Island	1,391	1,525	1,391	1,525
Totals	1,699	2,665	1,699	2,665

MINE-AIR SAMPLING IN COAL-MINES.

During the year 510 mine-air samples were taken in the coal-mines of the Province. Of this number, thirty-nine samples were spoiled in transit, accidents in laboratory, or by reason of incomplete records.

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. A great deal of sampling has been done in the mines operated by the Crow's Nest Pass Coal Company to determine the gas-flow, and also to determine what bearing the breaking of coal has on the gas-flow of these mines. It is claimed by the officials of the Miners' Union and the men that the adoption of a single-shift system would lower the gas-flow in these mines. During the months of April, May, and June, 1917, when the mines were idle in the Crowsnest Pass District, mine-air samples were taken regularly each month to determine the gas-flow while no coal was being mined. The results obtained were astonishing; in some cases the flow of gas was as large at the end of seventy days as when the mine was working, proving that the outflow of gas does not depend on the breaking of the coal alone, but is constantly being given off by the exposed surface of the coal and strata.

During 1918 some very interesting results were obtained by sampling in the Crowsnest Pass mines during the idle period in September, and also by sampling every two hours during a working day of twenty-four hours and every half-hour during a working-shift of eight hours.

The following are percentages found in samples taken during idle period in September in No. 1 East mine, Coal Creek Colliery, and for nine days after starting to work again:—

South Side Split.—It is to be regretted that a sample was not taken in this split the day before the mines were closed down. One taken on August 9th, 2.34 per cent.; July 3rd, 1.82 per cent.; June 18th, 1.86 per cent.

Mine idle	45 hours	1.82 per cent. of methane.
"	67 "	1.77 "
"	71 "	1.80 "
"	115 "	1.64 "
"	119 "	1.70 "
"	121 "	1.68 "
"	141 "	1.54 "
"	165 "	1.55 "
"	9 days	1.57 "
"	9 "	1.52 "
"	10 "	1.33 "
"	12 "	1.73 "
"	13 "	1.61 "
"	14 "	1.62 "
"	15 "	1.64 "
"	16 "	1.63 "

Mine idle 17 days	1.65	per cent. of methane.
" 19 "	1.61	" "
" 23 "	1.45	" "
" 26 "	1.57	" "
" 28 "	1.50	" "
" 30 "	1.52	" "
Mine working again 1 day	1.48	" "
" 2 "	1.43	" "
" 3 "	1.61	" "
" 7 "	1.62	" "
" 8 "	1.66	" "
" 9 "	1.66	" "

The following are percentages found in samples taken during the idle period in September in No. 1 South mine and for nine days after starting work again:—

Main return airway idle 10 days	1.24	per cent. of methane.
" 12 "	1.14	" "
" 13 "	1.31	" "
" 15 "	1.43	" "
" 16 "	1.52	" "
" 17 "	1.40	" "
" 19 "	1.62	" "
" 31 "	1.46	" "
Main return airway working again 2 days	1.11	" "
" 3 "	1.25	" "
" 4 "	1.41	" "
" 5 "	1.19	" "
" 8 "	1.30	" "
" 9 "	1.35	" "

The chart on page 331 shows the quantity of air passing when the various tests were made. In No. 1 South mine there is an increase of 0.22 per cent. in twenty-one days with the mine idle, and the same quantity of air passing, and a decrease is shown when the mine is operating again during the first nine days with the same quantity of air passing.

The following are percentages found in samples taken in the last working-place on the South side split, No. 1 East mine, Coal Creek Colliery, every two hours during working-hours, from 9 a.m. until 7 a.m. on April 25th and 26th, 1918:—

9 a.m.	2.02	per cent. of methane.
11 "	2.14	" "
1 p.m.	2.29	" "
3 "	2.26	" "
5 "	2.26	" "
7 "	2.20	" "
9 "	2.20	" "
11 p.m. (spoiled).		
1 a.m.	2.21	" "
3 "	2.21	" "
5 "	2.13	" "
7 "	2.08	" "

The following are percentages found in samples taken every half-hour in No. 6 incline, No. 3 mine, Coal Creek Colliery, on June 1st, 1918:—

9.30 a.m.	0.79	per cent. of methane.
10.00 "	0.72	" "
10.30 "	0.74	" "
11.00 "	0.85	" "
11.30 "	0.83	" "
12.00 noon	0.86	" "
12.30 p.m.	1.09	" "
1.00 "	1.13	" "

1.30 p.m.	1.25 per cent. of methane.
2.00 "	1.11 " "
2.30 "	1.03 " "
3.00 "	1.12 " "
3.30 "	1.23 " "

The following are percentages found in samples taken every half-hour in the same place on June 6th, 1918:—

9.30 a.m.	0.75 per cent. of methane.
10.00 "	0.88 " "
10.30 " (spoiled).	
11.00 "	1.03 " "
11.30 "	1.11 " "
12.00 noon	1.06 " "
12.30 p.m.	1.16 " "
1.00 "	1.14 " "
1.30 "	1.26 " "
2.00 "	1.29 " "
2.30 "	1.26 " "
3.00 " (spoiled).	
3.30 " (spoiled).	

From the results obtained it would appear that the breaking of coal has not much bearing on the gas-flow in these mines, and from the results shown in the returns from samples taken every two hours it is apparent that the conditions are not changed much by the working of two shifts, the maximum raise at any time during the twenty-four hours being less than $\frac{3}{10}$ of 1 per cent.; while samples taken every half-hour in No. 3 mine showed a maximum raise of a little over $\frac{1}{2}$ per cent.

There is no doubt that a single shift inaugurated in some of the Crowsnest Pass mines would have very beneficial results on the dust conditions, and in any mine have beneficial results for the prevention of accidents due to other causes at the working-faces.

The following table shows the tabulated data obtained from the mine-air sampling in coal-mines during 1918:—

RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS COAL-MINES OF THE PROVINCE OF BRITISH COLUMBIA DURING THE YEAR 1918.

Coast District.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine 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 ₂ .	O.	CH ₄ .	N.				Dry Bulb.	Wet Bulb.	Humidity.				
82	Feb. 11	Extension No. 1	East side split	Working	170	120	0.34	20.47	0.06	79.13	185	11,100	29.1	55	55	100	6.0	8,640	878	72
96	Mar. 9	"	"	"	176	120	0.31	20.45	0.07	79.17	300	12,000	28.9	55	55	100	8.8	11,520	498	96
118	April 11	"	"	"	160	90	0.34	20.36	0.12	79.19	90	6,480	29.5	57	55	88	7.6	10,944	468	121
142	May 8	"	"	"	160	100	0.37	20.36	0.11	79.19	110	6,000	29.5	56	56	100	7.0	10,080	431	100
205	Nov. 19	"	"	"	175	120	0.36	20.39	0.12	79.23	100	4,800	29.5	57	56	98	5.7	8,208	351	68
83	Feb. 11	"	West side split	"	170	50	0.32	20.43	0.12	79.18	230	11,600	29.1	56	56	100	13.0	18,720	801	374
97	Mar. 9	"	"	"	178	66	0.34	20.42	0.19	79.05	250	12,500	28.9	54	53	98	23.0	33,120	1,417	591
119	April 11	"	"	"	160	70	0.30	20.40	0.16	79.14	180	9,720	29.5	58	55	93	15.4	22,176	949	316
143	May 9	"	"	"	160	90	0.28	20.37	0.19	79.13	120	6,000	29.5	54	54	100	12.0	17,280	739	288
206	Nov. 19	"	"	"	170	55	0.35	20.40	0.10	79.15	600	10,000	29.5	55	55	100	10.0	14,400	616	261
84	Feb. 11	"	Main return airway	"	175	55	0.33	20.45	0.07	79.15	570	31,350	29.1	54	54	100	21.0	80,240	1,294	177
98	Mar. 9	"	"	"	170	55	0.33	20.44	0.09	79.14	550	30,800	28.9	55	55	100	27.0	88,880	1,664	220
120	April 11	"	"	"	160	55	0.38	20.34	0.11	79.17	500	32,000	29.5	55	54	93	35.0	50,400	2,157	315
141	May 8	"	"	"	160	55	0.35	20.17	0.11	79.39	563	33,800	29.5	55	55	100	37.0	52,280	2,280	333
207	Nov. 19	"	"	"	175	55	0.36	20.35	0.09	79.20	600	27,600	29.5	56	56	100	24.0	34,560	1,479	197
78	Feb. 9	Extension No. 2	No. 2 East split	"	215	54	0.57	19.65	0.09	79.69	200	6,000	29.1	59	58	93	5.0	7,200	308	374
93	Mar. 8	"	"	"	274	71	0.48	19.84	0.08	79.60	220	6,000	28.8	58	58	100	5.0	7,200	308	101
114	April 11	"	"	"	300	85	0.52	19.61	0.14	79.73	300	7,500	29.5	68	58	100	10.5	15,120	647	177
144	May 8	"	"	"	290	84	0.59	19.44	0.17	79.80	250	6,750	29.5	60	60	100	11.0	15,840	677	188
208	Nov. 19	"	"	"	312	104	0.50	19.72	0.07	79.71	300	6,000	29.5	60	58	87	4.2	6,048	253	58
80	Feb. 9	"	No. 4 East split	"	215	78	0.44	20.16	0.08	79.37	300	13,500	29.1	58	56	87	4.0	6,760	246	73
94	Mar. 8	"	"	"	274	110	0.47	20.10	0.04	79.39	260	13,000	28.8	50	55	93	5.0	7,200	308	65
116	April 11	"	"	"	300	110	0.45	20.03	0.04	79.48	400	11,500	29.4	60	58	87	4.6	6,024	283	80
146	May 8	"	"	"	290	106	0.45	20.04	0.04	79.47	238	10,000	29.4	58	58	100	4.0	5,760	246	...
210	Nov. 19	"	"	"	312	118	0.34	20.25	...	79.41	1,750	10,500	29.4	59	58	93	...	...	...	...
79	Feb. 9	"	West side split	"	215	83	0.52	19.64	0.29	79.55	250	10,000	29.1	65	65	100	29.0	41,760	1,787	503
92	Mar. 8	"	"	"	274	92	0.64	19.31	0.31	79.74	210	8,400	28.8	65	64	93	26.0	37,440	1,602	407
115	April 11	"	"	"	300	104	0.67	19.57	0.27	79.50	340	9,000	29.5	65	64	93	24.0	34,560	1,479	332
145	May 8	"	"	"	290	100	0.65	19.29	0.31	79.75	228	8,200	29.5	66	65	93	25.0	36,000	1,540	360
209	Nov. 19	"	"	"	312	90	0.46	19.94	0.05	79.55	480	27,990	29.4	59	58	93	18.0	18,720	801	208
81	Feb. 9	"	Main return airway	"	215	...	0.43	19.98	0.11	79.48	460	27,000	29.1	59	59	100	29.0	41,760	1,787	194
95	Mar. 8	"	"	"	274	...	0.38	20.05	0.10	79.47	470	28,200	28.8	57	57	100	23.0	40,320	1,725	147
117	April 11	"	"	"	300	...	0.40	20.01	0.11	79.43	500	27,500	29.5	57	57	100	30.0	43,200	1,848	144
147	May 8	"	"	"	290	...	0.39	20.05	0.10	79.46	470	43,000	29.4	58	58	100	43.0	61,920	2,650	213
201	Nov. 19	"	"	"	312	...	0.33	20.22	0.03	79.42	1,000	35,000	29.4	56	55	93	10.0	14,400	616	46
89	Mar. 7	Extension No. 3	No. 1 split	"	350	205	0.89	19.22	0.32	79.71	350	14,000	29.1	61	60	93	44.0	63,360	2,711	309
122	April 12	"	"	"	350	177	0.58	19.58	0.31	79.55	290	12,150	29.3	62	60	88	37.0	53,280	2,280	301
148	May 9	"	"	"	350	165	0.41	19.83	0.24	79.52	280	14,800	29.4	61	59	88	35.0	50,400	2,157	305
212	Nov. 19	"	"	"	350	200	0.42	19.81	0.23	79.54	270	13,500	29.4	61	60	93	31.0	44,640	1,910	223
75	Feb. 8	"	No. 2 split	"	350	145	0.15	20.49	0.20	79.16	260	10,400	29.2	59	58	93	20.0	28,800	1,232	198
90	Mar. 7	"	"	"	350	145	0.10	20.59	0.23	79.08	200	10,000	29.1	56	55	93	23.0	33,120	1,417	228
121	April 12	"	"	"	350	173	0.09	20.63	0.22	79.06	120	7,200	29.3	57	56	93	15.8	22,652	969	130
149	May 8	"	"	"	350	185	0.13	20.40	0.27	79.11	125	7,500	29.5	53	52	93	20.0	28,800	1,232	155
213	Nov. 19	"	"	"	350	150	0.07	20.67	0.18	79.08	200	10,000	29.4	59	58	93	18.0	25,920	1,109	172
77	Feb. 8	"	Main return airway	"	350	...	0.40	20.01	0.17	79.42	500	55,000	29.2	59	59	100	42.0	60,480	2,588	172
91	Mar. 7	"	"	"	350	...	0.41	20.05	0.18	79.36	550	27,500	29.1	59	59	100	49.0	70,560	3,019	201
123	April 12	"	"	"	350	...	0.36	20.13	0.19	79.32	520	20,800	29.1	59	58	93	39.0	56,160	2,403	160
150	May 8	"	"	"	350	...	0.39	19.89	0.21	79.51	610	20,400	29.4	60	59	93	42.0	60,480	2,588	172

214	Nov. 19	Extension No. 3	Main return airway	Working	350	0.35	20.11	0.11	79.43	250	30,000	29.4	60	59	93	33.0	47,520	2,083	135	
205	Nov. 19	S. Wellington No. 5	"	"	175	0.02	20.86	0.11	79.12	900	64,000	30.1	47	47	100					
85	Feb. 20	Comox No. 4	No. 1 slope	"	780	350	0.16	19.23	1.29	78.87	450	22,500	29.5	60	60	100	290.0	417,600	17,873	1,193
101	Mar. 18	"	"	"	800	350	0.78	18.99	1.63	78.66	400	20,000	29.8	60	60	100	326.0	469,440	20,092	1,341
127	April 20	"	"	"	750	350	0.69	19.09	1.50	78.72	420	21,000	30.4	61	61	100	315.0	453,600	19,414	1,296
158	May 28	"	"	"	800	350	0.68	19.16	1.49	78.68	430	19,350	30.1	61	61	100	287.0	413,280	17,688	1,131
162	July 21	"	"	Idle 40 hours	800	350	0.67	19.12	1.57	78.64	350	17,500	30.0	62	61	93	274.0	394,560	16,887	1,127
173	Aug. 30	"	"	Working	800	350	0.65	19.13	1.67	78.55	310	15,500	30.7	62	61	93	258.0	371,520	15,901	1,061
197	Nov. 6	"	"	"	800	350	0.55	19.37	1.50	78.58	315	15,750	30.1	61	61	100	235.0	338,400	14,483	967
220	Dec. 10	"	"	"	800	350	0.60	19.38	1.48	78.54	350	11,500	30.5	55	54	93	170.0	244,800	10,477	699
86	Feb. 23	"	East side, No. 2 slope	"	780	286	0.45	19.74	1.54	78.27	550	16,500	29.2	66	65	93	254.0	365,760	15,654	1,278
96	Mar. 18	"	"	"	800	300	0.45	20.15	1.83	77.57	725	32,825	29.9	65	65	100	586.0	858,240	36,738	2,860
124	April 20	"	"	"	800	250	0.43	19.67	1.59	78.31	760	27,360	30.5	65	65	100	434.0	624,960	26,748	2,499
156	May 28	"	"	"	800	250	0.44	19.50	1.76	78.30	900	27,000	30.2	67	67	100	475.0	684,000	29,275	2,786
160	July 21	"	"	Idle 40 hours	800	250	0.50	19.33	1.94	78.23	750	22,500	30.2	67	66	93	436.0	627,840	26,371	2,511
169	Aug. 30	"	"	Working	800	250	0.50	19.29	2.23	77.98	750	22,500	30.9	67	66	93	501.0	721,440	30,877	2,835
179	Oct. 2	"	"	"	800	250	0.58	19.23	2.27	77.92	725	21,750	30.1	69	68	94	492.0	708,480	30,322	2,834
221	Dec. 11	"	"	"	800	250	0.39	19.77	1.51	78.33	750	28,500	30.6	55	66	100	430.0	619,200	26,501	2,476
87	Feb. 23	"	West side, No. 2 slope	"	780	144	0.43	19.61	1.16	78.80	380	10,800	29.2	62	61	93	125.0	180,000	7,604	1,250
100	Mar. 18	"	"	"	800	150	0.29	20.03	0.75	78.63	440	13,200	30.0	64	60	76	99.0	142,560	6,101	950
125	April 20	"	"	"	800	200	0.34	19.89	0.93	78.84	620	15,500	30.6	65	62	76	144.0	207,360	8,875	1,382
157	May 28	"	"	"	800	200	0.27	19.90	1.07	78.76	750	15,000	30.2	65	63	88	160.0	230,400	9,871	1,152
161	July 21	"	"	Idle 40 hours	800	200	0.33	19.69	1.43	78.55	750	18,750	30.2	65	63	88	267.0	384,480	16,455	1,922
171	Aug. 30	"	"	Working	800	200	0.40	19.47	2.17	77.96	420	12,600	31.0	65	64	84	273.0	393,120	16,825	1,065
180	Oct. 2	"	"	"	800	200	0.34	19.57	1.88	78.21	310	13,020	30.2	64	63	93	244.0	351,360	15,038	1,756
196	Nov. 6	"	"	"	800	200	0.43	19.33	1.93	78.96	300	10,500	30.2	64	62	88	202.0	290,880	12,449	1,454
223	Dec. 11	"	"	"	800	200	0.62	18.99	2.34	78.05	406	10,800	30.7	64	62	88	252.0	362,880	15,531	1,814
88	Feb. 23	"	Main return airway	"	780	0.54	19.64	0.84	79.03	2,000	168,000	29.2	59	58	93	1,411.0	2,031,840	86,962	2,604	
128	April 20	"	"	"	750	0.55	19.56	0.79	79.10	1,640	127,920	29.9	58	58	100	1,010.0	1,454,400	62,248	1,939	
159	May 28	"	"	"	800	0.62	19.49	0.88	79.11	2,000	140,000	27.6	52	51	93	1,232.0	1,774,080	75,930	2,217	
163	July 21	"	"	Idle 40 hours	800	0.64	19.19	1.10	79.07	1,600	136,000	29.8	52	61	93	1,496.0	2,154,240	92,201	2,692	
168	Aug. 30	"	"	Working	800	0.69	19.07	1.28	78.96	1,430	107,250	30.2	61	60	93	1,372.0	1,975,680	84,559	2,469	
182	Oct. 2	"	"	"	800	0.67	19.12	1.18	79.03	1,500	130,000	29.0	61	61	100	1,416.0	2,039,040	87,270	2,548	
198	Nov. 6	"	"	"	800	0.62	19.36	0.95	79.07	1,460	131,400	29.5	59	59	100	1,248.0	1,797,120	76,916	2,246	
224	Dec. 11	"	"	"	800	0.55	19.56	0.88	79.01	1,880	112,200	30.0	54	54	100	967.0	1,421,280	60,830	1,778	
103	Mar. 19	Comox No. 5	West side, No. 1 dip	"	750	100	0.08	20.64	0.42	78.86	1,950	11,700	29.4	61	60	93	49.0	70,560	3,019	750
136	April 23	"	"	"	850	100	0.08	20.65	0.51	78.98	2,425	14,550	29.6	50	50	100	45.0	64,800	2,773	648
154	May 27	"	"	"	900	100	0.08	20.67	0.19	79.00	575	25,375	29.8	50	49	93	49.0	70,560	3,019	705
177	Aug. 31	"	"	"	800	45	0.05	20.68	0.22	79.05	325	13,000	29.5	52	52	100	28.0	40,320	1,725	806
199	Nov. 8	"	"	"	800	45	0.05	20.76	0.18	79.01	270	11,340	29.3	51	51	100	20.0	28,800	1,232	640
104	Mar. 19	"	East side, No. 1 dip	"	750	250	0.08	20.65	0.41	78.86	240	17,280	29.4	52	51	93	70.0	100,800	4,314	403
137	April 24	"	"	"	850	300	0.10	20.54	0.58	78.78	235	18,330	29.6	52	51	93	106.0	152,640	6,532	508
153	May 27	"	"	"	900	350	0.09	20.56	0.52	78.83	210	15,120	29.8	53	53	100	78.0	112,320	4,807	320
176	Aug. 31	"	"	"	800	355	0.12	20.40	0.79	78.69	240	14,400	29.5	55	54	93	113.0	162,720	6,964	458
200	Nov. 8	"	"	"	800	355	0.11	20.43	0.49	78.94	400	22,400	29.8	54	54	100	105.0	151,200	6,471	425
105	Mar. 19	"	No. 1 dip and incline pillars	"	750	650	0.19	20.31	0.35	79.15	1,460	78,840	29.4	55	55	100	275.0	396,000	16,948	609
135	April 23	"	"	"	850	500	0.14	20.24	0.35	79.27	1,200	64,800	29.6	55	55	100	226.0	325,440	13,928	479
152	May 27	"	"	"	900	550	0.04	20.82	0.02	79.12	1,350	72,900	29.8	55	55	100	14.0	20,160	862	36
175	Aug. 31	"	"	"	800	650	0.15	20.21	0.35	79.29	1,385	69,250	29.4	57	56	93	242.0	348,480	14,904	630
201	Nov. 8	"	No. 2 dip	"	800	200	0.12	20.43	0.24	79.21	100	4,000	29.8	55	54	93	9.0	12,960	554	64
106	Mar. 19	"	West side of shaft	"	750	106	0.12	20.59	0.19	79.10	1,750	14,000	29.4	51	51	100	26.0	37,440	1,602	374
133	April 23	"	"	"	850	250	0.08	20.74	0.11	79.07	1,100	44,000	29.6	49	49	100	48.0	69,120	2,958	276
151	May 27	"	"	"	900	250	0.03	20.69	0.14	79.14	600	27,720	29.3	48	48	100	38.0	54,720	2,342	218
174	Aug. 31	"	"	"	800	250	0.06	20.63	0.12	79.14	1,250	50,000	29.4	62	61	93	60.0	86,400	3,697	344
202	Nov. 8	"	"	"	900	200	0.06	20.81	0.09	79.04	1,275	51,000	29.7	52	51	93	45.0	64,800	2,773	824
107	Mar. 19	"	Main return airway	"	750	*	0.13	20.51	0.23	79.13	1,500	180,000	29.2	51	51	100	414.0	596,160	25,515	794
134	April 23	"	"	"	850	*	0.10	20.52	0.21	79.17	1,430	110,160	29.6	51	51	100	231.0	332,640	14,236	391
178	Aug. 31	"	"	"	800	*	0.11	20.44	0.25	79.20	1,625	162,500	29.3	53	53	100	406.0	584,640	25,022	730
208	Nov. 8	"	"	"	800	*	0.08	20.57	0.17	79.31	2,000	180,000	29.6	53	53	100	306.0	440,640	18,559	550
108	Mar. 20	Comox No. 7	West side split	"	288	165	0.17	20.53	0.29	79.01	245	7,350	30.1	54	53	93	31.0	42,240	1,794	155
129	April 22	"	"	"	300	200	0.12	20.49	0.29	79.10	475	11,400	29.9	54	54	100	33.0	47,520	2,033	237
164	July 22	"	"	"	320	143	0.12	20.46	0.25	79.17	425	8,500	29.8	55	55	100	21.0	30		

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—Continued.
Coast District—Concluded.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or idle.	Tonnage of Mine 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 ₂	O.	CH ₄	N.				Dry Bulb.	Wet Bulb.	Humidity.				
108	Mar. 20	Comox No. 7	No. 1 East	Working	236	38	0.09	20.76	0.08	79.07	Slack.	29.8	49	49	100					
131	April 22	"	"	"	300	60	0.14	20.64	0.13	79.09	430	21,500	29.5	47	47	100	28.0	40,320	1,725	672
136	July 22	"	"	"	320	117	0.12	20.55	0.20	79.13	350	16,500	29.5	49	49	100	33.0	47,520	2,033	408
218	Nov. 22	"	"	"	335	65	0.10	20.71	0.10	79.09	500	22,600	29.7	49	49	100	22.0	31,680	1,355	487
130	April 22	"	No. 2 East	"	300	40	0.05	20.82	Trace.	79.13	280	8,400	29.9	49	48	93				
165	July 22	"	"	"	320	82	0.06	20.82	0.02	79.10	100	1,000	29.7	54	54	100	2.0	288	12	
217	Nov. 22	"	"	"	335	60	0.13	20.73	0.10	78.99	150	6,750	30.1	55	55	100	6.0	8,640	369	
110	Mar. 20	"	Main return airway	"	288		0.11	20.71	0.19	78.99	1,420	99,400	29.5	48	48	100	188.0	270,720	11,586	946
132	April 22	"	"	"	300		0.13	20.62	0.22	79.03	1,320	126,720	29.5	48	48	100	273.0	400,320	17,133	1,334
167	July 22	"	"	"	320		0.15	20.58	0.23	79.04	1,275	127,500	29.5	50	49	93	239.0	421,920	18,058	1,318
219	Nov. 22	"	"	"	335		0.15	20.67	0.18	79.00	2,100	126,000	29.7	43	43	100	226.0	325,440	13,928	971
80	Feb. 19	N. side No. 1, Nanaimo	Newcastle return	"	780	810	0.29	20.35	0.23	79.13	400	16,000	30.2	58	57	93	36.0	51,840	2,218	167
92	Mar. 12	"	"	"	750	380	0.34	20.11	0.30	79.25	300	10,800	30.4	59	59	100	32.0	46,080	1,972	121
117	April 16	"	"	"	720	270	0.30	20.20	0.29	79.21	310	15,500	30.6	64	64	100	45.0	64,800	2,773	240
133	May 9	"	"	"	790	315	0.33	20.00	0.28	79.39	400	14,000	30.5	58	56	88	39.0	56,160	2,403	178
93	Mar. 12	"	Nos. 1 and 2 walls and inclined pillars	"	750	260	0.32	20.14	0.18	79.36	350	35,000	30.5	61	61	100	63.0	90,720	3,882	348
118	April 16	"	"	"	720	410	0.36	20.10	0.34	79.30	360	36,000	30.8	61	61	100	98.0	123,840	5,300	302
134	May 9	"	"	"	790	430	0.37	19.88	0.27	79.48	425	42,500	30.5	62	61	93	114.0	164,160	7,026	381
97	Mar. 13	"	Main return airway	"	800		0.34	20.13	0.18	79.35	1,260	50,400	31.1	58	57	93	90.0	129,600	5,546	162
116	April 16	"	"	"	720		0.34	20.18	0.16	79.32	1,800	45,500	30.6	58	57	93	72.0	108,680	4,437	144
137	May 9	"	"	"	745		0.33	20.13	0.17	79.37	1,150	33,500	30.5	58	58	100	56.0	80,640	3,451	108
86	Jan. 22	South side of No. 1	Sims dip	"	720	400	0.21	20.22	0.35	79.22	300	15,000	30.0	65	64	93	52.5	75,000	3,235	189
89	Feb. 25	"	"	"	550	300	0.19	20.14	0.41	79.26	300	12,000	30.2	65	64	93	49.0	70,560	3,019	235
96	Mar. 13	"	"	"	500	240	0.19	20.16	0.39	79.26	280	14,000	31.5	63	63	100	54.0	77,760	3,328	324
113	April 16	"	"	"	500	240	0.19	20.14	0.34	79.33	145	12,000	31.2	62	61	93	40.0	57,600	2,465	240
142	June 7	"	"	"	500	240	0.21	19.95	0.35	79.49	660	7,260	30.9	66	65	94	25.0	36,000	1,540	150
151	July 5	"	"	"	400	200	0.24	19.90	0.35	79.51	915	10,065	30.8	67	66	94	35.0	50,400	2,157	251
158	Aug. 22	"	"	"	700	60	0.20	20.05	0.21	79.54	625	9,375	31.1	67	66	94	19.0	27,360	1,171	456
67	Jan. 22	"	Farmer's section	"	720	320	0.29	19.67	0.30	79.24	300	18,000	30.0	60	60	100	144.0	207,360	9,875	648
90	Feb. 25	"	"	"	550	250	0.29	19.70	0.38	79.13	200	10,000	30.2	65	64	94	88.0	126,720	5,428	507
95	Mar. 13	"	"	"	500	260	0.27	19.56	0.76	79.11	80	5,120	31.5	63	63	100	38.0	54,720	2,342	210
112	April 16	"	"	"	500	260	0.31	19.79	0.83	79.07	150	9,500	31.2	62	61	93	78.0	112,320	4,807	432
143	June 7	"	"	"	500	260	0.22	19.75	0.33	79.20	80	4,000	30.9	65	64	94	38.0	47,520	2,033	152
150	July 5	"	"	"	400	200	0.28	19.82	0.72	79.18	100	5,000	30.8	65	65	100	36.0	51,840	2,218	259
167	Aug. 23	"	"	"	700	206	0.25	19.96	0.71	79.08	100	5,000	31.2	66	65	94	35.0	50,400	2,157	245
89	Jan. 22	"	Protection pillars, No. 6 South and Nos. 2 and 7 North	"																
92	Feb. 19	"	Ditto	"	150		0.20	20.52	0.07	79.21	1,300	52,000	30.2	60	60	100	36.0	51,840	2,218	370
115	April 16	"	do	"	400		0.19	20.50	0.07	79.24	1,000	42,000	30.6	60	60	100	29.0	41,760	1,725	104
136	May 9	"	do	"	460		0.18	20.32	0.08	79.42	920	36,800	30.5	60	60	100	29.0	41,760	1,725	90
152	July 5	"	No. 2 South	"	90		0.34	20.03	0.18	79.45	1,125	5,000	30.3	65	64	94	9.0	12,960	554	144
159	Aug. 23	"	"	"	70		0.36	20.01	0.14	79.49	800	3,000	30.7	67	65	88	4.0	5,760	246	82
63	Jan. 22	"	Main return airway	"	720		0.35	19.95	0.39	79.33	800	42,500	30.0	60	60	100	165.0	237,600	10,169	330
91	Feb. 25	"	"	"	550		0.32	20.02	0.39	79.27	1,000	60,000	30.2	66	66	100	234.0	336,960	14,421	612
98	Mar. 13	"	"	"	500		0.31	20.08	0.34	79.27	770	46,200	31.1	62	62	100	167.0	226,080	9,676	452
114	April 16	"	"	"	500		0.33	20.04	0.35	79.28	745	41,160	30.6	62	62	100	143.0	206,920	8,813	411
145	June 7	"	"	"	500		0.36	20.05	0.33	79.36	600	33,000	30.4	64	64	100	108.0	155,520	6,606	311
153	July 5	"	"	"	800		0.30	20.00	0.32	79.38	700	38,500	30.3	65	65	100	123.0	177,120	7,580	221

100	Aug. 23	South side of No. 1.	Main return airway.	Working.	700	0.30	20.07	0.29	79.34	500	27,500	30.7	65	64	94	79.0	113,760	4,863	162
70	Jan. 23	Reserve	No. 1 East split.	"	520	0.09	20.72	0.09	79.10	370	18,500	30.3	57	55	88	16.0	23,040	986	164
83	Feb. 22	"	"	"	500	0.07	20.62	0.16	79.15	350	15,700	30.0	58	55	93	25.0	38,000	1,540	180
99	Mar. 14	"	"	"	500	0.07	20.65	0.10	79.18	430	19,350	31.5	58	55	93	19.0	27,300	1,171	152
121	April 17	"	"	"	480	0.07	20.68	0.08	79.16	330	16,500	31.6	57	56	93	14.0	20,160	862	126
162	Aug. 23	"	"	"	350	0.08	20.67	0.11	79.24	200	10,000	31.1	63	61	88	11.0	15,840	677	158
71	Jan. 23	"	No. 2 East split.	"	520	0.08	20.69	0.04	79.19	300	18,000	30.3	57	55	88	7.0	10,080	431	91
84	Feb. 22	"	"	"	500	0.11	20.60	0.04	79.25	350	10,500	30.0	57	55	88	4.0	5,760	246	57
100	Mar. 14	"	"	"	500	0.11	20.57	0.04	79.23	145	2,900	31.5	56	55	93	1.0	1,440	61	72
72	Jan. 23	"	No. 3 East split.	"	520	0.06	20.84	0.02	79.08	300	15,000	30.0	54	52	88	3.0	4,320	184	72
85	Feb. 22	"	"	"	500	0.05	20.84	0.03	79.06	500	20,000	30.0	55	53	86	6.0	8,640	369	240
73	Jan. 23	"	No. 1 West split.	"	520	0.10	20.68	0.15	79.06	500	30,000	30.3	58	55	93	45.0	64,800	2,773	240
86	Feb. 22	"	"	"	600	0.08	20.67	0.15	79.10	500	25,080	30.0	55	54	93	37.0	53,280	2,280	266
101	Mar. 14	"	"	"	600	0.05	20.81	0.04	79.10	190	9,500	31.3	57	56	93	3.0	4,320	184	86
122	April 17	"	"	"	460	0.16	20.78	0.05	79.01	150	6,750	31.5	56	54	88	3.0	4,320	184	72
163	Aug. 23	"	"	"	350	0.08	20.77	0.09	79.08	730	19,500	31.1	56	54	88	17.0	24,480	1,047	163
102	Mar. 14	"	No. 2 West split.	"	500	0.07	20.66	0.19	79.08	470	26,320	31.1	56	54	88	50.0	72,000	3,081	288
123	April 17	"	"	"	460	0.09	20.66	0.18	79.07	460	23,000	31.5	55	54	93	41.0	59,040	2,526	246
164	Aug. 23	"	"	"	350	0.06	20.66	0.22	79.06	380	15,200	31.1	55	54	93	33.0	47,520	2,033	475
74	Jan. 23	"	Main return airway	"	520	0.06	20.84	0.14	79.16	800	80,000	30.0	56	54	88	112.0	161,280	6,902	310
87	Feb. 22	"	"	"	500	0.07	20.65	0.14	79.14	1,000	70,000	30.0	53	53	100	98.0	141,120	6,049	282
103	Mar. 14	"	"	"	500	0.06	20.70	0.13	79.11	1,060	84,800	31.3	55	54	93	110.0	158,400	6,779	317
124	April 17	"	"	"	460	0.10	20.72	0.13	79.05	760	60,800	31.5	56	55	93	79.0	118,760	4,868	247
165	Aug. 23	"	"	"	350	0.06	20.64	0.14	79.16	800	72,000	31.1	57	56	93	100.0	144,000	6,163	411
76	Jan. 30	Harewood	No. 1 split.	"	680	0.06	20.70	Trace.	79.18	200	8,000	29.1	50	48	86				
125	April 18	"	"	"	735	0.13	20.81	0.03	79.03	210	10,500	30.2	43	48	100	3.0	4,320	184	9
77	Jan. 30	"	No. 2 split.	"	680	0.07	20.78	Trace.	79.15	250	13,000	29.1	50	48	86				
108	Mar. 15	"	"	"	750	0.06	20.83	Trace.	79.12	330	18,480	29.9	52	51	93				
126	April 18	"	"	"	735	0.09	20.73	0.02	79.16	80	4,000	30.2	50	60	100	8.0	1,152	49	7
127	April 18	"	No. 3 split.	"	735	0.05	20.70	0.02	79.23	1,650	6,750	30.2	48	47	93	1.0	1,440	64	32
128	April 18	"	No. 4 split.	"	735	0.09	20.82	0.03	79.06	90	5,400	30.2	49	49	100	1.0	1,440	64	14
78	Jan. 30	"	Main return airway	"	680	0.06	20.84	Trace.	79.10	450	22,500	29.1	48	48	100				
108	Mar. 15	"	"	"	750	0.05	20.82	Trace.	79.13	350	22,050	29.9	48	47	93				
129	April 18	"	"	"	735	0.08	20.78	0.03	79.11	300	13,000	30.2	51	49	88	5.0	7,200	308	9
109	April 11	Morden.	Left side split.	"	850	0.06	20.62	0.78	78.54	300	18,000	30.7	53	52	93	140.0	201,600	8,028	806
130	May 7	"	"	"	400	0.05	20.67	0.55	78.73	730	26,280	30.6	59	58	93	144.0	207,360	8,375	1,036
138	June 6	"	"	"	400	0.05	20.60	0.58	78.77	750	19,500	30.6	55	55	100	113.0	162,720	6,904	813
147	July 4	"	"	"	400	0.05	20.62	0.54	78.79	725	23,375	30.6	57	56	93	136.0	195,840	8,381	1,500
154	Aug. 22	"	"	"	275	0.07	20.62	0.62	78.73	525	18,900	30.3	57	56	98	117.0	168,480	7,210	1,465
166	Nov. 19	"	"	"	150	0.04	20.73	0.30	78.84	620	24,800	30.3	55	54	93	96.0	138,240	5,916	3,456
110	April 11	"	Right side split.	"	350	0.05	20.78	0.34	78.83	2,300	13,800	30.7	53	52	93	46.0	66,240	2,835	862
131	May 7	"	"	"	400	0.04	20.66	0.51	78.79	790	17,400	30.6	53	53	100	88.0	126,720	5,423	633
139	June 6	"	"	"	400	0.06	20.60	0.49	78.85	900	22,500	30.7	55	54	93	110.0	158,400	6,779	792
143	July 4	"	"	"	400	0.06	20.68	0.40	78.86	950	14,250	30.7	56	56	100	56.0	90,640	3,451	295
155	Aug. 22	"	"	"	400	0.05	20.67	0.44	78.84	200	15,800	31.0	69	68	93	63.0	97,920	4,190	612
167	Nov. 19	"	"	"	275	0.06	20.82	0.25	78.89	300	21,060	30.9	57	56	93	52.0	74,880	3,204	680
75	Jan. 29	"	Main return airway	"	400	0.08	20.61	0.55	78.78	800	64,060	29.8	52	50	86	352.0	508,880	21,694	1,267
105	Mar. 14	"	"	"	400	0.05	20.71	0.45	78.79	640	51,200	31.1	52	51	92	230.0	331,200	14,175	823
111	April 11	"	"	"	250	0.05	20.69	0.40	78.86	650	45,500	30.6	52	51	93	182.0	262,080	11,217	748
132	May 7	"	"	"	400	0.03	20.65	0.46	78.86	870	60,000	30.6	52	52	100	278.0	397,440	17,010	903
140	June 6	"	"	"	400	0.05	20.63	0.43	78.89	620	37,200	30.6	54	53	93	160.0	230,400	9,861	576
149	July 4	"	"	"	400	0.07	20.60	0.43	78.90	800	40,000	30.6	54	54	100	172.0	347,680	10,600	619
156	Aug. 22	"	"	"	275	0.08	20.64	0.47	78.81	520	23,400	30.8	56	56	100	110.0	158,400	6,779	676
168	Nov. 19	"	"	"	150	0.05	20.75	0.29	78.91	900	43,200	30.8	54	53	93	125.0	170,000	7,704	1,300
119	April 16	Grant	East split.	"	110	0.13	20.73	0.13	79.01	500	11,000	30.2	54	54	100	14.0	20,160	862	183
120	April 16	"	Main return airway	"	110	0.03	20.78	0.07	79.12	500	15,000	30.2	55	55	100	10.0	14,400	616	130
169	Nov. 20	"	"	"	100	0.08	20.84	0.05	79.08	130	10,400	30.4	55	54	93	5.0	7,200	308	72
170	Nov. 20	E. Wellington No. 1.	"	"	120	0.04	20.77	0.08	79.11	700	15,600	30.7	57	57	100	12.0	17,280	739	144

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—Continued.

Nicola-Similkameen District.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine 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 ₂	O.	CH ₄	N.				Dry Bulb.	Wet Bulb.	Humidity.				
35	April 5	Princeton No. 1	Main return airway	Working	140		0.16	20.36	0.23	79.26	700	30,000	27.7				69.0	99,380	3,825	709
39	May 16	"	"	"	125		0.18	20.44	0.17	79.21	510	20,400	27.9				64.0	48,960	1,884	301
47	Aug. 20	"	"	"	140		0.20	20.34	0.28	79.18	600	21,600	28.3	58	57	93	60.0	86,400	3,326	617
43	Aug. 21	Coalmont No. 2	"	"	30		0.03	20.77		79.20	Slack.	No veloc.	26.2	55	55	100				
36	April 6	Coal Hill No. 3	"	"	135		0.06	20.77	Trace	79.17	265	16,695	27.6	48	47	98				
38	May 14	"	"	"	160		0.15	20.48		79.37	835	11,725	26.9							
54	Aug. 23	"	"	"	160		0.11	20.76	0.03	79.11	1,840	41,000	27.7	54	54	100	12.0	17,280	665	108
51	Aug. 23	"	Split of No. 5 seam	"	160	55	0.11	20.62	0.02	79.25	350	1,400	27.7	53	53	100	0.28	403	15	7
53	Aug. 23	"	Split of No. 3 seam	"	160	105	0.12	20.68	0.04	79.16	340	23,800	27.7	52	52	100	9.0	12,960	488	123
34	April 4	Middlesboro No. 4 E.	Main return airway	"	125		0.06	20.78	0.03	79.13	430	24,800	27.7				7.0	10,080	388	80
40	May 7	"	"	"	125		0.09	20.68	0.12	79.11	800	20,000	28.0				24.0	34,560	1,330	276
57	Aug. 23	"	"	"	100		0.07	20.76	0.12	79.05	600	33,600	28.1	64	59	72	40.0	57,600	2,217	576
33	April 4	Middlesboro No. 4	Incline district	"	80	80	0.20	20.44	0.08	79.32	190	10,400	27.5				8.0	11,520	443	144
55	Aug. 23	"	"	"	110		0.18	20.48	0.05	79.29	200	10,000	27.8	59	58	93	5.0	7,200	277	65
56	Aug. 23	"	No. 6 district	"	110	30	0.09	20.72	0.07	79.12	300	9,000	27.8	55	53	87	6.0	8,640	332	282
32	April 4	Middlesboro No. 7	Main return airway	"	160		0.09	20.70	0.13	79.08	650	26,000	27.4	55	54	93	33.0	47,520	1,829	297
42	May 17	"	"	"	140		0.13	20.61	0.28	79.08	500	25,000	27.6				70.0	100,800	3,880	720
49	Aug. 22	"	"	"	130		0.19	20.26	0.34	79.21	600	30,000	27.8	59	57	88	102.0	146,880	5,654	1,129
50	Aug. 22	Middlesboro No. 8	"	Idle 7 days	15		0.04	20.77	0.03	79.16	100	1,500	27.7	54	52	86	0.45	648	24	43

Crowsnest Pass District.

158	Jan. 23	No. 1 North	Main return airway	Working	150		0.17	20.57	0.45	78.81	170	11,900	25.8	58	57	93	53.0	76,320	2,831	508
163	Feb. 3	"	"	"	190		0.15	20.54	0.47	78.84	190	9,760	25.6	58	57	93	45.0	64,800	2,404	341
192	Mar. 21	"	"	"	200		0.21	20.47	0.64	78.63	280	16,800	25.6	56	56	100	107.0	154,080	5,716	780
193	April 10	"	"	"	250		0.18	20.50	0.57	78.75	150	12,000	25.8	58	58	100	68.0	97,920	3,632	301
244	May 23	"	"	"	220		0.20	20.41	0.50	78.69	820	16,000	25.5	58	58	100	80.0	115,200	4,273	523
316	Aug. 14	"	"	"	240		0.26	20.33	0.90	78.61	230	13,000	25.7	60	60	100	78.0	112,320	4,667	468
391	Nov. 4	"	"	"	200		0.22	20.45	0.36	78.97	240	14,400	25.4	58	57	93	51.0	73,440	2,724	367
162	Jan. 24	No. 1 South	"	"	500		0.14	20.18	1.92	77.76	400	30,000	24.9	51	49	58	576.0	829,440	30,772	1,658
176	Feb. 15	"	"	"	500		0.11	20.43	1.26	78.20	400	30,000	26.0	48	48	93	378.0	544,320	20,194	1,088
190	Mar. 8	"	"	"	560		0.15	20.17	2.10	77.58	480	36,000	25.6	48	47	92	756.0	1,088,640	40,388	1,978
205	April 13	"	"	"	560		0.15	20.27	1.69	77.89	550	35,750	25.8	50	49	93	603.0	868,320	32,214	1,678
234	May 4	"	"	"	560		0.11	20.13	1.95	77.81	520	33,800	25.0	51	50	93	659.0	945,960	35,207	1,735
290	July 5	"	"	"	560		0.19	19.99	2.28	77.54	575	37,375	25.6	55	54	93	850.0	1,224,000	45,410	2,225
321	Aug. 22	"	"	"	560		0.21	19.93	2.44	77.42	560	36,400	25.7	61	60	93	888.0	1,278,720	47,440	2,324
373	Oct. 9	No. 1 South	"	"	560		0.21	20.23	1.11	78.45	600	34,000					432.0	622,080	23,079	1,203
378	Oct. 10	"	"	"	343		0.25	20.16	1.25	78.34	600	39,000	26.0				437.0	701,280	26,817	2,044
378	Oct. 11	"	"	"	365		0.21	20.13	1.41	78.25	600	39,000	26.0				549.0	790,560	29,329	2,165
381	Oct. 12	"	"	"	326		0.17	20.22	1.19	78.42	600	39,000	26.0				464.0	698,160	24,788	2,049
383	Oct. 15	"	"	"	400		0.21	20.16	1.30	78.38	600	39,000	25.9				507.0	730,080	27,085	1,825

* Recommended after being idle 35 days.

885	Oct. 16	No. 1 South.	Main return airway.	Working.	400	0.22	20.12	1.85	78.31	600	39,000	26.0				526.0	757,440	28,105	1,898
396	Nov. 5	"	"	"	400	0.19	20.26	1.00	78.55	600	39,000	25.2				405.0	581,600	20,835	1,404
439	Dec. 19	"	"	"	305	0.21	20.17	1.04	78.58	600	39,000	25.6				405.0	533,200	21,630	1,912
442	Dec. 21	"	"	"	380	0.20	20.21	1.06	78.54	600	39,000	26.2				409.0	588,960	21,850	1,686
320	Aug. 22	"	Main level split.	"	550	0.15	20.24	1.78	77.83	250	23,750	25.7	56	55	93	421.0	606,240	22,491	2,204
443	Dec. 24	"	"	"	308	0.17	20.32	0.89	78.62	600	39,000	26.2				347.0	499,680	18,538	1,649
161	Jan. 24	"	"	"	500	0.06	20.62	1.00	78.42	300	27,000	24.9	44	42	84	270.0	388,800	14,424	2,592
179	Mar. 8	"	"	"	550	0.09	20.37	1.78	77.76	340	27,200	25.6	42	41	92	484.0	696,960	25,857	2,534
204	April 18	"	"	"	550	0.09	20.41	1.46	78.04	380	27,500	25.8	45	44	93	398.0	573,120	21,262	1,910
233	May 4	"	"	"	550	0.09	20.33	1.67	77.91	470	32,900	25.0	49	47	85	549.0	700,560	29,329	2,874
289	July 5	"	"	"	550	0.12	20.22	1.93	77.78	400	28,000	25.5	58	57	93	530.0	777,600	28,848	2,827
158	Jan. 11	No. 1 East.	South side split.	"	620	0.11	20.27	2.64	77.08	320	25,000	26.4	47	46	92	635.0	914,400	33,924	3,516
170	Feb. 11	"	"	"	550	0.09	20.27	1.06	77.68	500	37,500	25.8	45	43	85	735.0	1,058,400	39,266	5,292
183	Mar. 9	"	"	"	600	0.10	20.33	2.17	77.40	540	40,500	25.7	44	42	84	878.0	1,234,320	46,906	6,321
198	April 12	"	"	"	600	0.10	20.30	2.30	77.40	550	42,000	26.0	46	45	93	966.0	1,391,040	51,697	6,955
241	May 7	"	"	"	500	0.11	20.27	2.55	77.07	410	31,570	26.0	52	49	90	803.0	1,156,320	42,899	5,781
287	June 18	"	"	Idle 70 hours	480	0.10	20.32	1.94	77.64	500	37,500	26.0	52	51	93	727.0	1,046,880	38,839	5,816
801	July 23	"	"	Working.	500	0.09	20.26	1.82	77.83	550	38,500	25.9	57	55	88	700.0	1,008,000	37,396	5,040
313	Aug. 9	"	"	"	500	0.11	20.20	2.34	77.35	520	36,400	25.8	56	55	93	851.0	1,225,440	45,464	6,127
364	Oct. 4	"	"	Idle 30 days	"	0.11	20.37	1.52	78.06	440	30,800	26.0	56	55	93	468.0	673,920	25,002	
377	Oct. 11	"	"	Working.	390	0.13	20.39	1.61	77.87	470	32,900	26.0				529.0	761,760	28,261	5,078
382	Oct. 15	"	"	"	350	0.10	20.41	1.62	77.87	470	32,900	25.9				532.0	766,080	28,421	5,107
386	Oct. 17	"	"	"	360	0.13	20.38	1.64	77.55	460	32,200	26.0				528.0	774,720	28,742	5,633
418	Dec. 7	"	"	"	400	0.13	20.27	2.31	77.29	470	32,900	25.7				759.0	1,092,960	40,548	7,286
169	Feb. 11	"	North side split.	"	550	0.06	20.62	0.79	78.53	260	36,400	25.8	43	42	92	387.0	413,280	15,332	1,180
182	Mar. 9	"	"	"	600	0.09	20.52	1.23	78.16	300	30,000	25.7	43	42	92	369.0	531,860	19,713	1,323
197	April 12	"	"	"	600	0.07	20.50	1.47	77.96	240	28,800	26.0	47	47	100	423.0	609,120	22,598	1,522
242	May 7	"	"	"	500	0.10	20.39	1.68	77.88	375	30,000	26.0	52	50	86	504.0	725,760	26,925	2,419
285	June 18	"	"	Idle 64 hours	480	0.10	20.40	1.45	78.05	325	30,000	26.1	52	50	86	435.0	626,400	23,239	2,068
802	July 23	"	"	Working.	500	0.12	20.33	1.53	78.02	300	30,000	25.9	56	55	93	459.0	660,960	24,521	2,030
814	Aug. 9	"	"	"	500	0.15	20.29	1.46	78.10	580	29,000	25.8	56	55	93	423.0	609,120	22,598	2,030
940	Sept. 13	"	"	Idle 9 days	"	0.08	20.53	0.93	78.46	350	25,000	26.1	56	55	93	232.0	334,080	12,398	
387	Oct. 23	"	"	Working.	300	0.11	20.41	1.28	78.20	420	31,500	25.7	56	55	93	408.0	580,320	21,629	3,224
419	Dec. 7	"	"	"	400	0.14	20.33	1.91	77.62	370	33,300	25.7	56	55	93	636.0	915,840	33,975	3,063
163	Jan. 24	"	Main return airway.	"	600	0.12	20.41	1.28	78.19	1,120	120,960	25.7	49	48	93	1,647.0	2,227,680	72,646	3,712
184	Mar. 9	"	"	"	600	0.14	20.41	1.26	78.19	1,300	140,000	25.7	48	47	93	1,764.0	2,540,160	94,239	4,233
199	April 12	"	"	"	600	0.13	20.40	1.38	78.09	1,206	129,600	26.0	49	48	93	1,788.0	2,574,720	95,522	4,291
243	May 7	"	"	"	500	0.11	20.39	1.16	78.34	1,330	143,640	26.0	52	50	86	1,665.0	2,397,600	88,950	4,795
303	July 23	"	"	"	500	0.16	20.23	1.27	78.34	1,300	140,000	25.9	56	55	93	1,778.0	2,560,320	94,987	5,120
316	Aug. 9	"	"	"	500	0.12	20.24	2.01	77.63	1,300	140,400	25.8	56	55	93	2,822.0	4,063,680	150,762	8,127
341	Sept. 13	"	"	Idle 9 days	"	0.15	20.41	0.98	78.46	1,200	144,000	26.1	55	54	93	1,411.0	2,031,840	75,381	
388	Oct. 23	"	"	Working.	300	0.17	20.31	1.09	78.44	1,300	140,400	25.7	56	55	93	1,530.0	2,203,200	81,788	7,344
399	Nov. 2	"	"	"	300	0.06	20.34	1.78	77.82	1,100	118,000	26.0	55	54	93	2,100.0	3,024,000	112,190	10,080
420	Dec. 7	"	"	"	400	0.14	20.39	1.06	78.42	1,400	151,300	25.7	"	"	"	1,588.0	2,286,720	84,837	5,716
174	Feb. 12	"B"	Incline split.	"	275	0.10	20.60	1.08	78.22	230	13,800	25.5	62	49	80	149.0	214,560	7,960	4,291
187	Mar. 9	"	"	"	300	0.14	20.36	2.00	77.50	210	12,600	25.7	52	51	93	252.0	332,880	13,462	2,419
196	April 11	"	"	"	250	0.13	20.37	1.88	77.62	270	13,300	25.8	50	49	93	253.0	364,320	13,516	4,554
238	May 7	"	"	"	250	0.10	20.42	1.59	77.89	300	16,000	25.8	50	49	93	286.0	411,840	15,279	4,118
282	June 13	"	"	"	260	0.14	20.32	1.57	77.87	180	12,600	25.6	51	50	93	200.0	288,000	10,684	4,500
805	July 29	"	"	"	250	0.12	20.43	1.46	77.99	150	9,000	25.8	51	51	100	131.0	188,640	6,998	3,772
318	Aug. 14	"	"	"	250	0.15	20.34	1.65	77.86	150	12,000	25.6	52	52	100	198.0	255,120	10,577	2,851
365	Oct. 5	"	"	Idle 31 days	"	0.12	20.49	1.30	78.09	150	14,000	25.8	"	"	"	182.0	262,080	9,723	
400	Nov. 6	"	"	Working.	250	0.13	20.45	1.26	78.16	450	18,000	25.7	47	46	93	226.0	325,440	12,073	3,254
155	Jan. 22	"	Side split	"	275	0.18	20.56	1.22	78.09	150	9,000	25.9	52	50	90	109.0	166,060	5,823	1,046
173	Feb. 12	"	"	"	275	0.19	20.22	2.52	77.07	300	10,800	25.5	51	50	93	272.0	391,680	14,531	1,740
186	Mar. 9	"	"	"	300	0.11	20.51	1.45	77.93	1,250	7,500	25.7	44	42	88	108.0	155,520	5,769	1,086
239	May 7	"	"	"	250	0.14	20.46	1.38	78.03	400	20,000	25.8	48	47	92	276.0	297,440	14,745	2,649
281	June 13	"	"	"	250	0.16	20.41	1.44	77.99	300	13,500	25.6	53	52	93	194.0	279,360	10,364	1,892
304	July 24	"	"	"	250	0.17	20.38	1.54	77.91	220	11,000	25.8	50	50	100	169.0	243,360	9,028	1,166
817	Aug. 16	"	"	"	250	0.14	20.43	1.35	78.08	300	15,000	25.5	55	55	100	202.0	290,880	10,791	1,939
366	Oct. 5	"	"	Idle 31 days	"	0.15	20.53	0.85	78.47	300	16,000	25.8	"	"	"	136.0	295,840	7,265	
399	Nov. 6	"	"	Working.	250	0.10	20.62	0.63	78.60	280	14,000	25.7	50	49	93	95.0	136,800	5,075	912
172	Feb. 12	"	Main return airway.	"	275	0.09	20.53	1.38	78.00	1,000	36,000	25.5	51	50	93	496.0	714,240	26,498	2,597

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—Continued.

Crowsnest Pass District—Concluded.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine 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 ₂	O.	CH ₄	N.				Dry Bulb.	Wet Bulb.	Humidity.				
185	Mar. 9	"B"	Main return airway	Working.	300		0.14	20.42	1.55	77.80	520	37,800	25.7	51	49	86	586.0	843,840	81,306	2,819
200	April 12	"	"	"	250		0.10	20.46	1.40	77.98	640	35,200	25.8	49	49	100	492.0	708,480	26,284	2,834
240	May 7	"	"	"	250		0.11	20.46	1.21	78.23	770	41,540	25.8	32	31	87	502.0	722,380	26,818	2,891
280	June 13	"	"	"	250		0.15	20.43	1.21	78.21	630	34,020	25.6	52	61	93	411.0	591,840	21,957	2,967
306	July 24	"	"	"	250		0.15	20.39	1.34	78.12	600	30,000	25.9	47	46	93	402.0	573,380	21,476	2,915
319	Aug. 10	"	"	"	250		0.15	20.41	1.22	78.27	600	34,400	25.5	51	51	100	419.0	603,360	22,384	2,413
160	Jan. 24	No. 2	High line split	"	225	40	0.06	20.71	0.43	78.51	280	7,560	24.9	41	38	77	32.0	46,080	1,709	1,152
166	Feb. 7	"	"	"	230	30	0.06	20.77	0.30	78.77	200	6,000	25.7	37	37	100	18.0	25,920	961	864
188	Mar. 21	"	"	"	300	50	0.05	20.69	0.54	78.72	220	5,900	25.6	38	38	100	32.0	46,080	1,709	921
202	April 17	"	"	"	250	50	0.06	20.75	0.49	78.70	270	6,700	26.2	40	39	93	32.0	46,080	1,709	921
278	June 12	"	"	"	220	24	0.15	20.48	0.72	78.65	100	8,000	26.2	55	54	93	57.0	82,080	3,045	3,420
294	July 12	"	"	"	165	15	0.32	20.48	0.72	78.70	100	8,000	26.0	52	52	100	57.0	82,080	3,045	5,472
308	Aug. 2	"	"	"	200	15	0.08	20.06	0.44	78.82	100	6,000	25.9	55	54	93	26.0	37,440	1,389	2,496
388	Oct. 5	"	"	Idle 31 days.			0.15	20.58	0.60	78.67	80	6,400	25.8				38.0	54,720	2,080	
396	Nov. 5	"	"	Working.	200	15	0.08	20.65	0.42	78.85	Slack.	Slack.	25.2	49	47	87				
165	Feb. 7	"	Rock Tunnel split	"	230	200	0.19	20.34	1.15	78.32	130	11,700	25.7	59	59	100	134.0	192,960	7,158	964
191	Mar. 21	"	"	"	306	250	0.12	20.56	0.57	78.75	200	14,000	25.9	57	57	100	80.0	115,200	4,275	461
201	April 17	"	"	"	250	200	0.12	20.46	0.75	78.67	240	16,800	26.2	58	58	100	126.0	181,440	6,781	907
279	June 12	"	"	"	220	196	0.16	20.38	0.96	78.50	120	12,000	26.2	59	58	93	115.0	165,600	6,143	844
298	July 12	"	"	"	165	150	0.18	20.37	0.94	78.51	120	12,640	26.0	58	58	100	118.0	169,920	6,304	1,182
309	Aug. 2	"	"	"	200	185	0.19	20.17	1.24	78.40	100	10,000	25.9	60	59	93	124.0	178,560	6,624	964
344	Sept. 14	"	"	Idle 10 days.			0.22	20.17	1.44	78.17	140	14,000	28.2				201.0	289,440	10,739	
368	Nov. 5	"	"	Working.	200	185	0.17	20.36	0.88	78.69	100	10,800	25.7	50	50	100	95.0	136,800	5,075	788
412	Dec. 2	"	"	"	212	180	0.24	20.30	1.08	78.38	100	10,800	25.5				116.0	167,040	6,197	928
167	Feb. 7	"	Main return airway	"	230		0.26	20.32	0.69	78.73	650	37,700	25.8	56	56	100	260.0	374,400	13,800	1,627
308	April 17	"	"	"	250		0.24	20.39	0.66	78.71	600	34,800	26.2	56	56	100	239.0	329,760	12,284	1,819
277	June 22	"	"	"	220		0.24	20.27	0.72	78.77	630	36,540	26.2	57	56	93	262.0	377,280	13,907	1,714
295	July 12	"	"	"	165		0.26	20.25	0.68	78.78	640	37,320	26.0	59	58	93	253.0	364,320	13,516	2,208
307	Aug. 2	"	"	"	200		0.30	20.20	0.76	78.74	670	37,520	25.9	59	58	93	285.0	410,400	15,225	2,052
370	Oct. 7	"	"	Idle 33 days.			0.22	20.43	0.65	78.70	340	23,680	26.1				185.0	266,400	9,888	
397	Nov. 5	"	"	Working.	200		0.26	20.34	0.74	78.66	380	28,800	25.7	52	52	100	218.0	306,720	11,379	1,083
247	May 23	No. 3	No. 6 incline split	"	150	138	0.10	20.65	0.52	78.73	430	27,950	26.2	56	54	87	145.0	208,500	7,746	1,513
296	July 12	"	"	"	200	180	0.20	20.49	1.23	78.08	410	26,650	26.0	56	55	93	326.0	469,440	17,416	2,608
311	Aug. 6	"	"	"	220	180	0.17	20.49	1.20	78.14	490	31,850	26.0	56	56	100	331.0	543,640	20,354	3,048
367	Oct. 5	"	"	Idle 31 days.			0.10	20.69	0.56	78.65	400	26,000	25.8				145.0	208,800	7,746	
374	Oct. 10	"	"	Working.	195	100	0.12	20.62	0.37	78.39	460	27,600	26.0				240.0	345,000	12,821	3,456
426	Dec. 12	"	"	"	300	160	0.18	20.47	1.38	77.97	460	27,600	25.7	56	55	93	380.0	547,200	20,301	3,048
246	May 23	"	South level split	"	150	12	0.10	20.72	0.24	78.94	200	16,800	26.2	69	58	93	40.0	57,600	2,136	4,900
297	July 12	"	"	"	200	20	0.10	20.84	0.57	78.77	270	18,900	26.0	69	58	93	107.0	154,080	5,716	7,704
312	Aug. 6	"	"	"	220	40	0.10	20.62	0.61	78.67	275	17,875	26.0	58	57	93	108.0	155,420	5,769	3,888
337	Sept. 13	"	"	Idle 9 days.			0.10	20.71	0.84	78.85	320	20,800	26.1				70.0	100,800	3,739	
392	Nov. 4	"	"	Working.	150	20	0.07	20.72	0.41	78.80	330	21,450	25.7	58	57	93	87.0	125,280	4,647	6,964
245	May 23	"	Main return airway	"	150		0.11	20.62	0.56	78.71	840	52,940	26.2	59	57	83	296.0	426,240	15,813	2,841
298	July 12	"	"	"	200		0.14	20.68	0.99	78.41	725	46,625	26.0	57	56	93	461.0	663,840	24,628	8,319
310	Aug. 6	"	"	"	220		0.12	20.47	0.92	78.40	800	52,000	26.0	58	57	93	478.0	682,320	25,596	9,128
398	Nov. 4	"	"	"	150		0.16	20.49	0.71	78.64	800	52,000	25.7	59	58	93	369.0	531,360	19,713	3,542
423	Dec. 12	"	"	"	300		0.21	20.42	1.33	78.04	800	52,000	25.7	59	57	83	691.0	995,040	36,915	3,516

Michel Colliery.

177	July 16	Old No. 8.	Main return airway	Working...	30	0.23	20.32	0.73	78.72	300	39,000	26.0	56	55	93	284.0	408,960	15,172	13,632
191	Sept. 4	"	"	"	150	0.23	20.36	0.09	78.74	600	60,000	26.3	53	53	100	402.0	578,880	21,476	8,859
216	Nov. 8	"	"	"	100	0.10	20.04	0.72	79.06	550	55,000	25.7	48	47	93	396.0	570,240	21,155	6,702
223	Dec. 11	"	100 feet from last working-place.	"	180	0.09	20.70	0.05	78.56	200	6,000	25.9	43	43	100	39.0	56,160	2,083	351
122	Jan. 10	No. 3 East	West side of slope	"	350	0.10	20.42	1.23	78.25	340	14,280	26.4	49	49	100	174.0	250,560	9,295	1,670
134	Feb. 15	"	"	"	350	0.12	20.47	1.31	78.10	330	13,950	25.7	47	47	100	180.0	250,200	9,016	3,240
141	Mar. 4	"	"	"	430	0.10	20.61	0.98	78.31	320	13,400	25.7	47	46	92	131.0	188,640	6,908	950
150	April 10	"	"	"	410	0.12	20.24	1.86	77.78	210	8,820	25.9	49	49	100	163.0	234,720	8,708	989
169	May 9	"	"	"	380	0.11	20.35	1.78	77.76	220	9,240	25.9	53	51	86	364.0	524,160	19,446	4,032
174	June 11	"	"	"	350	0.13	20.23	2.13	77.50	950	17,100	26.2	54	53	98	478.0	688,320	25,663	2,867
180	July 17	"	"	"	380	0.14	20.20	2.31	77.35	1,150	20,700	26.0	53	52	98	327.0	470,880	17,469	2,354
187	Aug. 10	"	"	"	350	0.20	0.17	1.81	77.77	330	18,150	25.6	55	54	93	350.0	504,000	18,098	4,200
193	Sept. 4	"	"	"	250	0.12	20.46	1.67	77.80	320	21,000	26.3	56	56	100	255.0	367,200	13,623	1,900
200	Sept. 25	"	"	Idle 21 days.	250	0.09	20.43	1.76	77.72	220	14,500	25.9				360.0	518,400	19,232	4,990
209	Oct. 30	"	"	Working...	270	0.09	20.43	1.45	78.03	450	29,700	26.7	60	50	100	430.0	619,200	22,972	5,629
218	Nov. 8	"	"	"	300	0.10	20.51	1.28	78.11	350	21,000	25.8				268.0	385,920	14,317	3,216
224	Dec. 12	"	"	"	350	0.08	20.63	0.99	78.80	3,100	13,950	25.7	47	46	93	137.0	197,280	7,319	1,315
135	Feb. 15	"	East side of slope	"	430	0.05	20.06	0.84	78.45	2,050	10,925	27.7	40	40	100	84.0	120,960	4,487	2,419
142	Mar. 14	"	"	"	410	0.09	20.56	1.15	78.20	250	11,250	20.9	44	44	100	128.0	184,320	6,838	3,072
160	April 10	"	"	"	380	0.10	20.40	1.34	78.16	350	14,000	25.9	46	46	100	187.0	269,280	9,990	6,732
170	May 9	"	"	"	390	0.09	20.51	0.95	78.45	2,500	11,250	26.0	53	52	93	106.0	152,640	5,662	3,816
181	July 17	"	"	"	250	0.09	20.52	0.81	78.48	310	12,400	26.3	55	55	100	100.0	144,000	5,342	2,890
194	Sept. 4	"	"	"		0.08	20.60	0.83	78.49	225	9,000	25.9				74.0	106,560	3,953	
206	Sept. 21	"	"	Idle 21 days.	270	0.09	20.68	0.59	78.64	3,500	16,200	25.7	47	47	100	95.0	136,000	5,075	4,560
219	Nov. 8	"	"	Working...	300	0.06	20.72	0.60	78.53	275	11,000	25.3				75.0	108,000	4,006	3,600
226	Dec. 12	"	"	"	350	0.05	20.70	0.71	78.54	530	31,800	26.4	58	58	100	225.0	324,000	12,020	3,240
120	Jan. 10	No. 6 East split	"	"	350	0.04	20.79	0.22	78.95	520	23,400	25.7	40	40	100	51.0	73,440	2,724	612
133	Feb. 15	"	"	"	430	0.08	20.67	0.78	78.47	520	31,200	25.7	40	40	100	243.0	349,920	12,982	1,944
140	Mar. 4	"	"	"	380	0.10	20.57	0.85	78.52	750	33,750	25.9	47	47	100	286.0	417,840	15,279	2,941
168	May 9	"	"	"	350	0.08	20.57	0.85	78.50	700	31,500	26.2	46	46	100	267.0	384,480	14,267	1,922
172	June 11	"	"	"	380	0.09	20.56	0.74	78.61	700	31,500	26.0	52	52	100	233.0	335,520	12,447	3,355
173	July 17	"	"	"	350	0.14	20.17	2.32	77.37	700	31,500	25.6	60	60	100	730.0	1,051,200	38,999	10,512
186	Aug. 10	"	"	"	250	0.10	20.54	0.85	78.51	700	28,000	26.3	58	58	100	238.0	343,720	12,714	4,284
192	Sept. 4	"	"	"		0.08	20.63	0.70	78.59	500	22,500	25.9				157.0	226,080	8,387	
204	Sept. 25	"	"	Idle 21 days.	270	0.09	20.59	0.68	78.64	600	14,000	25.7	52	52	100	95.0	136,800	5,075	1,052
217	Nov. 8	"	"	Working...	350	0.14	20.51	1.01	78.34	1,230	77,490	25.8	47	47	100	781.0	1,424,640	41,724	3,213
127	Jan. 12	"	Main return airway	"	350	0.12	20.54	0.96	78.38	1,150	75,900	25.7	46	46	100	728.0	1,048,320	38,892	2,995
136	Feb. 15	"	"	"	430	0.11	20.49	1.18	78.22	1,050	69,300	25.7	47	47	100	817.0	1,176,480	43,647	2,736
143	Mar. 4	"	"	"	410	0.13	20.46	1.17	78.30	1,100	79,200	25.9	47	47	100	879.0	1,265,760	46,959	3,087
161	April 10	"	"	"	380	0.10	20.41	1.13	78.36	1,000	72,000	25.9	58	58	100	813.0	1,170,720	43,433	3,080
171	May 9	"	"	"	350	0.14	20.43	1.14	78.29	1,000	72,000	26.2	62	62	100	820.0	1,180,800	43,807	3,473
176	June 11	"	"	"	380	0.14	20.41	1.20	78.25	1,300	78,000	26.0	50	50	100	936.0	1,347,840	50,004	3,547
182	July 17	"	"	"	250	0.13	20.41	1.70	78.36	1,100	72,600	26.3	56	56	100	798.0	1,149,120	42,632	4,596
195	Sept. 4	"	"	"		0.12	20.38	1.48	78.07	590	59,400	25.9				879.0	1,265,760	46,959	
207	Sept. 25	"	"	Idle 21 days.	380	0.14	20.42	1.01	78.43	1,050	66,150	25.7				667.0	960,480	35,683	3,430
211	Oct. 30	"	"	Working...	270	0.10	20.51	0.89	78.50	1,100	69,300	25.7	46	46	100	616.0	887,040	32,909	3,285
320	Nov. 8	"	"	"	300	0.08	20.47	0.96	78.49	1,250	78,750	25.3				755.0	1,087,200	40,335	3,624
227	Dec. 12	"	"	"	900	0.19	20.44	0.27	79.10	1,300	9,100	25.2	41	41	100	24.0	34,680	1,282	218
131	Feb. 14	New No. 8.	No. 1 incline split.	"	520	0.16	20.49	0.19	79.16	1,350	9,450	25.0	40	40	100	17.0	24,480	908	174
149	Mar. 5	"	"	"	500	0.11	20.60	0.15	79.14	1,750	12,250	25.2	54	54	100	18.0	25,920	961	120
155	April 9	"	"	"	600	0.08	20.33	Nil	79.09	1,300	5,200	25.2	66	66	100				
124	Jan. 11	"	No. 4 incline split.	"	600	0.04	20.33	Trace	79.13	350	8,800	25.2	40	39	92				
230	Feb. 14	"	"	"	520	0.05	20.35	0.03	79.07	550	8,800	25.0	41	40	93	2.0	2,880	106	14
148	Mar. 5	"	"	"	500	0.09	20.60	0.09	79.13	750	12,000	25.2	58	58	100	10.0	14,400	524	96
154	April 9	"	"	"	500	0.30	20.37	0.22	79.11	600	4,000	25.4	47	47	100	8.0	11,520	427	128
164	May 8	"	"	"	600	0.10	20.69	0.13	79.08	300	2,400	25.2	66	66	100	3.0	4,320	160	21
123	Jan. 11	"	No. 6 incline split.	"	520	0.06	20.78	0.18	78.98	250	1,500	25.0	52	48	74	2.0	2,880	106	16
147	Mar. 5	"	"	"															

RETURNS FROM MINE-AIR SAMPLES TAKEN IN COAL-MINES—*Concluded.*

Michel Colliery—Concluded.

Sample No.	Date.	Mine.	Ventilating District.	Mine Working or Idle.	Tonnage of Mine 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 ₂	O.	CH ₄	N.				Dry Bulb.	Wet Bulb.	Humidity.				
126	Jan. 11	New No. 8	Main return airway	Working	600		0.15	20.67	0.11	79.07	1,200	72,000	25.2	42	42	100	79.0	113,700	4,220	189
132	Feb. 14	"	"	"	600		0.07	20.71	0.09	79.13	750	52,500	25.5	40	40	100	47.0	67,680	2,510	112
150	Mar. 5	"	"	"	520		0.10	20.71	0.11	79.08	570	39,900	25.0	38	38	100	43.0	61,920	2,297	119
156	April 9	"	"	"	500		0.10	20.65	0.12	79.13	800	56,000	25.2	54	54	100	67.0	91,480	3,579	193
166	May 8	"	"	"	500		0.05	20.85	0.03	79.12	800	48,000	25.4	45	45	100	14.0	20,160	747	40

Corbin Colliery.

118	Jan. 8	No. 4	Main return airway	Working	250		0.13	20.65	0.53	78.69	120	12,000	24.5	50	50	100	63.0	90,720	3,365	362
151	Mar. 26	"	"	"	250		0.10	20.66	0.50	78.74	1,050	26,250	24.7	64	44	100	180.0	187,200	6,945	749
163	April 23	"	"	"	300		0.09	20.63	0.36	78.93	230	23,000	23.9				82.0	118,080	4,380	393
177	June 19	"	"	"	300		0.09	20.65	0.27	78.99	225	22,500	24.1				60.0	86,400	3,205	288

CHART SHOWING THE NUMBER OF CUBIC FEET AND THE NUMBER OF TONS OF METHANE DELIVERED INTO THE ATMOSPHERE BY THE VENTILATING FANS IN THE COAL CREEK COLLIERY, CROWS NEST PASS DISTRICT.

Mine	CUBIC FEET OF METHANE EXPELLED INTO THE ATMOSPHERE PER MINUTE SHOWN GRAPHICALLY.			Per cent of Methane in current	Cubic feet of air circulating per minute	Cu.ft. of METHANE delivered into the atmosphere per minute	Cu.ft. of METHANE delivered into the atmosphere per day of 24 hours	Tons of methane delivered into the atmosphere per day of 24 hours	
	250	500	750						
Nº 1 East									
South Side Split.									idle
"				1.82	36,400	662	953,280	17.68	4.5 hrs.
"				1.77	"	644	927,360	17.13	67 "
"				1.80	"	655	943,200	17.43	71 "
"				1.09	"	396	570,240	10.57	73 "
"				1.64	"	596	858,240	15.92	115 "
"				1.70	"	618	885,920	16.50	119 "
"				1.68	"	611	879,840	16.32	121 "
"				1.34	"	540	806,400	14.95	141 "
"				1.55	"	564	812,160	15.06	165 "
"				1.37	35,000	549	790,560	14.64	3 days
"				1.52	"	632	766,080	14.21	"
"				1.33	"	443	669,600	12.42	10 days
"				1.73	31,800	544	785,360	14.53	12 "
"				1.61	32,900	529	761,760	14.13	13 "
"				1.62	31,500	510	734,400	13.62	14 "
"				1.64	"	516	743,040	13.78	15 "
"				1.63	"	513	738,720	13.70	16 "
"				1.65	"	519	747,360	13.86	17 "
"				1.61	"	507	730,080	13.54	19 "
"				1.45	30,800	446	642,240	11.91	23 "
"				1.57	28,000	439	632,160	11.72	26 "
"				1.50	29,400	441	635,040	11.77	28 "
"				1.52	30,800	468	673,920	12.50	30 "
"				1.48	34,300	507	730,080	13.54	Working day
"				1.43	"	490	709,600	13.08	" 2 "
"				1.61	32,900	629	761,760	14.13	" 3 "
"				1.62	"	632	766,080	14.21	" 7 "
"				1.65	"	646	786,240	14.58	" 8 "
"				1.64	32,200	528	774,720	14.37	" 9 "
Nº 1 South									
Main return airway				1.24	39,000	483	695,520	12.90	Idle 10 days
"				1.14	"	444	639,360	11.86	" 12 "
"				1.31	35,750	467	672,480	12.47	" 13 "
"				1.62	31,200	505	727,200	13.48	" 19 "
"				1.45	"	446	642,240	11.91	" 15 "
"				1.52	32,500	494	711,360	13.19	" 16 "
"				1.40	29,250	400	587,520	10.89	" 17 "
"				1.46	39,000	569	819,360	15.19	" 31 "
"				1.11	"	432	622,080	11.53	Working day
"				1.25	"	487	701,280	13.00	" 3 "
"				1.41	"	509	790,560	14.64	" 4 "
"				1.49	"	464	668,160	12.39	" 5 "
"				1.50	"	507	730,080	13.54	" 8 "
"				1.35	"	526	747,440	14.03	" 9 "

OUTBURSTS OF GAS.

Several blow-outs of gas occurred in the Crowsnest Pass mines during the year. On January 10th, 1918, a blow-out of coal and gas occurred in No. 26 room, off No. 10 East slope, No. 1 East mine, Coal Creek Colliery; details of same as furnished by Senior Inspector Strachan are herewith given:—

"Report of Blow-out of Coal and Gas in No. 1 East Mine on the Morning of January 10th, 1919.

"I have the honour to report a blow-out of gas in No. 1 East mine, Coal Creek, shortly after midnight of Thursday, resulting in the displacement of about 45 tons of coal and giving off large quantities of gas.

"The blow-out took place in No. 26 room, off No. 10 East slope, about 12.30 a.m. on Friday, 10th inst., while the regular shift was at work. Inspector Lancaster, who was in Coal Creek on the 10th inst., took a sample of the gas (sample No. 150) as close to the face as possible. According to the description given by Mr. Lancaster and others, this blow-out is different from that of November 7th in No. 3 North room, as the coal displaced was mostly round or coarse and not fine dust.

"I visited the place on Tuesday, the 15th inst., after a large amount of the coal had been loaded out, and found that a large cavity had been left ahead of the working-face. This cavity was about 16 feet deep, about 9 feet wide, and 8 feet high. The aperture or mouth was small and bulged out inside, probably due to the roof and sides caving, either while the gas was blowing out or after. This place is about 600 feet south from the No. 3 room, which blew out on November 7th, No. 3 room being driven north and No. 26 room south from No. 10 East slope.

"I interviewed nearly all the workmen who were in the vicinity when the blow-out occurred, and it is noticeable that for at least two places on either side of No. 26 room the workmen thought it was coming out in their place, the rumbling sounded so close.

"About five places away nothing very peculiar was noticed, as slight 'bumps' are common, and the men continued to work until withdrawn by the fireboss; this refers to the workmen on the other split.

"All the workmen in the vicinity agree that they knew there was going to be a blow-out, as it seemed to roll, just like thunder, or a car running above you, for about two to four minutes; therefore they were all out on the Main slope before it blew out. Even there the amount of dust was noticeable, and the gas, of course, filled the air-current on the return side. No. 26 room is the first place on the North split, and there was no extra amount of gas in the South split.

"Personally, I think, after investigating this blow-out, that it was not nearly as strong as that of November 7th, and sufficient time or warning seemed to have been given to allow of the men escaping before it occurred. I have tried to impress, and have requested the officials to do so, the importance of the men, whenever they hear the noise indicative of a blow-out, to immediately retire, and at the same time to warn any who are near the place.

"It may be that these blow-outs may get less as we travel south, but it will require some time to determine; the overburden at this point is not excessive, and so far there is no coal taken out underneath. I am enclosing a sketch, which will give you an idea of the position.

"None of the timbers were blown out; on the high side (where the blow-out occurred) the timbers were scarcely disturbed, while on the low side the posts were all swung outwards for four sets."

"Bumps."

No severe "bumps" have occurred during the year, but several small disturbances have been reported, which resulted in caves occurring at the working-faces and the liberation of large quantities of methane, causing the workmen to withdraw from the mine.

It is the opinion of the writer that a great many of these caves resulting from these small disturbances could be avoided by the use of heavier timber and more care being given to the lagging and bracing of the same.

MINE FIRES.

There has been more or less trouble with mine fires during the year at Corbin, Coal Creek, and Princeton Collieries.

The fire reported at Corbin Colliery during 1917 spread to a lower level, but was successfully sealed off in October, 1918.

There was a very serious outbreak of fire in No. 1 South mine, Coal Creek Colliery, reported early in November, which was successfully dealt with by loading out. Fortunately there was a good supply of water convenient, by the use of which the fire was kept from spreading until the burning material was loaded out, which was successfully accomplished about the middle of December.

A further outbreak in the old fire area was reported from the Princeton Colliery during the latter end of November. This area has been sealed off from the remainder of the mine for some time, but the fire burned over the stoppings into the present working; this was sealed off again by building a new line of stoppings outside of the old ones.

The fires reported this year were originated by spontaneous combustion, the principal cause of which is lack of sufficient ventilation. Sufficient attention is not exercised by the management in keeping old districts in a reasonably good condition. Abandoned districts should be effectively sealed off or thoroughly ventilated.

EXPLOSIONS.

No explosions occurred during the year 1918. A further report is herewith submitted on the explosion which occurred in No. 3 mine, Coal Creek Colliery, on April 5th, 1917.

IMPROVEMENTS INAUGURATED IN THE MINES OF THE PROVINCE DURING THE YEAR.

A further reduction in the use of naked lights in coal-mines was effected during the year. There is only one mine, which is a small one, that is using naked lights. A few naked lights are used on the main haulage-roads in three other mines where electric haulage is in use.

Introduction of Electric Safety-lamps.—The total number of electric safety-lamps in use in the Province at the end of 1918 is 2,665, an increase of 1,107 during the year. Over 61 per cent. of the safety-lamps in use in the Province are electric lamps.

The electric safety-lamp is finding much favour with both the operators and workmen, and it is claimed by some of the larger operating companies that it has reduced the minor accidents 50 per cent. Apart from the above, it gives almost as much light as a naked light, without the risk attached to the use of the latter.

Introduction of the Burrell Gas-detector.—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. It has frequently been checked by chemical analyses of samples taken at the same time, and the results have been remarkable. All the mines are now equipped with this detector, and the Inspectors on each monthly visit test all the return air of the various splits and main return airway. The officials of the company have them in use daily. Tabulated data showing comparison between tests made with Burrell gas-detector and chemical analyses on 149 samples is herewith attached.

COMPARATIVE TESTS TAKEN WITH BURRELL GAS-DETECTOR AND CHEMICAL ANALYSIS.

Crowsnest District.

(Samples taken by Inspectors Robert Strachan and Wm. Lancaster.)

[illegible]

Vancouver Island.
(Samples taken by Dudley Michell.)

Sample No.	Chemical Analysis.	Burrell Detector.	Sample No.	Chemical Analysis.	Burrell Detector.
117.....	0.29	0.4	179.....	2.27	2.1
89.....	0.41	0.5	183.....	2.16	2.2
113.....	0.34	0.3	184.....	2.18	2.0
142.....	0.35	0.7	185.....	2.12	1.7
95.....	0.76	0.8	186.....	0.17	0.2
112.....	0.83	0.8	192.....	0.78	0.6
143.....	0.83	0.9	100.....	0.75	0.4
98.....	0.34	0.4	125.....	0.93	0.5
114.....	0.35	0.3	157.....	1.07	1.0
145.....	0.33	0.3	180.....	1.88	1.6
101.....	1.63	1.3	128.....	0.79	0.5
127.....	1.50	1.4	159.....	0.88	1.0
158.....	1.49	1.7	182.....	1.18	1.2
126.....	1.34	1.5	106.....	0.29	0.2
188.....	1.81	1.9	129.....	0.29	0.3
189.....	0.34	0.2	131.....	0.13	0.3
99.....	1.83	1.7			
124.....	1.59	1.6	Average of 35 samples.....	1.02	0.98
156.....	1.76	1.9			

Totals.—Average of 149 check samples taken during 1918: Chemical analysis, 1.17 per cent.; Burrell gas-detector, 1.10 per cent.

Treatment of Coal-dust.—The coal-dust question has received very serious attention during the year, and various treatments have been adopted at the mines in the Province.

Ventilation.—A good deal of attention has been given during the year to ventilation, and special efforts have been made to keep the percentage of methane in the return airways down to a minimum. Gratifying results have been obtained in the Crowsnest Pass District, and I have before me a report from the Senior Inspector of the district, an extract from which reads as follows: "The percentage of methane in the various air-currents is fairly low, as shown by the Burrell gas-detector, only in four cases rising above 1 per cent.—namely, South level split, No. 3 mine; No. 1 South; North split, No. 1 East; and the incline split, No. B North, of Coal Creek mines.

"In Michel only one split—namely, the West split, No. 3 East mine—shows above 1 per cent."

MINE-AIR SAMPLING IN METALLIFEROUS MINES.

During the year 1918 thirty-five mine-air samples were taken in the metalliferous mines of the Province. Of this number, eight were spoiled in transit, accidents, laboratory, or by reason of incomplete records. Much valuable information has been obtained from these samples in reference to the hydrogen, carbon-monoxide, and carbon-dioxide contents.

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, 1918.

East Kootenay District.

Sample No.	Date.	Mine.	Location in Mine.	CHEMICAL ANALYSIS.					HYGROMETER.			Remarks.
				CO ₂ .	O.	CO.	H.	N.	Dry Bulb.	Wet Bulb.	Humid-ity.	
3	Aug. 7	Sullivan	1,087 stope	0.20	20.46	0.04		79.30	48	48	100	Sample taken 8 hours after blasting.
4	" 7	"	1,188 "	0.28	20.33	0.06		79.33	50	49	93	Sample taken 16 hours after blasting.
5	Sept. 10	Lake Shore	1,732 "	0.06	20.84			79.10	51	51	100	Sample taken 17 hours after blasting.
6	" 14	Sullivan	1,084 "	0.17	20.54			79.29	60	60	100	Sample taken 4 hours after blasting.
7	" 14	"	1,189 "	0.26	20.24			79.49	64	64	100	Sample taken 4 hours after blasting.

West Kootenay District.

1	Nov. 15	Bluebell	350 feet down shaft	0.12	20.72			79.16				
2	" 16	Highland	In face of lower tunnel, 1,700 feet from surface	0.35	20.42	0.05		79.18				
3	" 17	Florence	At face of No. 5 tunnel	0.08	20.78	0.03		79.11				
4	" 27	Granby	No. 2 tunnel, 1,000 feet from surface	0.03	20.95			79.02				
18	Mar. 9	Le Roi No. 2	Stope No. 6, P.E.	0.25	20.50			79.25				
19	Nov. 13	Emerald	150 feet from face of No. 4 tunnel	0.14	20.70			79.16				
20	" 15	Eureka	100 feet from face of No. 3 tunnel	0.25	20.52			79.23				
21	" 21	Galena Farm	No. 1 stope off intermediate level	0.12	20.82			79.06				
22	" 21	Bosun	50 feet from face of No. 4 tunnel	0.04	20.89			79.07				Sample taken 17 hours after blasting.
23	" 26	War Eagle	617 crosscut north	0.25	20.75			79.00				Sample taken 21 hours after blasting.
25	" 28	Le Roi	1,689 crosscut west	0.08	20.78			79.14				Sample taken 8½ hours after blasting.
26	" 29	Le Roi No. 2	No. 5 G.W. winze	0.09	20.80			79.11				Sample taken 8½ hours after blasting.
27	Dec. 7	Inland Empire	Stope 60 feet below Main tunnel level	0.08	20.76	Trace.		79.16				Sample taken 17½ hours after blasting.

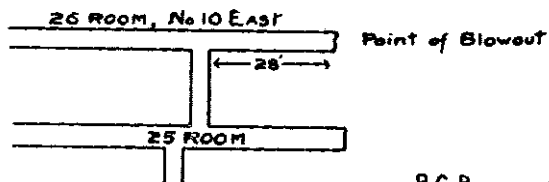
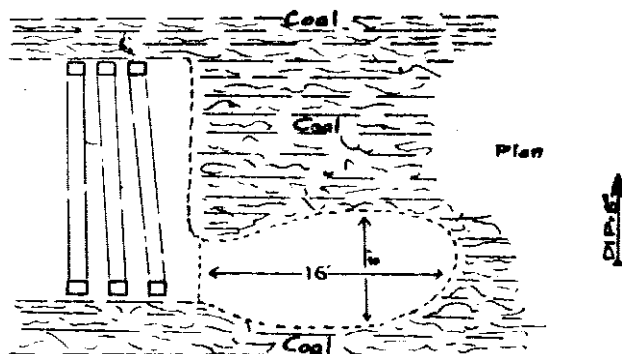
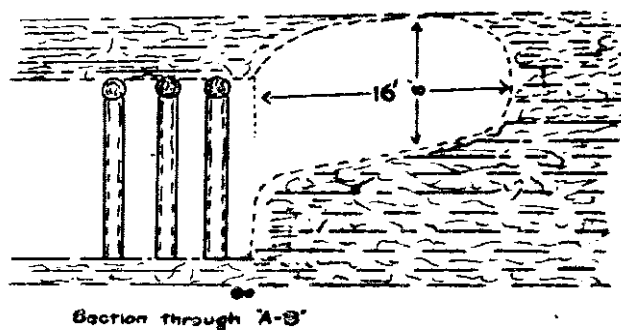
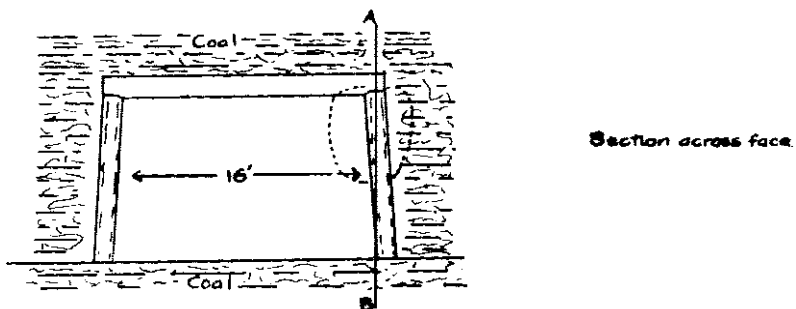
Coast District.

13	Dec. 4	Britannia	Wylie stope, E. 1,000-foot level	0.05	20.82	Trace.		79.13	45	45	100	Sample taken 7½ hours after blasting.
14	" 4	"	Gillies stope, W. 850-foot level	0.09	20.79	"		79.12	44	44	100	Sample taken 9 hours after blasting.
15	" 5	"	Huff stope, 1,200-foot level	0.06	20.82	"		79.12	42	42	100	Sample taken 3½ hours after blasting.
16	" 5	"	Zero vein, Jane Creek tunnel	0.30	20.56	"		79.14	45	44	93	Sample taken 9 hours after blasting.
17	" 5	"	Beta tunnel	0.73	19.49	0.11		79.67	50	50	100	Sample contains trace of ethylene.

Northern District.

23	Nov. 15	Drum Lummon	No. 1 stope	0.29	20.04		0.05	79.82	60	50	76	
24	" 16	"	Main drift, 400 feet from portal	0.11	20.79		0.03	79.07	60	56	76	
25	" 25	Hidden Creek	60 drift, near 113 chute	0.05	20.86		Trace.	79.09	62	54	58	Sample taken 6 hours after blasting.
26	" 25	"	730 drift, 530 level	0.09	20.85		"	79.06	62	54	58	Sample taken 6 hours after blasting.
29	" 26	Quartz Point	No. 3 stope	0.13	20.82		"	79.05	68	62	68	Sample taken 5 hours after blasting.
30	" 27	Macy Quartz	No. 1 drift, No. 1 pocket	0.09	20.69	Trace.	"	79.22	66	62	78	

Sketch to illustrate 'Blow-out' in N^o 26 Room,
N^o 1 East Mine, Coal Creek, B.C. (seam 15' to 30' thick)



B.C. Bureau of Mines.

I am much indebted to Dr. Eugene Haanel, Director of the Mines Branch, Ottawa, for co-operation in the work; the Dominion Department furnishing the sample-bottles, with franking privileges, and making all analysis without charge of any kind.

MINE-RESCUE WORK.

During the year the Department ordered six sets of the Gibbs oxygen breathing apparatus for the Fernie Mine-rescue Station. This apparatus has been proven much more efficient than the Draeger or Proto apparatus.

The Canadian Western Fuel Company ordered six sets of Gibbs, the Granby Consolidated Mining, Smelting, and Power Company four sets, and the Pacific Coast Coal Company two sets, making a total of eighteen sets ordered during the year. Shipments of the above have been delayed owing to the priority of war contracts. The Mine Safety Appliance Company is the distributors of this apparatus, which is built by the Edison Phonograph Works under contract to the United States Bureau of Mines. The first 500 sets of this apparatus were supplied to the United States Government during the latter part of 1918.

There were nineteen certificates of competency in mine-rescue work issued by the Department during the year; four at Nanaimo, fourteen at Cumberland, and one at Fernie, as shown by the attached list:—

LIST OF PERSONS WHO HAVE RECEIVED MINE-RESCUE CERTIFICATES DURING THE YEAR 1918.

Date.	Name.	Where trained.	Cert. No.	Date.	Name.	Where trained.	Cert. No.
April 30	Laird, Robert.....	Nanaimo....	400	June 12	Swanson, Sinclair	Cumberland..	410
" 30	Holliday, William	"	401	" 12	Franceschini, Louis...	"	411
" 30	Nichol, Richard.....	"	402	" 12	Biggs, John G.....	"	412
" 30	Wallace, George.....	"	403	" 12	Evans, William George	"	413
June 12	Wilkinson, George....	Cumberland..	404	" 12	Quinn, John Graham .	"	414
" 12	Thomson, John	"	405	" 12	Brown, Robert.....	"	415
" 12	Gillies, William	"	406	" 12	Graham, Charles	"	416
" 12	Williams, John S.....	"	407	" 12	Beveridge, William...	"	417
" 12	Eccleston, Thomas....	"	408	Oct. 4 24	Puckey, John T	Fernie	418
" 12	Domanis, Alexander..	"	409				

TECHNICAL CLASSES ON MINING.

Considerable interest has been maintained in this work around the coal-mining centres. The chief difficulty met with seems to be getting classes to suit the different shifts.

Considerable attention is being given by the Education Department and the Mines Department towards issuing a Government correspondence course for firebosses and shotlighters, overmen and managers, also a course for mine surveyors. This should be of great value to men wishing to qualify for certificates of competency.

SUPERVISION OF COAL-MINES.

During the year fourteen coal companies operated seventeen collieries, with thirty-nine mines, employing 3,658 men underground. In the supervision of these underground employees there were twenty-two managers, thirty-two overmen, and 175 firebosses and shotlighters, a total of 229 officials, or one official for every sixteen 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.

In the light of the experience of the past year, I beg to submit the following concluding remarks and suggestions:—

SUGGESTIONS REGARDING LEGISLATION.

From the evidence brought out at the inquest in connection with explosion at No. 3 mine, Coal Creek, and the subsequent tests made regarding the percentage of methane in the air-current to height of flame-cap on a safety-lamp, it is apparent that some rule should be embodied in the "Coal-mines Regulation Act" compelling the withdrawal of men when the percentage reaches a fixed quantity. The limit set by the British Act is 2½ per cent. A rule has been established

by the management of the Crowsnest Pass mines, at the suggestion of the Mines Department, to the effect of establishing the withdrawal percentage at $2\frac{1}{2}$ per cent., or $\frac{1}{4}$ -inch gas-cap, but this rule should be embodied in the "Coal-mines Regulation Act."

While blasting did not enter into this explosion as a possible cause, the writer is of the opinion that some limit should be set for the permissive percentage of gas in the air in which to allow blasting operations.

At the present time 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 a 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 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-face." 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 a 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 in the British Columbia "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 consequently 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, or even in the neighbouring Provinces, is the Inspector compelled to visit each mine and every part thereof monthly, but can make them oftener where 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 of the Act carried out, and thereby neglecting their own duties in that respect.

LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY IN MINE-RESCUE TRAINING FOR THE PROVINCE
OF BRITISH COLUMBIA.

Name.	Date.	Cert. No.	Name.	Date.	Cert. No.
Adamson, Robert	Sept. 2, 1913	45	Clark, Joseph	July 23, 1915	221
Addison, Walker	Jan. 26, 1916	289	Clark, Louis	July 23, 1915	214
Ainsworth, Edward	May 5, 1914	124	Clarkstone, Wm. Walter	March 6th, 1916	308
Aitken, Thomas M.	Jan. 26, 1916	261	Clements, Edwin F.	Oct. 13, 1916	356
Almond, Walter	July 24, 1916	343	Commons, William	June 30, 1913	22
Allan, Alexander McD.	June 30, 1913	32	Coomb, Alexander	Jan. 26, 1914	117
Allan, Hamilton	July 27, 1917	360	Corlett, William D.	June 1, 1914	150
Andren, Alfred	Jan. 28, 1916	303	Courtney, Albert Warren	July 27, 1917	363
Anderson, Robert	June 30, 1913	27	Craig, James	July 15, 1916	324
Arbuckle, John	July 1, 1914	157	Crawford, David	Sept. 12, 1913	80
Archibald, George	July 23, 1915	222	Crichton, Robert	Aug. 1, 1914	161
Archibald, Thomas	Sept. 6, 1916	353	Crosscombe, James	Nov. 1, 1914	178
Baggaley, John	June 10, 1913	15	Cullinane, James	Nov. 1, 1914	169
Bain, James	Nov. 1, 1913	90	Cunliffe, Thomas	Dec. 1, 1914	192
Ball, Alfred	July 24, 1916	341	Dando, Caleb	June 30, 1915	216
Ball, Benjamin	Dec. 1, 1914	190	Dando, Caleb V.	June 30, 1915	213
Barlow, Benjamin R.	Oct. 20, 1917	392	Dando John	June 30, 1915	212
Barnes, James	Nov. 1, 1914	177	Davidson, Hugh McL	Nov. 25, 1915	234
Barton, Joseph	June 1, 1914	129	Davidson, Norman	Jan. 28, 1916	301
Baxter, Robert	Oct. 20, 1917	394	Davis, Stephen	June 22, 1916	314
Baybutt, Thomas	Dec. 12, 1914	199	Dean, John	Jan. 26, 1916	262
Beck, Alexander	Jan. 26, 1914	114	Delaney, James	Nov. 25, 1915	233
Bell, Frederick	Dec. 22, 1915	247	Devlin, Henry	Jan. 26, 1914	104
Bell, John	July 1, 1914	151	Dickinson, Clifford	June 1, 1914	128
Bell, William E.	July 15, 1916	329	Dickson, James	June 1, 1914	141
Bengtson, Victor	Aug. 27, 1917	378	Dignan, William	Oct. 20, 1917	396
Bennett, Andrew M.	Oct. 13, 1916	357	Domenis, Alex.	June 12, 1918	409
Bevis, Nathaniel	Dec. 22, 1915	254	Drake, Samuel	Jan. 26, 1916	281
Beveridge, James	July 1, 1914	158	Duncan, James	July 1, 1914	153
Beveridge, William	June 12, 1918	417	Dunnigan, James	July 23, 1915	225
Biggs, John	June 10, 1913	18	Dykes, Joseph W.	Jan. 26, 1916	257
Biggs, John G.	June 12, 1918	412	Eccleston, Thomas	June 12, 1918	408
Blair, J.	Sept. 12, 1913	66	Evans, William G.	June 12, 1918	413
Blass, Emile	July 27, 1917	361	Ewart, Alexander	Sept. 12, 1913	71
Bonar, Robert	Jan. 26, 1916	263	Ewing, Robert F.	June 22, 1916	318
Bond, Frank	Sept. 12, 1913	81	Fairfoull, James	Sept. 12, 1913	72
Brace, Tom	Sept. 12, 1913	54	Fawcett, Albert	March 6, 1916	307
Bradshaw, George	Jan. 26, 1914	116	Ferguson, James N.	June 22, 1916	313
Broderick, Matthew	June 30, 1915	214	Fisher, John H.	Nov. 1, 1915	229
Brough, William F.	Jan. 26, 1916	272	Foran, John T.	Nov. 1, 1914	182
Brown, Alexander	March 6, 1916	311	Fowler, Robert	June 30, 1913	35
Brown, David	Jan. 26, 1916	276	France, Thomas	Nov. 1, 1913	88
Brown, Edward	Nov. 1, 1914	179	Franceschini, Louis	June 12, 1918	411
Brown, Frank	Oct. 10, 1917	391	Frater, George	July 15, 1916	327
Brown, James	June 30, 1915	210	Frearson, Albert W.	Dec. 1, 1913	95
Brown, John	June 30, 1915	209	Freeland, P. B.	Jan. 28, 1916	302
Brown, John T.	Sept. 12, 1913	69	Freeman, Henry N.	June 1, 1914	134
Brown, Robert	June 12, 1918	415	Frew, Andrew	Dec. 1, 1914	193
Brown, Robert J.	June 30, 1913	23	Galloway, James	July 27, 1917	364
Brown, R. S.	Sept. 12, 1913	63	Geater, James G.	Oct. 20, 1917	395
Brown, William A.	Dec. 15, 1913	99	Gemmell, James	Sept. 12, 1913	60
Brunt, Henry	July 15, 1916	335	Gibson, Edward	Jan. 26, 1916	285
Bryce, Richard	Dec. 22, 1915	248	Gillespie, John	June 30, 1915	208
Buchanan, Henry	Dec. 22, 1915	251	Gillies, William	June 12, 1918	406
Bullen, Thomas	Sept. 12, 1913	75	Gould, Alfred	Jan. 26, 1916	264
Bushell, James P.	June 30, 1913	36	Gourlay, Robert	Oct. 20, 1917	393
Callow, Charles	Oct. 13, 1916	359	Graham, Charles	June 12, 1918	416
Campbell, Andrew	July 27, 1917	362	Graham, Thomas	Jan. 26, 1914	105
Cameron, Samuel	Dec. 22, 1915	250	Gray, George	June 1, 1914	137
Carson, George	June 1, 1914	139	Green, Francis	Nov. 1, 1914	186
Caufield, Bernard	Sept. 1, 1914	166	Greenhorn, John	July 27, 1917	365
Caufield, Edward	Sept. 1, 1914	165	Gregory, William	Sept. 1, 1914	167
Caufield, John	Sept. 2, 1913	43	Griffiths, John	June 1, 1914	149
Challoner, John A.	Jan. 26, 1916	280	Groutage, Edgar E.	Nov. 1, 1915	230
Charnock, John	Sept. 27, 1917	385	Guinness, Matthew	Jan. 26, 1914	120
Chester, John	Sept. 2, 1913	44	Hamer Joseph	Nov. 1, 1913	86

LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY—Continued.

Name.	Date.	Cert. No.	Name.	Date.	Cert. No.
Hamilton, John.....	June 1, 1914	135	Lunan, George.....	Sept. 6, 1916	346
Hamilton, John.....	July 27, 1917	366	Lynch, Stewart.....	June 30, 1913	28
Hamilton, Robert.....	June 1, 1914	130	Maffeo, Peter.....	July 27, 1917	369
Hancock, Arthur.....	Dec. 15, 1913	100	Male, Philip.....	July 15, 1916	326
Harrison, Albert E.....	Oct. 1, 1914	171	Malone, Patrick.....	Nov. 25, 1915	237
Hawkins, John.....	Nov. 1, 1914	183	Matlman, James.....	June 30, 1913	34
Hays, William.....	July 23, 1915	223	Marrs, John.....	Jan. 26, 1916	287
Healer, Robert.....	Nov. 1, 1915	227	March, John.....	July 24, 1916	342
Hemer, Herbert.....	June 1, 1914	132	Martin, David.....	June 10, 1913	6
Henderson, Robert.....	Dec. 22, 1915	245	Martin, David, Jr.....	Aug. 1, 1914	160
Hendry, James.....	Sept. 12, 1913	57	Martin, Henry.....	May 5, 1914	123
Herd, William.....	June 30, 1915	203	Mason, Joseph.....	Dec. 1, 1914	194
Hesketh, Edward.....	June 1, 1914	143	Mason, Thomas.....	Jan. 26, 1916	279
Heyes, Edward.....	Dec. 1, 1914	191	Mawson, John T.....	Sept. 2, 1913	46
Hindmarsh, Thomas.....	Sept. 6, 1916	352	Maxwell, George.....	Sept. 6, 1916	347
Hodgson, James.....	Jan. 26, 1916	273	Meek, Matthew.....	June 22, 1916	319
Hollands, Alexander.....	Sept. 6, 1916	351	Mercer, James.....	Dec. 18, 1917	398
Holliday, William.....	April 30, 1918	401	Miard, Henry E.....	June 10, 1913	11
Houston, Robert.....	June 22, 1916	312	Michell, Dudley.....	June 10, 1913	13
Howden, Archibald B.....	Dec. 1, 1913	93	Michell, George G.....	March 6, 1916	305
Huby, Norman.....	Dec. 22, 1915	252	Millar, John A.....	Jan. 28, 1916	297
Hudson, George.....	Sept. 12, 1913	77	Miscisco, Nicholas.....	June 1, 1914	144
Hughes, J. C.....	Sept. 12, 1913	79	Mitchell, Henry.....	Nov. 25, 1915	243
Hunt, John.....	Jan. 26, 1916	282	Montgomery, Edgar G.....	Oct. 1, 1914	172
Hunter, Frederick.....	Jan. 26, 1916	283	Moore, George.....	July 15, 1916	323
Hunter, Thomas.....	July 27, 1917	367	Moore, John.....	Sept. 2, 1913	51
Hunter, William.....	Sept. 1, 1914	163	Moore, William H.....	June 1, 1914	125
Hutson, Frederick.....	Dec. 1, 1913	96	Mordy, Thomas.....	Dec. 22, 1915	246
Hynds, William.....	Oct. 10, 1917	388	Morgan, John.....	Nov. 25, 1915	241
Irving, Thomas.....	July 15, 1916	333	Morgan, William.....	Oct. 10, 1917	389
Ivey, George D.....	Aug. 27, 1917	381	Morris, David.....	Dec. 15, 1913	101
Jackson, Thomas R.....	Nov. 1, 1914	184	Mottishaw, Samuel K.....	Jan. 26, 1916	294
James, David.....	Nov. 1, 1913	87	Moyes, James.....	July 23, 1915	218
James, Edward.....	Nov. 1, 1915	228	Murphy, Andrew.....	Jan. 26, 1916	265
James, William.....	Nov. 25, 1915	242	Musgrove, John.....	June 30, 1913	25
Jardine, Alfred.....	June 1, 1914	131	Myers, Peter.....	June 30, 1915	202
Jaynes, Frank.....	June 30, 1915	201	McAlpine, John.....	June 30, 1913	38
Jemson, James W.....	Jan. 26, 1914	119	McArthur, John.....	June 1, 1914	126
John Francis.....	Jan. 26, 1916	260	McCourt, John.....	July 1, 1914	154
John, Howell.....	Sept. 12, 1913	59	McDonald, Allan.....	July 27, 1917	370
Johnstone, Robert.....	Aug. 1, 1914	159	McDonald, J.....	Sept. 12, 1913	78
Jolly, Andrew.....	July 15, 1916	332	McFagan, Alexander.....	Sept. 2, 1913	49
Jones Evan.....	Nov. 1, 1913	91	McFegan, William.....	June 10, 1913	12
Jones, Samuel.....	June 30, 1915	206	McGrath, James.....	Sept. 6, 1916	355
Jones, Samuel.....	July 27, 1917	368	McGuckie, John.....	June 1, 1914	110
Jordon, Thomas.....	Jan. 26, 1916	270	McGuire, Thomas.....	Dec. 1, 1913	94
Joyce, Walter.....	Sept. 2, 1913	41	McKelvie, James.....	June 30, 1913	26
Kenny, Clair F.....	Jan. 26, 1916	268	McKendrick, Andrew.....	July 23, 1915	219
Kilburn, George H.....	Nov. 1, 1914	175	McKibben, Matthew.....	July 23, 1915	220
Kirkpatrick, James.....	July 15, 1916	337	McKinnon, D. A.....	Jan. 28, 1916	295
Kirkwood, John.....	Sept. 12, 1913	64	McLachlan, Alexander.....	Nov. 25, 1915	236
Knowles, James E.....	June 1, 1914	142	McLachlan, James.....	June 1, 1914	145
Laird, Robert.....	April 30, 1918	400	McLauchlin, John A.....	Jan. 28, 1916	296
Lancaster, William.....	June 10, 1913	7	McLean, Michael.....	Dec. 12, 1914	194
Lander, Frank.....	Sept. 2, 1913	42	McMillan, John H.....	June 30, 1915	208
Lane, Joseph.....	June 10, 1913	20	McMillan, R.....	Sept. 12, 1913	68
Lanfear, Herbert.....	Sept. 2, 1913	52	McNay, Carmichael.....	June 10, 1913	16
Lantermo, Antonio.....	Aug. 27, 1917	383	McNeil, Robert.....	Dec. 22, 1915	256
Lauderbach, Carl.....	June 22, 1916	320	McPherson, James E.....	Nov. 1, 1913	83
Lee, George.....	July 15, 1916	336	Neave, William.....	Jan. 26, 1914	111
Leeman, Thomas.....	Dec. 22, 1915	253	Neen, Joseph.....	Jan. 26, 1916	266
Lewis, Thomas.....	Jan. 26, 1916	274	Neilson, William.....	Sept. 6, 1916	345
Leynard, Paul.....	Jan. 26, 1916	292	Nelson, N. E.....	Jan. 28, 1916	298
Lindsay, William.....	Nov. 1, 1914	181	Newbury, Arthur.....	Jan. 26, 1916	286
Littler, Matthew.....	Dec. 12, 1914	197	Newman, John.....	Dec. 18, 1917	399
Loxton, George.....	Nov. 1, 1913	85	Newton, John.....	Jan. 26, 1914	103

LIST OF HOLDERS OF CERTIFICATES OF COMPETENCY—*Concluded.*

Name.	Date.	Cert. No.	Name.	Date.	Cert. No.
Nichol, Richard	April 30, 1918	402	Stacey, Reginald	Dec. 18, 1917	397
Nimmo, James	Nov. 1, 1914	187	Staton, Edward	Sept. 6, 1916	349
Nimmo, James Pollock, Jr.	July 27, 1917	371	Stephens, Ralph	March 6, 1916	309
Nisbet, Robert	Sept. 6, 1916	350	Stephens, Roy	Nov. 1, 1914	174
Norris, Joseph	Jan. 26, 1916	293	Stewart, Aaron	Jan. 26, 1916	269
O'Brien, Charles	Sept. 2, 1913	39	Stewart, Adam	Jan. 26, 1916	271
O'Brien, George	June 10, 1913	4	Stewart, James	June 10, 1913	9
O'Brien, Melbourne M.	Oct. 1, 1914	170	Stewart, John D.	Jan. 26, 1916	106
Osborne, Hugh	July 23, 1915	224	Stewart, Robert T.	Nov. 1, 1913	92
Oswald, George L.	Jan. 26, 1916	291	Stobbs, Ralph	Jan. 26, 1916	259
Park, Alexander	July 15, 1916	334	Stobbs, Jacob	Jan. 26, 1914	108
Parkinson, Harry	July 24, 1916	344	Stockwell, William	June 10, 1913	17
Parkinson, Thomas	June 1, 1914	133	Stone, William	July 23, 1915	226
Parnham, Charles	June 30, 1915	211	Strachan, Robert	June 10, 1913	2
Parrott, John	July 15, 1916	331	Strand, Peter	Aug. 27, 1917	382
Parsons, Herbert	Sept. 27, 1917	386	Strang, James	Nov. 25, 1915	239
Patterson, John	Jan. 26, 1916	275	Strang, James	June 22, 1916	315
Peacock, James	Aug. 27, 1917	379	Strang, Thomas	Nov. 25, 1915	240
Perry, James	Jan. 26, 1914	115	Strang, William	Sept. 12, 1913	73
Phelan, Arthur	Sept. 12, 1913	56	Sutherland, John	July 15, 1916	330
Phillips, James Henry	July 24, 1916	321	Swanson, Sinclair	June 12, 1918	410
Phillips, Richard	Sept. 27, 1917	387	Taylor, Edward	Dec. 1, 1913	98
Poole, S.	Sept. 12, 1913	65	Taylor, James	Dec. 1, 1913	97
Price, Walter	June 30, 1913	29	Taylor, J. T.	Sept. 12, 1913	55
Puckey, John T.	Oct. 24, 1918	418	Taylor, Thomas	Jan. 26, 1916	267
Purss, David	Nov. 15, 1915	238	Taylor, Thomas H.	Jan. 26, 1916	290
Quinn, James	July 24, 1916	340	Teahan, Denis	July 1, 1914	155
Quinn, John G.	June 12, 1918	414	Thacker, George	Sept. 12, 1913	62
Radcliffe, Joseph	Jan. 26, 1914	113	Thompson, John	June 30, 1915	207
Rafter, Robert	July 27, 1917	372	Thompson, Michael	July 27, 1917	375
Rafter, William Benjamin	July 27, 1917	373	Thomson, John	June 12, 1918	405
Rankin, George	June 30, 1913	31	Tipton, William C.	June 1, 1914	140
Rankin, William	June 30, 1913	33	Todd, Henry J.	July 15, 1916	328
Ratcliffe, Thomas	June 10, 1913	19	Toubey, James	Dec. 1, 1914	188
Reid, Robert	June 1, 1914	136	Turnbull, Matthew	Sept. 27, 1917	384
Reid, Thomas	Oct. 10, 1917	390	Tully, Matthew	May 5, 1914	121
Richards, James	Jan. 26, 1916	284	Tully, Thomas	May 5, 1914	122
Rickard, John William	July 27, 1917	374	Vardy, Robert	Sept. 12, 1913	61
Roberts, Thomas D.	Nov. 1, 1914	176	Walker, George M.	Sept. 6, 1916	354
Robertson, James H.	Jan. 26, 1916	277	Wallace, George	April 29, 1918	403
Rogers, Ellis	Dec. 22, 1915	249	Wallbank, John W.	June 1, 1914	127
Roper, William	July 15, 1916	339	Wallis, John	Nov. 1, 1915	231
Rowan, Alexander	Nov. 1, 1914	185	Wardrop, James	June 30, 1913	30
Rowbottom, Thomas	Sept. 12, 1913	70	Warburton, Leonard E.	Sept. 12, 1913	74
Rowlands, Evon J.	Aug. 27, 1917	380	Watson, Adam G.	June 10, 1913	10
Rutledge, Edwin	June 30, 1913	37	Watson, Arthur	Nov. 25, 1915	244
Scott, George	July 15, 1916	325	Watson, Joseph	June 22, 1916	310
Scott, Thomas W.	June 30, 1915	215	Waugh, Andrew W.	Jan. 26, 1916	288
Seaton, C. A.	Nov. 1, 1915	232	Weeks, John	Jan. 26, 1914	109
Seggie, Robert	Jan. 26, 1914	118	Wesledge, William	Sept. 12, 1913	50
Shanks, David	Sept. 12, 1913	48	White, William	June 10, 1913	21
Shanks, John	June 10, 1913	5	Whitehouse, William	Dec. 12, 1914	196
Sharp, James	Sept. 12, 1913	67	Wilcox, J.	Sept. 12, 1913	58
Shaw, Thomas J.	Nov. 1, 1913	89	Wilkinson, George	June 12, 1918	404
Shaw, William	June 30, 1913	24	Wilkinson, Edward	Jan. 26, 1916	258
Shelley, Rowland B.	Oct. 1, 1914	168	Williams, John S.	June 12, 1918	407
Sherwin, Edward	Sept. 1, 1914	162	Williams, Thomas H.	June 10, 1913	3
Simpson, Ralph	March 6, 1916	306	Williams, Watkin	June 1, 1914	138
Skimming John	Sept. 6, 1916	348	Williams, William D.	Jan. 28, 1916	299
Smith, Arthur E.	Sept. 12, 1913	82	Wilson, Thomas	Nov. 1, 1913	84
Smith, George	Nov. 25, 1915	235	Wilson, William	June 10, 1913	8
Smith, Thomas	Jan. 26, 1916	278	Winstanley, Henry	July 27, 1917	376
Solowski, Angus	Dec. 15, 1913	102	Worthington, Joseph	Sept. 2, 1913	40
Spicer, John E.	Dec. 22, 1915	255	Wright, John	June 22, 1916	316
Spruston, Robert L.	Dec. 1, 1914	189	Yarrow, George	Jan. 26, 1914	112
Spruston, Thomas A.	June 30, 1915	200	Young, Joseph	July 15, 1916	322

FIRST-AID WORK.

REPORT OF DUDLEY MICHELL, FIRST-AID INSTRUCTOR.

I have the honour to submit herewith a report on the first-aid instruction in the coal and metalliferous mines of the Province for the year ending December 31st, 1918.

During the year approximately 200 mining employees attended a course of lectures on first-aid work given by the various mine doctors. The total number passing final examinations and who were awarded certificates of various grades issued by the St. John Ambulance Association is placed at ninety-four. The location of the class, number attending lectures, and number passing final examinations is as follows:—

Place.	PASSED EXAMINATIONS.				Total.
	First Year.	Second Year.	Third Year.	Fourth Year.	
Nanaimo.....	27	4	2	2	35
Cumberland.....	1	..	1	..	2
Fernie.....	10	3	2	..	15
Michel.....	4	..	5	2	11
Corbin.....	7	2	..	..	9
Anyox.....	16	..	..	..	16
Kimberley.....	6	..	..	..	6
Totals	71	9	10	4	94

From the commencement of systematic first-aid training in the mining centres of the Province until the close of 1918 there have been 944 mining employees who have passed examinations in this work.

Upon your instructions, I commenced taking mine-air samples in each operating mine of the Vancouver Island and Nicola coal-mines on March 1st. These samples were taken periodically, and much information was obtained as to the gas-outflow, etc. Statistics on same have been prepared and submitted to you. During 1918 I have taken 226 mine-air samples.

EXPLOSION IN No. 3 MINE, COAL CREEK COLLIERY, APRIL 5TH, 1917.*

REPORT BY GEORGE WILKINSON, CHIEF INSPECTOR.

I have the honour to submit the following additional report on the explosion which occurred in No. 3 mine, Coal Creek Colliery, on April 5th, 1917, resulting in the loss of thirty-four lives:—

At the time of the examination made immediately after the occurrence of the explosion, the general opinion was, with which the writer agreed, that the force of the explosion originated in the levels inside of No. 6 incline and split at the foot of No. 6 incline. A part of the same travelled up No. 6 incline, splitting again at No. 1 room off No. 6 incline, a part going up the incline and a part into No. 1 room up crosscut and into No. 2 room; up the crosscut to No. 3 room; out of No. 3 room and going again on No. 6 incline into Nos. 4 and 5 rooms and No. 6 incline. This force broke the stoppings between Nos. 5 and 6 inclines and passed direct through to No. 4 Incline district. The other part that went into Nos. 5 and 6 inclines made conflicting lines of force, but eventually joined up with forces going into No. 4 Incline district. Nos. 5 and 6 inclines and Nos. 4 and 5 rooms being practically blind ends or culs-de-sac, conflicting lines of force could be expected at this point. The forces going through No. 4 Incline district came down Nos. 3 and 4 inclines, joining the forces from Nos. 5 and 6 inclines, and were outwards from that point. All lines of force on the counter-level were outward, going up crosscuts at some places on to the Main level.

In my former report, under the heading of "Deductions as to the Initial Point of Explosion," I stated as follows: "The lines of force as found in the mine seem to indicate that the point of origin was somewhere inside of No. 6 incline. As to where inside of this point the explosion originated it is premature as yet to decide, but, personally, I am inclined to think there was a primary explosion of fire-damp within this area which was propagated through the mine by the agency of coal-dust."

From the additional evidence found, I have no reason to change the opinion then stated, but believe that the actual point of ignition can now be accepted as having taken place at the face of the crosscut off the counter-level.

CONDITIONS FOUND AT FOOT OF NOS. 5 AND 6 INCLINES AND FROM THERE INTO FACES OF LEVEL, COUNTER-LEVEL, AND CROSSCUT OFF COUNTER-LEVEL.

During the recovery-work at the bottom of Nos. 5 and 6 inclines the bodies of Drivers Richardson, Bagglioli, Evans, McDougall, and Clarkstone were found, and conditions show that the most of the damage done to the cars seems to have been done by a force which came from the inside of the level, the upper structure of the empty cars being all stripped and thrown outwards.

Three of the bodies recovered at this point had their heads pointing outwards, two of which were lying on their faces. The body of Richardson seems to have been half-turned around, as if he had been thrown outward, his head behind the loaded car, which he seems to have been assisting Bagglioli to push down to the loaded trip. Clarkstone, who was holding two horses and was standing on the empty track, seems to have been looking towards the face of the level; he was holding his own horse and Bagglioli's, his own horse being attached to an empty car. The custom was for each driver to take an empty car out to the foot of the slope, so as to get a ride out. Clarkstone, who was severely burned, all the clothes being stripped off the body from the knees to the shoulder, was found with his left arm up and over his eyes as if to protect them, his mouth open and tongue protruding; and while there were indications of burning on the other three bodies, Richardson, Bagglioli, and Evans, none of them was so severe as with Clarkstone. McDougall's body was found lying about 10 feet inside of No. 6 incline, doubled up with a heavy timber across the shoulders, pressing the head down so that the face was resting on the chest, head and feet both pointing outward. It seems as if the horse must have been blown outwards and out of the shafts, the driver being thrown into the position occupied by the horse and the falling timber held the body there. McDougall's horse was found lying across the loaded track, head pointing inwards, while its collar was found about 12 feet farther inside.

Lamp No. 3449 was broken into two separate pieces. The bottom was found beside the first empty car 5 feet inside from McDougall's body, the top on the base of the second car. This

* Special preliminary reports on this explosion by Geo. Wilkinson, Thos. Graham, and Jas. Ashworth were published in an appendix to the Report of Minister of Mines for 1917.

lamp was issued to Driver Evans and McDougall's lamp was found with Evans. The woodwork on the empty cars was completely smashed, but very little damage was done to the loaded cars.

The bodies of Puillandre and Redoulez, the two miners who worked in the Main level, were found on their way out at a point about 500 feet from their working-face; both bodies were found lying on their backs, head pointing outwards, and were stripped of clothing, apart from two pieces of overall, very little indication of clothing being found.

One safety-lamp was found with these men and was found broken in two separate pieces. The bottom was found on the high side of the roadway, 13 feet inside of Puillandre and 4 feet inside of Redoulez, and the top frame 28 feet farther inby. The gauzes were found outside the top part and 6 inches away.

The trap-door in the haulage-road crosscut, which was variously estimated as being from 20 to 30 feet off the Main level towards the counter, presumably had been blown upwards, as the only portion found was one hinge and one socket; these were found at the top of the crosscut practically on the Main level. The evidences of force from the position of timbers is conflicting, some being outward and some inwards.

Proceeding in the counter-level, about 10 feet from the edge of the caving a shirt was found, and at the edge of the cave two sets of tools; then two dinner-pails; and on the right side going in, a rail-bender and safety-lamp.

At the foot of the crosscut, with his head towards the frog pointing outwards, the body of William Brown was found extended at full length, face downwards, and arms stretched forward.

At the face of the counter a car was almost loaded and off the track at the front end, and on the inside the body of Joe Bravin was found, lying between the floor-brushing and the car. Under the body was a saw-blade, while the handle was found a little nearer the face, and a safety-lamp was found beside the car-wheels on the raise side. This lamp was issued to Brown and the one inside of the rail-bender was issued to Bravin. At the face of the counter there was loose coal, as if the miners had loosened enough to complete the car, and their shovels were both sticking in the loose coal, as if they had been loading the loose coal when the explosion occurred. A pick lay on each side of the place and the axe was on the low side near the pick. A cap was found on the loose coal and one set of timber was lying on the floor, as if it had been blown out. Everything in and around the place was heavily coated with coked coal-dust, especially on the inside of the car; this was adhering very heavily to the car and could be lifted off in handfuls.

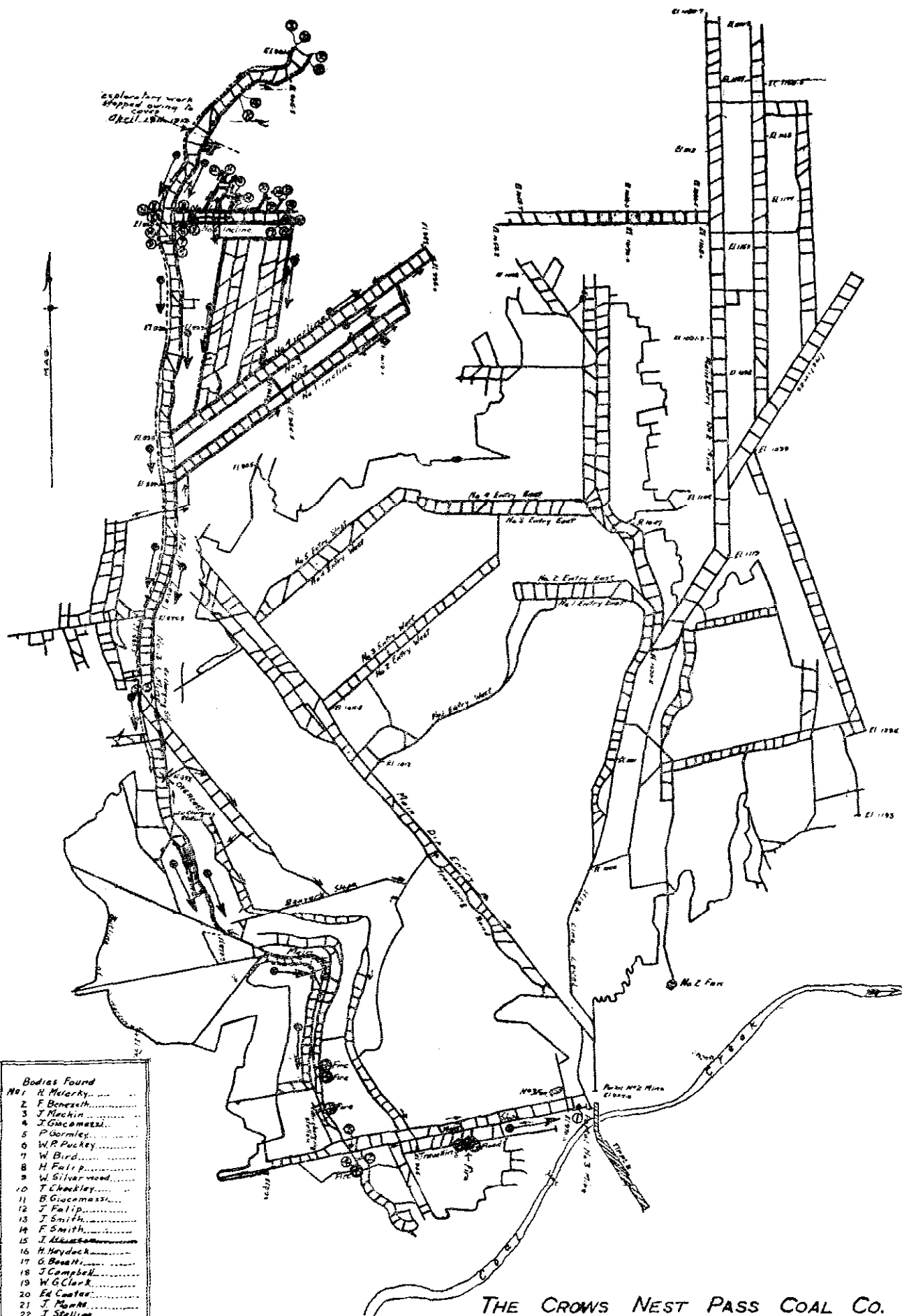
At the foot of the crosscut the bridge-stick seemed to be swung on the inside end towards the face of the crosscut, and two sets were out. Brattice-cloth was found driven into the pack-wall on the low side of the crosscut.

About 60 feet from the bottom of the crosscut Hector Leonard was found, lying on the right side of the crosscut, face downwards, head pointing outwards; his tools beside him, consisting of shovel, axe, and pick. The body was lying in the centre of the track and the tools were lying on the left-hand side of the body going up the crosscut; his dinner-pail and drinking-flask were also found on the side at this point, and a little nearer the face his coat was found.

The car was loaded, and lying between the car and the brattice on the right-hand side was another set of tools, which it is presumed belonged to August Leonard, consisting of one pick on a handle, two loose blades, a shovel, and a saw; a little farther on was a safety-lamp, No. 1349, also between the car and the line of brattice-cloth, with a hole punctured in the upper part of the glass. About the same place, but nearer the rib, lamp No. 1350 was found, standing upright and in apparently good condition, as if it had been placed at the end of the brattice to cool.


August Leonard was found lying between the car and the face, 8 feet 6 inches from the face and about 2½ feet from the car, head against the rib, resting on his right arm and face downward, with his legs drawn up, very suggestive of trying to protect himself. The place was cleaned up, no loose coal, and was timbered close up; the brattice was 12 feet 2 inches back from the face, and about 8 feet of it was still hanging. A coat was also hanging on a nail between the car and the rib, at a point where the brattice-cloth ended. August Leonard's cap was found lying near the car on the same side, and Hector's a short distance on the outside of the body.


Evidence of slight coking seemed everywhere, on sides, roof, car, and floor, but it seemed to be more pronounced on the rib nearest to where the lamps were found.




Bodies Found	
No. 1	H. Hererky
2	F. Boness
3	J. Mackin
4	J. Gucomass
5	P. Gormley
6	W. R. Puckey
7	W. Bird
8	H. Fall
9	W. Silverwood
10	T. Chockley
11	B. Gucomass
12	J. Fall
13	J. Smith
14	F. Smith
15	J. Gucomass
16	H. Haydock
17	G. Bonatti
18	J. Campbell
19	W. G. Clark
20	Ed. Coates
21	J. Mann
22	J. Stallings
23	A. Barton
24	G. Richardson
25	V. Baggall
26	H. Evans
27	V. Clark
28	H. McDougall
29	J. Fulland
30	A. Redula
31	H. Leonard
32	A. Leonard
33	V. Brown
34	J. Brown

Legend

Caves shown thus 

Fires 

Lines of Force 

THE CROWS NEST PASS COAL CO.

PLAN OF

NO. 2 AND NO. 3 MINES

COAL CREEK COLLIERY

Scale 0 400 800 1200 1600 2000 feet

The caving extended to within a few feet of the Main level, but there was no unusual condition found at that point; while there was a heavy deposit of soot, there were no signs of coking.

LINE OF FORCE OF EXPLOSION INSIDE OF NO. 6 INCLINE.

The lines of force from No. 6 incline for some distance in were conflicting, but in the writer's opinion this was caused by the recoil blast. The first evidence of a conflict in the lines of force is found at McDougall's horse, which was lying across the loaded track, head pointing inside, while the collar belonging to it was found about 12 feet inside. In the case of the safety-lamp found with Puillandre and Redoulez, this was found broken in two pieces; the first part found was the bottom of the lamp on the high side, 13 feet inside from Puillandre's body and 4 feet inside of Redoulez; the top part, including shield, 28 feet farther inside. The gauzes were outside the top part and were found 6 inches farther outside.

In some of the crosscuts very distinct evidences of an outward blast was found, the tops of the posts having been broken off and having a distinct leaning towards the counter-level.

In the haulage crosscut the only indication found of the trap-door which stood in this crosscut was one hinge and one socket, which was found at the top of the crosscut on the Main level, whereas the door stood from 20 to 30 feet off the level. The bridge-stick at the foot of the haulage crosscut, on which the check-curtain was fastened, was found in by from its original position and almost round a right-angled turn. A little farther inside on the counter-level on the low side stood three posts, one practically vertical, the other two showing a decided leaning outwards. In the ventilating crosscut there was evidence of conflict of forces, as shown by some posts leaning towards each other.

The brattice-cloth which had been erected in the level and up the crosscut was completely destroyed, with the exception of about 8 feet at the face of the crosscut. Small remnants of the brattice was found sticking on projections on the sides along the stone pack on the low side of the roadway, and at the bottom of the crosscut it was found driven into the pack-wall, which showed unmistakable signs of it having been carried by force down the crosscut and driven in the pack-wall.

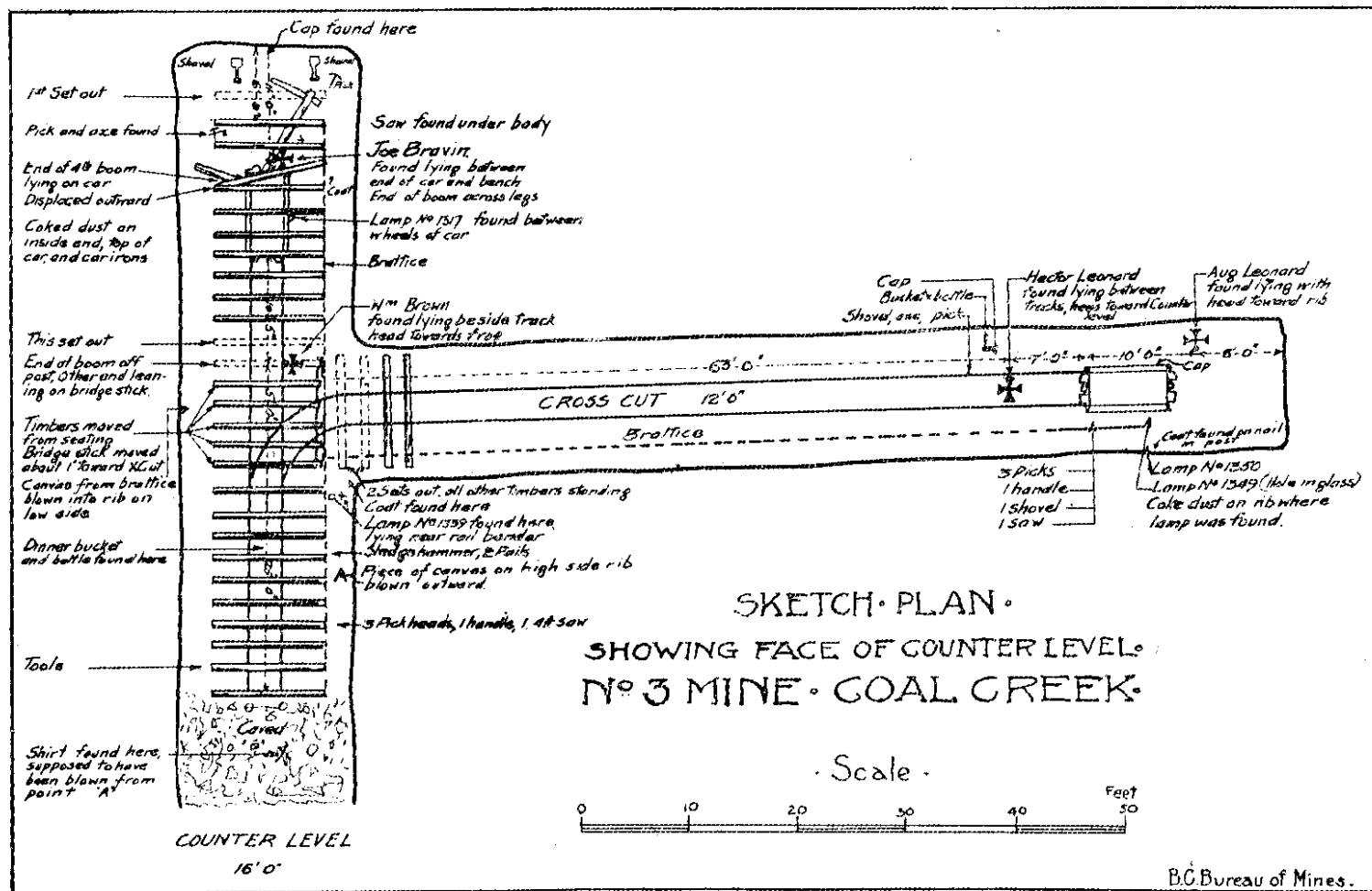
At the foot of the crosscut of the counter-level the bridge-stick seems to have been swung on the end towards the face of the crosscut. The next two sets were out; one set was lying right across the crosscut and the other at right angles to it. With this exception little damage was in evidence.

In reviewing the evidence of force, the writer must come to the conclusion that first blast was outward. Regarding conflicting force, where the horse was turned around and the collar blown inwards, in the writer's opinion this was done by the return blast down No. 6 incline, or in the recoil blast of the explosion. There must have been an outward blast in the first place to blow the horse out of the shafts. The driver was found in the position where the horse should have been, right between the shafts, so it would appear that prior to the occurrence of the explosion the horse had been standing attached to two cars, and in all probability the driver had been sitting on the front of the first car, and in the first outward blast the horse had been blown clear out of the shafts and the driver had been blown off the end of the car in between the shafts, and a set of timber had fallen on him, pinning him there, or in all probability he would also have been moved by the second blast.

It is conclusive in the writer's mind that no inward force could have blown the horse out of the shafts into the position it was in. There must have been an outward force to first blow it clear of the shafts. The inward force, as shown by the scattered pieces of the lamp, are also from the same force that turned the horse around.

DEDUCTIONS AS TO THE INITIAL POINT OF THE EXPLOSION.

It will be necessary here to review the conditions of the mine prior to the explosion. From March 1st to April 5th, 1917, the day of the explosion, there were ninety-six fireboss reports entered in the book, and on eighty of these gas was reported. This was reported mostly as a cap of gas in return air from face of level to face of counter-level. From evidence brought out by the witnesses at the inquest, it was proved that this was from a $\frac{1}{2}$ - to $\frac{3}{4}$ -inch gas-cap. From experimental tests made since the occurrence of this explosion, it has been demonstrated that a $\frac{1}{4}$ -inch cap represents $2\frac{1}{2}$ per cent. of methane. From this it may be assumed that the ventilation in the counter and crosscut must have been continuously bordering on the danger-line.



Mr. Lane, who worked in the Main level, stated in his evidence given at the inquest that on the morning of April 5th, when he went in his place, there was a $\frac{1}{2}$ -inch gas-cap in it, and this was gradually increased to $\frac{3}{4}$ inch at the end of the shift. He also stated that this was no unusual condition since the double shift was put on. (The double shift was put on to place the men thrown out of work by the "bump" in No. 1 East mine last November.) He also admitted that Inspector O'Brien had withdrawn him owing to there being a 1-inch cap of gas in the air. Lane, who is an old experienced miner, had worked for many years as fireboss.

R. Dodson, bratticeman, claimed he went into the Main level that morning and found a small cap of gas about $\frac{1}{2}$ inch.

J. McCourt, fireboss on the night shift, gave evidence that he found a small cap of gas in the crosscut off the counter-level, which he reported.

John Biggs, overman of No. 3 mine, testified that he visited Lane's place on the afternoon of the day of the explosion and examined for gas, and only found a $\frac{1}{2}$ -inch cap.

Of samples of mine-air taken on March 23rd, 1917, one taken 150 feet on the return side of the counter-level showed 3.43 per cent. and one taken 500 feet from the face of the Main level showed 1.99 per cent. As a fact, we have the Main and counter levels showing from 2 to $3\frac{1}{2}$ per cent. continuously. Lane states that conditions got worse towards the end of the morning shift the day of the explosion, and it is safe to assume that conditions were yet worse in the counter-level and crosscut of the counter-level; and if they got worse from 7 a.m. until 3 p.m., it is safe to assume that conditions got still worse by the end of the afternoon shift. The long brattice on the crosscut off the counter makes it the weakest link in the whole ventilating system, and it can be assumed that in all probability there was a thin stratum of explosive gas along the roof at the face of the crosscut.

The indications in the counter-level are that the two miners, Brown and Bravin, were busily engaged loading a car, and evidently working with one lamp, the other apparently having been extinguished and placed behind the brattice to cool. The fact that these men in the counter-level were loading a car would naturally create a cloud of dust.

In the crosscut the two miners, Leonard brothers, had apparently completed the loading of the car and had put up a set of timber. They had evidently been working with one lamp, the other lamp having been placed at the end of the brattice to cool. From the appearance they had evidently decided to finish the shift and were putting back their tools; Hector going first, carrying his tools in the dark, and his brother, Augustus, following down with his tools and carrying a lamp. Apparently, in passing through the narrow space between the car and the brattice, the glass in the lamp carried by August Leonard got punctured by coming in contact with some sharp instrument, presumably the point of a pick.

It is the opinion of the writer that this is the point of origin of the explosion, and what took place is about as follows: August Leonard was in the act of carrying back his tools. Having too many he probably stumbled, and one of the pick-points struck and penetrated the glass. It would seem probable Leonard heard the pick strike the glass, dropped his tools, and raised his lamp to see what damage was done, raising it high enough to reach an accumulation of explosive gas along the roof of the place, so igniting the same, thereby causing the primary explosion. There is no doubt but that it would have been only a local inflammation of gas if the condition in the other places had not been so ripe for the propagation of the explosion throughout the mine.

Once the explosion was started, there was sufficient dust to propagate it the length of the crosscut to the counter-level, where the miners were loading a car, which would make a very dust-clouded atmosphere at that point. This theory is borne out by the amount of coking deposited in this place.

The dust must have been very pure at this point, as is demonstrated by the amount of coke adhering to the surface of the car. The explosive wave had apparently travelled from the counter out and up the ventilating crosscut to the face of the Main level; from here outward it had travelled on both the Main and counter levels, until the wave had been checked in the counter by lack of material to carry it along. This occurred when it reached the swamp in the counter-level, which was about opposite Nos. 5 and 6 inclines. From No. 6 incline out, the path of the explosive wave was as stated in my former report.

In outlining the above theory for the initial point of the explosion, three important points have been kept in mind: First, to have an explosion there has to be material to explode; second,

there has to be a means of ignition; third, there has to be material necessary to propagate the explosion through the mine. All of the above can be found in the counter-level and crosscut off the counter-level. From evidence given at the inquest it was brought out that almost continuously for thirty days there had been from a $\frac{1}{2}$ - to $\frac{3}{4}$ -inch gas-cap present in these places. At the time of the inquest it was taken that a $\frac{1}{2}$ -inch gas-cap would equal 2 to $2\frac{1}{2}$ per cent. From experiments made since in measuring flame-cap, and taking samples for analysis and checking with the Burrell gas-detector, it has been proven that a $\frac{1}{4}$ -inch cap on the Wolf safety-lamp is equivalent to $2\frac{1}{2}$ per cent., and that a $\frac{1}{2}$ -inch cap equals about $3\frac{1}{2}$ per cent.; so, if the evidence of the miners is to be credited, that if there was a $\frac{3}{4}$ -inch cap at the end of the morning shift, there must then have been upwards of 4 per cent. in the current.

It appears that Inspector Williams was fully alive to the dangerous conditions existing in the Main and counter levels of No. 3 mine. In a letter to Manager Caufield dated March 26th, 1917, he draws attention to conditions on the 23rd as showing a $\frac{3}{4}$ -inch gas-cap in the air-current of the Main and counter levels of No. 3 mine, and stating this quantity of gas is altogether too much for operations to be carried on safely, and requesting that steps be taken immediately to improve the ventilation, and while this was being done, that only one shift of eight hours out of the twenty-four could be worked in these places.

According to evidence given at the inquest, the explanation was given that this $\frac{3}{4}$ -inch cap was due to some door being broken and the ventilation being deranged. In the writer's opinion this $\frac{3}{4}$ -inch cap was not due to the disarrangement of the ventilation, for the simple reason that a mine-air sample taken the same day in the intake to these places showed 1.99 per cent. of methane. From the above it can be seen that conditions must have been ripe for an explosion at times in this particular area, and that all that was needed was a means of ignition, and this was readily supplied by the broken safety-lamp of Augustus Leonard. The peculiar position in which Augustus Leonard was found suggested that he had recoiled from some danger after throwing down his tools and lamp.

The position of Brown in the counter would indicate that he was startled, and saw or heard some alarming condition and made an attempt to escape. His partner, Bravin, also made some attempt to get out, and had got tangled up with the saw and fell between the brushing and the car. These seemed to be the only two men in the mine, beside Augustus Leonard, who had moved, and in the writer's opinion they had heard the noise in the crosscut when the explosion started and had made an attempt to escape. In all probability the initial explosion or flashing would be slow, and Brown is the only workman who had moved any distance, all the other workmen being caught where they were, showing that after the explosion did get started and caught up the dust in suspension from the loading of the car in the counter-level it travelled very quickly. After carefully reviewing all the evidence, I have come to the conclusion that this explosion originated in the crosscut off the counter-level, and was primarily an explosion of gas ignited by the flame in the broken lamp carried by Augustus Leonard. This explosion travelled down the crosscut and was augmented by the dust in suspension from the loading of a car in the counter-level, and was thus propagated throughout the mine-workings by the agency of coal-dust.

Appended to this report is a plan of No. 3 mine, showing position of bodies and general lines of explosive blast and direction of ventilating-current; also detailed sketches of position of bodies at foot of Nos. 5 and 6 inclines and face of counter-level and crosscut and Main level; also list of lamps found in recovery-work from Nos. 5 and 6 inclines in, and condition of lamps as far as ascertained.

SAFETY-LAMPS RECOVERED IN NO. 3 MINE, COAL CREEK.

Lamp No. 3508.—Spare lamp, found inside of South slope landing in empty track, 10 feet from lamp No. 579 measured diagonally alongside motor. Glass smashed; top seemed loose; one small piece of glass in place; gauzes in place; striker all right.

Lamp No. 579.—Spare lamp, found inside end of South slope landing on loaded track, 16 feet from frog near motor. The above two lamps would be in use by the motorman and conductor.

Lamp No. 3450.—Issued to G. Richardson, found hanging on his belt. Shield has hole $1 \times \frac{1}{4}$ inch and is bent inward on one side; brass shield slightly tarnished (green); iron parts rusty; not opened. Recovered in November, 1917.

Lamp No. 3454.—Issued to V. Baggioli, found underneath his right arm; November, 1917. Hole $1 \times \frac{1}{2}$ inch in shield; glass broken, some of glass projected up into gauze, and lower gauze-

ring displaced; fragments of brattice-cloth adhering to shield; small dent in lower gauze-ring; lamp coated with mud, as if been lying in either mud or water; not opened.

Lamp No. 3448.—Issued to B. Clarkstone, found between tracks alongside where body was found; November, 1917. Lamp seemed intact, except for small dent in top ring of shield; not opened; striker all right.

Lamp No. 3441.—Issued to B. McDougall, found with body of T. Evans on left side of loaded track and just inside where lamp No. 3454 was found; November, 1917. It was covered with mud, which had hardened on the lamp; the cover over the magnetic lock was broken off at the two rivets; shield tarnished (green); bottom and handle rusty; one of the glass standards bent inward, touching the glass; striker jammed; lamp seemed to have been lying in mud or water; not opened.

Lamp No. 3449.—Issued to Thos. Evans, found near body of McDougall; November, 1917. This lamp was smashed; bottom was found 5 feet inby where McDougall was found, and top inside an empty car 11 feet inby where McDougall was found (second empty car). Only one of the glass standards was attached; no rust; three severe dents in bottom; one of gauze standards reversed (probably done by workmen when lamp was recovered); striker all right.

Lamp No. 1038.—Spare lamp, found near body of A. Redoulez; March, 1918. Bottom found 4 feet inby body, top shield and frame 28 feet farther in, and gauze 6 inches outby from shield and frame; glass and three of the standards missing; bottom seems all right; striker same; hole in top shield, which was smashed inwards in two places the whole length of the shield. The whole of the top shield except one part seems to have been subjected to heat; the part not affected seems to have been protected by contact with the ground, as there is a yellow deposit on it. This lamp was found wedged tight between two timbers.

Lamp No. 1364.—Issued to E. Coats, found at entrance to crosscut off No. 6 incline in front of loaded car; March, 1918. Lamp intact, only shield dented a little; fragments of brattice-cloth and coked coal-dust driven into and adhering to upper shield; ring-plate depressed on one side; bottom rusty; striker all right; lamp not opened.

Lamp No. 1375.—Issued to J. Campbell, found at face of crosscut off No. 6 incline in centre of place; March, 1918. Glass of this lamp is broken and shield dented; some coked dust was found on shield of this lamp. Two pieces of the glass still in place; small coal and coked dust driven in and adhering to shield; striker all right; lamp not opened.

Samples of dust were taken from lamps Nos. 3454, 3448, 3450, and 1364, and a small portion of the shield from lamp No. 1038.

Lamp (No Check).—Found in No. 4 room, No. 6 incline; April 10th, 1918. Hanger and check missing; standards loose, as if lamp had been subject to abuse; upper shield forced inwards in two places; coked coal-dust practically in every opening of shield; glass sooty; piece of brattice-cloth stuck between glass and the standards of glass unbroken; striker in order.

Lamp (No Check).—Found at face of No. 5 room, No. 6 incline (supposed to belong to H. Haydock). Lamp in fairly good condition, although shield showed evidence of heating, and was slightly covered with coked coal-dust.

Lamp No. 1317.—Issued to Wm. Brown, found between wheels of car at face of counter and near the body of Joe Bravin. Lamp practically intact, except for a heavy coating of coked coal-dust; the shield seems to have been heated until all the brass coating had disappeared; some small pieces of brattice-cloth were adhering to shield, as if driven into the openings.

Lamp No. 1339.—Issued to Joe Bravin, found on bench outside crosscut off the counter-level, and about 10 feet outby where the body of Wm. Brown was found. Lamp was lying on its side; seems to have been subject to much abuse, as standards were loose; shield was ripped up for about 2½ inches and seemed generally loose; one side of lamp was especially heavily coated with coked dust, and the remarks *re* heating in lamp No. 1317 also apply here.

Lamp No. 1349.—Issued to August Leonard, found beside the car in crosscut, on its side, and between the brattice-cloth and car. Lamp showed evidence of much heat, a small bead of solder having run from beneath the maker's name-plate; the shield was coated with coked coal-dust, and there was a small hole in the glass near top and fractures extending to bottom.

Lamp No. 1350.—Issued to Hector Leonard, found near the last lamp, but sitting upright on the right-hand rib. Lamp seemed in fairly good condition, except for coating of coal-dust.

The lamps in the counter-level seemed to have been subjected to much more heat than those in the crosscut.

FATAL ACCIDENT, PROTECTION SHAFT, NANAIMO, SEPTEMBER 10TH, 1918.

REPORT BY GEORGE WILKINSON, CHIEF INSPECTOR.

I beg to submit the following report on accident which occurred at the Protection Island shaft at 7.15 on the morning of September 10th, 1918, when sixteen men lost their lives by the breaking of a hoisting-rope and the failure of the safety-catches to arrest the fall of the cage, and thereby allowing the cage to plunge to the bottom of the shaft, a distance of approximately 550 feet:—

DETAILS OF OCCURRENCE OF ACCIDENT.

On the morning of September 10th, at 7.45, I received a long-distance telephone call from Inspector of Mines John Newton, informing me that the hoisting-rope had broken at Protection shaft, allowing a cage to fall down the shaft with sixteen men on it.

Immediately on receipt of the news I made ready to leave for Nanaimo. Leaving Victoria on the 9 a.m. train, I arrived in Nanaimo at 12.40 p.m., proceeding to the Mine-rescue Station, and was informed that one body had been recovered. I immediately made preparation for proceeding to Protection Island shaft by descending No. 1 shaft and proceeding along what is known as No. 1 level. This level passes within about 300 yards of Protection shaft, by which it is connected with an incline. I arrived at Protection shaft about 1.45 p.m., and there met Mr. Hunt, general superintendent of the Western Fuel Company; Thomas R. Jackson, mine manager; David Brown, overman; Thomas Price, master mechanic, and many other officials; and John Newton, District Inspector of Mines. I was informed that five bodies had been recovered. The bodies were all very badly mangled, with the exception of the body of Robert Kelly, who appeared to have been thrown out of the cage on to the shaft landing.

The cage had broken through the landing at the Douglas seam, which is the landing used for handling the men, and had fallen a distance of approximately 70 feet to a disused landing of what is known as the Newcastle seam. The landing at the Douglas seam was made by 12- x 12-inch timbers placed across the shaft and planked over with 3- x 12-inch planking. The cage in its descent had sheared through this heavy timber, and, as might be expected, was a mass of crumpled iron and steel and was all tangled up with the chains and that part of the rope that had fallen with the cage. Out of this wreckage the bodies of the victims had to be recovered.

Protection shaft is situated on the southern end of Protection island and was formerly used for hoisting coal from what was known as Protection mine; shipping-wharves were also located at this point. Some years ago the hoisting of coal out of this shaft was abandoned, and all coal mined in Protection mine was hauled to No. 1 mine, making the one central screening and shipping plant at that point.

For a time Protection shaft was used only as a ventilating-shaft, but on the passing of the eight-hour law in 1904, this shaft, on account of its close proximity to the workings of the North side of No. 1 mine, was fitted up and used for lowering and raising the men from the North side of No. 1 mine. The men are taken across the bay on a large ferry which runs to suit the time of the different shifts.

The shaft is rectangular in shape and is divided into two hoisting compartments and well fitted for that purpose. The shaft is enclosed and used as a downcast shaft, the ventilation being produced by a blow-fan. The shaft is some 670 feet in depth and penetrates both the Douglas and Newcastle seams.

The hoisting and lowering of the men is done with duplex hoisting-engine with 30- x 60-inch cylinders and a drum 10 feet in diameter is used. The pulley-wheels are also 10 feet in diameter. Hoisting-ropes $1\frac{1}{2}$ inches in diameter, with a breaking strength of approximately 80 tons, are used. The gross load when men were being hoisted is about 6,000 lb., giving a safety factor of approximately 25. The cages are strongly built and are equipped with safety-catches and detaching-hooks.

The only work performed by the hoisting equipment at this shaft, apart from the hoisting and lowering of men, is the hoisting of coal for fuel for the boiler plant at that point, which consists of from forty to sixty cars a day. Two cars are hoisted each trip, so this would mean from twenty to thirty trips a day. The number of trips of men each day would be about twenty-five, so the amount of work performed by the hoisting plant at this mine is very small.

On the morning of the accident six loads of men had been safely lowered, and the rope broke when the seventh load was about 150 feet down the shaft.

HISTORY OF THE ROPE.

The rope which broke was manufactured by T. & W. Smith, Newcastle-on-Tyne, England, who have a world-wide reputation as manufacturers of high-class ropes. This rope was placed in use on the Protection shaft on March 6th, 1915, so up to the date of it breaking it had been in use three years six months and nine days.

APPARENT CONDITION OF ROPE AT THE TIME OF THE ACCIDENT.

A careful superficial examination did not reveal any broken wires; various measurements taken of the rope's circumference showed about $\frac{3}{16}$ shrinkage in circumference from dimensions of new rope, so that there was no evidence of internal corrosion or wear on the rope. The outer wires of the rope, apart from showing a slight flatness where coming in contact with the pulleys and drums, did not show any signs of external wear. At the break there was much evidence shown of internal corrosion, some of the inner wires being almost eaten away.

Some of the outer wires were very brittle and broke quite easily when bent, while others were tough and could not be broken by bending. The rope was in a very dry condition and did not appear to have been oiled for some time, although evidence given at the inquest by the ropemen and corroborated by the engineers stated that it had been oiled less than two weeks previous to the accident.

CONDITION OF SHAFT AFTER ACCIDENT.

The writer, in company with the Hon. the Minister of Mines and Andrew Bryden, who was appointed by the Hon. the Minister of Mines to make an examination and to report on the accident, and Inspector Newton, and the jury empanelled, and Mr. Gilmour, of the Workmen's Compensation Board, visited the scene of the accident. A thorough examination was made of the shaft, and it was found to be undamaged, with the exception of a broken guide at the bottom of the shaft. This guide had evidently been broken by the side force of the shoes on the cage at the moment when the bottom of the cage hit the 12- x 12-inch timbers across the shaft. There was no evidence of the safety-catches having ever made any attempt to grip in any part of the shaft.

CORONER'S INQUEST.

The writer attended the various sittings of the jury empanelled to inquire into the cause of the death of Robert Kelly and fifteen others, and endeavoured by cross-examination of the witnesses to bring out all the evidence possible. After all the evidence had been given by witnesses called, Wm. Fleet Robertson, Provincial Mineralogist, was called, and was instructed by the Coroner to proceed to Montreal and take with him sections of the rope and have them subjected to tests and microscopic examinations to try and determine the cause of the failure of the rope. To also take with him samples of water collected from the shaft and oil used on the rope for lubrication. On December 16th, 1918, and January 14th, 1919, Mr. Robertson presented his report to the Coroner and gave opinions as to the cause of failure of the rope.

The jury, after hearing Mr. Robertson's report and evidence given by Mr. Price regarding testing of safety-catches, also evidence given by Mr. Brown, an expert on wire ropes, retired, and after three hours' deliberations rendered the following verdict:—

"We, your Coroner's jury empanelled to inquire into the death of Robert Kelly and fifteen others in Protection shaft of the Canadian Western Fuel Company on September 10th, 1918, find that said men came to their death by descending on a defective cable which broke owing entirely to the oxidizing of the wires, chiefly caused by apparent absolute lack of any external* lubrication, leaving the wires thus exposed to the action of the more than normally corrosive water and humid atmosphere. In view of the evident general unreliability of exterior-lubrication measures, which from the evident adduced failed to preserve to any appreciable extent the life of said cable or preclude against deterioration, we suggest that the Department of Mines recommend the appointment of an expert inspector of hoisting-ropes, cages, safety-catches, and all appurtenances generally, and that legislation be enacted whereby, under such abnormal condition as obtained in said shaft, no new hoisting-cable be retained in service longer than some reasonable time to be determined by the Department of Mines, as otherwise there would appear to be no practicable process which can be adopted and absolutely relied upon looking to the absolute dependability of such hoisting-cables against defect or breakage under all present governing conditions.

"(Signed) M. C. IRONSIDES, Foreman."

* See Report of Provincial Mineralogist on condition of ropes, page 354.

CONCLUDING REMARKS.

After listening to the various witnesses and to Mr. Robertson's very excellent report, and from personal observations, I must conclude that the failure of the rope was due to internal corrosion, and that the dangerous condition of the rope was not visible to a superficial examination, and would not be revealed by the common practice adopted for examining hoisting-ropes, but I cannot entirely agree with the causes as given for the internal corrosion.

There is not a humid atmosphere in Protection shaft; the shaft is used as a downcast, and there is practically no change from the outside atmosphere. Hygrometer tests taken at the top of the shaft, in the middle of the shaft, and at the shaft-bottom show the following results:—

	Humidity, Relative per Cent. of Saturation.
Test at top of shaft	84.0
Test half-way down	84.5
Test at shaft-bottom	87.5

Another point that has not been cleared up in my estimation is why the corrosion should be so much more at the point where the break occurred than at various points above and below the break. We have the rope standing a breaking strain of 55 tons 21 feet below where the break occurred, and 42 tons 10 feet above where the break occurred, and at a point 7 feet below the break it only stood a load of 13 tons. Again, 28 feet below the point of break it broke with a load of 25 tons. It has been suggested that the abnormal state of the rope at the one particular spot may be due to local conditions in the shaft. I cannot think of any local condition that may have been responsible for the excessive corrosion at this particular point.

An examination of the shaft does not disclose any unusual conditions at any particular point. Again, the hoisting-rope is never left in any particular position, so that if there were local conditions at any particular point the same part of the rope would not be exposed to these conditions at all times.

A rope of similar make and size in use at this shaft and in the same compartment is in use five years and twenty-two days, and since that time has been coiled on a reel and standing exposed to the elements for nearly four years, and after nine years does not show much signs of corrosion. This would lead to the conclusion that the conditions in the shaft were not entirely responsible for the corrosion, and would also lead to the belief that lack of lubrication was not the entire cause of the internal corrosion. The writer is of the opinion that something may have crept into the manufacture of the rope at certain parts which has made it more susceptible to corrosion than others.

After the failure of the safety-catches to come into operation upon the breaking of the rope, the Hon. the Minister of Mines ordered a series of tests to be made of their efficiency. These tests were made and are fully dealt with in a separate report. In the evidence given at the inquest a very conflicting state of affairs was disclosed regarding the daily inspection of the rope as required under section 91, "Coal-mines Regulation Act," chapter 160, General Rule 36. The person whose duty it had been to examine the rope daily had left his position nine days before the accident, and his helper had taken the job and was supposed to be making the examination of the rope. He testified that he had examined the rope every day since he had been on the job, but admitted under cross-examination that he had not examined the whole length of the rope, but only about 40 feet of it. Yet his report left the impression that he had examined the whole length of the rope. The rope had been carefully examined weekly by James Menzies, rope inspector for the company, a man with twenty-eight years' experience with wire ropes; his last examination being made on September 4th, six days before the accident. His examination consisted of carefully running the rope through his hands very slowly, looking for broken wires and noting any change in the diameter of the rope. A very minute examination had been made monthly, also, by James Gillespie and another party named Atherston. This monthly examination was made as follows: A few feet would be minutely examined, then the rope moved the distance examined, and so on by the same method until the whole rope had been examined.

It would appear that if there had been any visible flaw in the rope it would have been revealed by some of the examinations. Regarding the condition of a wire rope, this is a very hard matter to ascertain. If there are outward signs of wear a superficial examination will reveal it, but if there is an internal disturbance a general lessening of the diameter of the rope

is expected where the disturbance is located. Regarding corrosion in a rope, this is a hard matter to locate, and any of the known methods of examination are inadequate.

Several methods are suggested for ascertaining this condition, but the best of them is only a guess. A method adopted at some places is to recap the rope every six months, cutting a portion off nearest the cage and thoroughly examining it for corrosion and having it tested regarding strength. Another method suggested is to open the rope up to the centre by inserting a flat spike. Either of the methods may form a useful purpose, but they do not reveal anything as to what may be the condition of the rope apart from the particular part tested and examined.

Another method suggested is testing the rope with a heavy load, which is not, in the writer's opinion, a good practice, as it may subject the rope to a shock or a strain which may stand at the time, but may damage it so that it would break with a lighter load at some future date, thereby defeating the purpose for which it was made.

In the writer's opinion the best safeguard to prevent accidents from breakage of hoisting-ropes would be to place on the Statutes a provision limiting the length of time that hoisting-ropes can be used for raising and lowering persons, and to also provide for all ropes used for raising persons to be put through a hot bath of oil before being put in use.

Regarding the oiling of this particular rope, it is stated by credible witnesses that this had been done regularly every two or three weeks, and they expressed the opinion that the rope had been sufficiently oiled; but it is well known that if corrosion has started internally no outward application of oil or grease will arrest it, hence the necessity for a thorough saturation of the rope before being put in use, by means of a bath of hot oil; and the writer is also of the opinion that this should be done before the rope leaves the factory, as shipping of mining supplies is usually (on account of lower freight rates) by the water routes, which usually mean a sea voyage to Vancouver via China and Japan, whereby there is a chance, if the rope should get wet, of internal corrosion having started before the rope reaches its destination, providing no bath has been given at the factory.

PROTECTION ISLAND DISASTER, SEPTEMBER 10TH, 1918.

INVESTIGATIONS AS TO CONDITION OF CABLE.

REPORT TO THE CORONER BY WM. FLEET ROBERTSON.

On September 14th I appeared before you in the Court-house at Nanaimo, and, having taken the customary oath, I promised to give true evidence in the case before you—an inquest into the cause of the deaths of Robert Kelly, John Turner, and others on September 10th, 1918—to the best of my knowledge and ability. Being still under the obligations of the oath then taken, I make the following statement to you of facts as I know them:—

On September 14th, 1918, you gave into my charge certain exhibits, viz.:—

Exhibit No. 13.—A coil of 1½-inch wire cable, marked and described as being part of the hoisting-cable, the breaking of which was the immediate cause of the fatalities in Protection Island shaft on September 10th, 1918, into which you were inquiring. This exhibit is described in your letter of instructions as being from that portion of the cable which had constantly remained wound on the hoisting-drum in the engine-room at Protection island. The coil was marked with white paint for identification.

Exhibit No. 11.—A coil of cable described by you as being that part of the same hoisting-cable, including upper end of the fracture and extending upwards, as the rope would hang in the shaft, for a length of about 100 feet. The coil was marked with black paint for identification.

Exhibit No. 12.—A coil of cable described by you as being that part of the same hoisting-cable, including the lower end of the fracture and extending downwards, as the rope would hang in the shaft, towards the cage for a length of approximately 100 feet.

Exhibit No. 14.—Several used spiral springs described as having been in use on the cage at the time of the accident and recovered from the wreckage at the bottom of the shaft, designed to bring the safety-clutches into action.

Exhibit No. 16.—Two unused springs (spiral), evidently spare springs to be used for same purpose.

Exhibit No. 7.—A small fruit-jar of water said to have been collected as it fell in Protection Island shaft.

Exhibit No. 9.—A bottle of black oil said to have been such as the cable was supposed to have been lubricated with.

Of these exhibits, the coils of cable were carefully wrapped in burlap; the springs were crated in two boxes; and the samples of water and oil were taken by me personally and packed in a box. All these exhibits were delivered to the Dominion Express Company at Nanaimo and Victoria, directed to me in care of McGill University, Montreal, where I found them unopened and intact on October 1st, and identified them. To this extent all these exhibits have been in my personal charge and keeping, as directed by yourself.

I was directed by you to submit these exhibits to the most critical, physical, and microscopical tests practicable in Montreal, and to report to you when they were completed.

In conformity with your instructions, I submitted the coils of cable and the springs to the Physical Testing Laboratory of McGill University, which is under the direction of Professor H. M. Mackay, with S. D. McNab as Superintendent. I explained all the circumstances of the case as I knew them, and after consultation we applied all the tests that we thought would cast any light on the subject in question. These tests, which I personally witnessed, I shall describe in detail subsequently; and I also submit herewith the official report by Professor H. M. Mackay.

For microscopic tests, to see if possibly any crystallization of the steel had taken place, I had a sample cut from Exhibit No. 13 which I considered to be the normal condition of the steel as received from the maker, and another sample cut from above the fracture in Exhibit No. 11. These samples I submitted for microscopical examination to Dr. Stansfield and Gordon Spencer, an expert microscopist, for critical examination.

I append their report, which speaks for itself, but I might here state that it shows that no injurious crystallization had taken place, which is as I expected, and which, while it is negative evidence, finally disposes of crystallization as a possible or contributing cause of the failure of the cable.

As regards the samples of water and oil, the Chemical Laboratories of McGill are so depleted by the war and we were so hampered by the opening of the session, and later by the "flu," that no work of this description could be undertaken, and upon the recommendation of the McGill authorities I took these to Dr. J. T. Donald, an analytical chemist of highest repute in Montreal, who undertook to do the work on these personally.

I might say that Dr. Donald is a graduate of McGill University and was for many years Professor of Chemistry in Lennoxville University, since when he has been in public practice as an analyst, and is doing the bulk of the chemical-work for the Imperial Munitions Board in Montreal.

I append Dr. Donald's reports on Exhibits Nos. 7 and 9, which showed that while the water was such as to have a decidedly corrosive action on steel wire, it was not unusually so. The oil was perfectly harmless.

TESTING LABORATORY.

Report on the Tests made in the Laboratory.

Before describing the tests in detail I will say a few words as to the Physical Testing Laboratory of McGill University. It is certainly the best-equipped testing laboratory in Canada for such tests; in fact, the only place where cable of this size could be broken. It is equipped with a large number of machines for testing strength, both tensile and compressive.

One large Wickstead 50-ton tensile-testing machine is exclusively used on Imperial Munitions Board work, and I was informed by Professor McKay that about 125,000 breaking-strain tests on shell-steel have been put through this year. This machine is hydraulically operated and is the most rapid and accurate on this continent.

The particular machine used in getting the breaking strength of the various samples of cable submitted by me is a Wickstead 100-ton single-lever machine made by J. Buckton & Co., of Leeds, England. The machine is capable of applying a breaking strain of 100 tons. It has been employed in testing a new 1½-inch steel cable made in Canada from English steel wire for the Shawnigan Company, and used as a span across the St. Lawrence river and having a length of 5,000 feet.

During my stay cables of 1¼ inches diameter were received from the Sudbury mines for testing, which, while apparently sound from surface indications, were found to be corroded internally.

Method of taking Samples of Cable for Testing.—In all instances the portion of cable selected for a test was carefully wrapped, very tightly, with special iron wire in two places, with about 36 inches of cable between the wrappings; this is the "test piece." At about 9 inches outside the wrappings the cable was cut through by an oxy-acetylene blow-pipe; the cut ends were then ground off on an emery-wheel to beyond the action of the blow-pipe. The 9 inches at each end outside the wrappings formed the attachment to the grip of the testing-machine.

Method of Attachment.—The grip is a steel cylinder about 8 inches outside diameter and 9 inches high. The interior of the grip is a hollow cone about 6 inches in diameter at the top and about 2 inches diameter at 1 inch from the bottom of the grip, the remaining 1 inch being a straight cylindrical hole to the bottom, 1½ inches in diameter.

The end of the test piece is passed up through the hole in the grip; the end of the test piece outside the wrapping is then opened up and each individual wire separated and the hemp centre cut out. The opened end of the cable is then immersed in gasoline to remove all grease. If the wires are free from rust (as was the case in Exhibit No. 13), then each individual wire is swabbed with half-strength hydrochloric acid; but if the wires are rusted, then full-strength commercial hydrochloric acid is used. If the wires are very rusty, they are rubbed bright with emery-cloth. The opened wires are then washed with very hot water and become dry. Each wire is then swabbed with "soldering-acid" (hydrochloric acid saturated with zinc).

The grip with the cable in place is held in a vice and the wires, somewhat straightened, are spaced equally throughout the conical cavity in the grip, leaving a clear annular space of about ½ inch next to the wall of the grip, the wires being held in place by smaller iron bands when necessary. Molten zinc is then poured into the grip-cavity around and among the wires until the cavity is full. The effect of this is that each individual wire is absolutely soldered in place into this cone of zinc and is immovable while the zinc cone becomes soldered to the surrounding grip. This method of attachment is that adopted and recommended by the United States Bureau of

Standards, and is in constant use at the McGill University Laboratory. Its efficiency is demonstrated by the fact that of the large number of ropes tested in the laboratory there has never been a wire budge and never has a cable broken in or at the grip.

TESTS APPLIED TO THE CABLE.

Exhibit No. 13.—Rope from off the Drum.

Construction of the Cable.—The cable consists of six strands wound around a hemp centre of about $\frac{3}{4}$ inch diameter. The peculiarity of the "lay" of the rope is that the strands forming the cable are twisted in the same direction as are the wires forming the strands. All wires and strands are wound in the same direction. This is known as "Lang's lay." The strands seem to have been made by taking a straight soft-iron wire about 0.0865 inch in diameter, around which is wrapped or twisted six steel wires of an average of 0.0853 inch diameter, thus forming what might be called a *sub-strand*, around which is wound in the same direction nine wires of an average diameter of 0.1255 inch.

I submit for your inspection untwisted wires forming one strand, marked "A"; also the hemp core from the same piece of cable, marked "B." There was no means of distinguishing one end of this piece of cable (*Exhibit No. 13*) from the other. A test piece was cut from each end and one of these only was tested as to breaking strength, the result being conclusive. A short piece about 24 inches long was also cut and unwound, and the individual wires from this were tested for their individual tensile strength. The details of these tests are contained in Professor Mackay's report herewith, and show such remarkable uniformity in size and breaking strength as to speak very highly for the workmanship of the maker and for the material used.

This piece of cable (*Exhibit No. 13*) showed only very slight wear and only on the outer wires, possibly caused by pressure on the drum. The individual wires were bright and free from rust; the cable was practically as good as new and had been lubricated, grease oozing out as the strain was applied.

Test No. 1.—The test piece taken was approximately 36 inches between the grips. The load was applied in successive increments of 10,000 lb. each, the elongation of the specimen being taken for each increment. The elongation for each 5-ton increment was 0.04 inch up to 70,000 lb., increasing gradually until at 120,000 lb. the elongation for the last increment was 0.08 inch, the total elongation under this load being 0.59 inch.

At about 130,000 lb. the elastic limit of cable seemed to be reached, and the cable broke under a load of 160,000 lb., after sustaining such load for a minute or so, when three strands broke simultaneously a few inches below the upper grip. The pull being continued, the other three strands broke near the lower grip. The breaking strength of the cable was 160,000 lb., or 80 short tons.

As a check and confirmation of this test a 24-inch piece of the cable adjoining the test piece was unwound, the individual wires somewhat straightened, and six of the larger wires and three of the smaller wires from each strand were submitted to a tensile breaking strain. These wires are submitted and marked "C."

These wires showed remarkable similarity in strength. The wires of average diameter of 0.1255 inches had average strength of 2,540 lb.; the wires of average diameter of 0.085 inches had average strength of 1,165 lb. The aggregate strength of all the wires composing the cable if pulled straight would be 179,000 lb. The strength of the cable was therefore about 89.35 per cent. of the aggregate of the wires, a result considered as indicating a well-built cable. The tensile strength of the steel in the wires would be equivalent to about 208,000 lb. to the square inch. This result, taken with the uniformity in strength of the wires, indicates an excellent quality of steel in the cable.

Exhibit No. 11.—Section of the Cable immediately above the Fracture.

Test No. 2.—The test piece from this was cut starting about 5 feet above the tapered end of the fractured cable. The exterior of this exhibit showed a certain amount of wear on the outer wires, but not at all serious. No broken or torn wire ends were observed on the whole length of *Exhibit No. 11* on the surface. A serious amount of rust was observable on surface wires.

On opening up the end of the test piece in preparing it for the grip, the smaller interior wires were found to be very badly rusted and eaten away, so much so that several of them were found to be completely eaten through. None of the larger (0.1255 inch in diameter) outer wires were eaten through, but they were also badly corroded, a rough estimate being that the steel

in these wires had about half the sectional area of similar wires in Exhibit No. 13 (the good rope). The cable and the core showed no indications of having been lubricated; both were dry and dusty.

This test piece, tested similarly to the former described Exhibit No. 13, showed very even elongation for each successive increment in 5 tons in load up to 60,000 lb., at about which point the elastic limit seemed to be reached. Under a load of 81,900 lb. four strands of the rope broke, the break extending 12 inches below the upper grip. In breaking, clouds of dust were given off, the doors of the building had to be opened to clear the air, indicating the interior to be very dry, with no indications of having been oiled. The two remaining strands broke under a load of 21,000 lb.

Exhibit No. 12.—Rope from the Fracture downwards towards the Cage.

Three separate pieces of this part of the rope were tested by breaking.

Test No. 3.—Test piece cut 11 feet from the end of exhibit nearest to the cage. This portion of the rope was seemingly uninjured by its fall with the cage. It was not untwisted at all and there were no loose or projecting wires on the surface. The surface was somewhat worn and was corroded to at least half-section of the externally visible wires. In the portion opened for the grip several of the smaller wires were found to be completely corroded through, as were a few of the larger wires.

The load was applied as in previous tests. With each 10,000 lb. increment of load the elongation was practically constant up to 40,000 lb. load, and was about 0.07 for each increment. At about 40,000 lb. certain of the interior wires were heard to break. At 49,400 lb. the cable broke at about 3 inches below the upper grip. The centre core was absolutely dry and dusty and large quantities of rust-dust were given off on breaking. Broken test piece submitted and marked "D."

Test No. 4.—A test piece from Exhibit No. 12 was cut 21 feet 6 inches below the fracture. The cable showed slight wear, but was much corroded, both on the surface and interior wires, and, as far as could be seen, few, if any, of the wires were actually eaten through. No evidence of lubrication was visible in the interior of the cable.

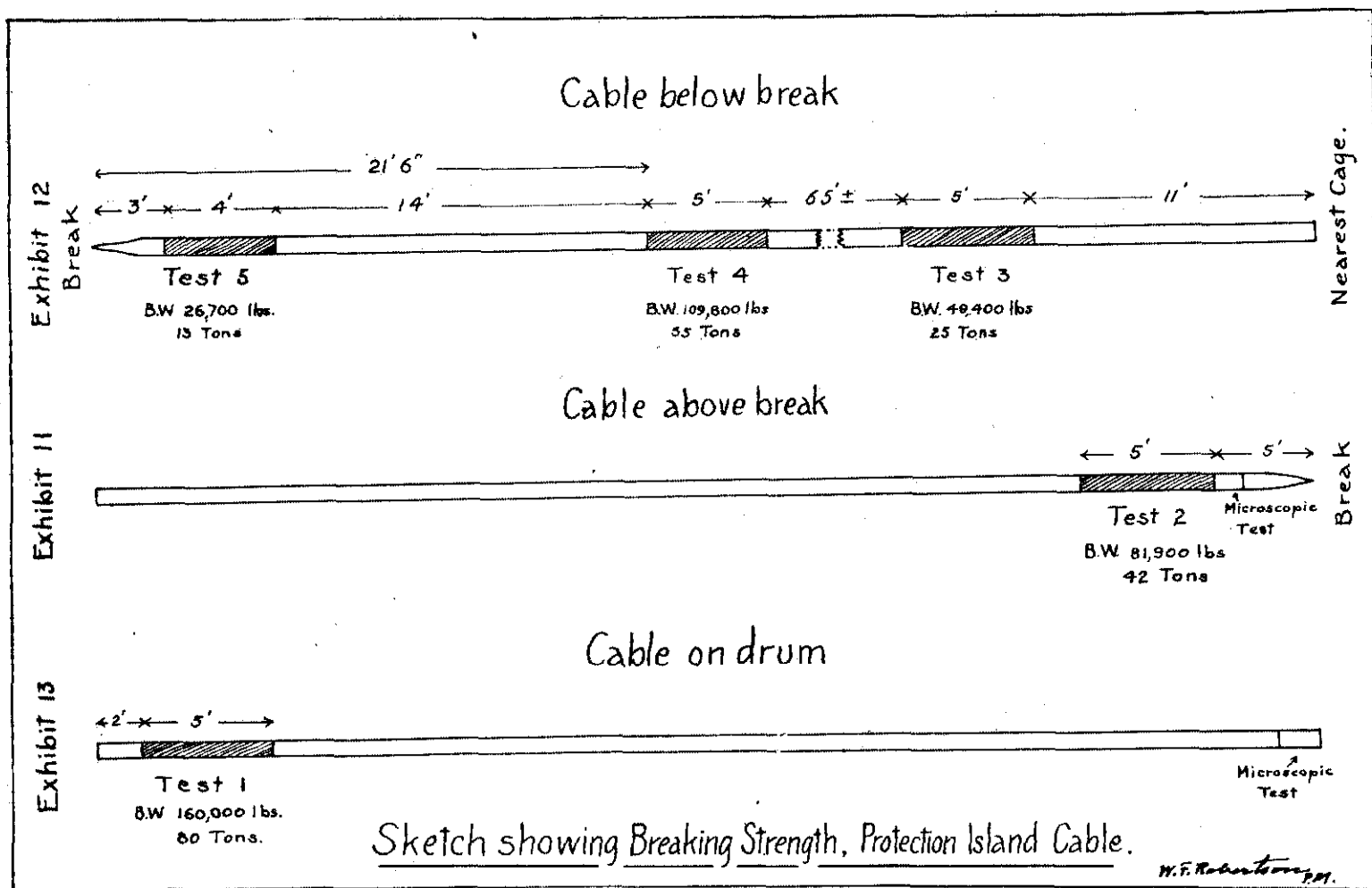
This test piece was treated as were the former tests. The elongation for each 10,000 lb. increment was constant at about 0.05 inch up to 80,000 lb., which was about the elastic limit. Under a load of 106,000 lb. some of the interior wires were heard to break. At 109,800 lb. the cable broke, two strands parting about 6 inches below the upper grip. Subsequently the remaining strands were broken by a reapplication of the load. The third strand broke under load of 55,000 lb.; fourth strand broke under load of 55,400 lb.; fifth and sixth strands broke under load of 43,700 lb. Three strands broke near each end of the test piece.

Test No. 5 on Exhibit No. 12.

Test piece was cut at 3 feet below the point of break. This test piece did not appear to have been damaged by the fall; the rope was still tightly twisted and but slightly bent, not enough to seriously affect it. This piece was badly corroded, so much so that even on the surface a number of the wires were seen to be completely eaten through and could be picked out with the fingers; none of the ends projected, however. In the interior of the cable one of the sub-strands was completely cut through by erosion. There were no indications that the rope had ever seen oil.

In opening up the two ends for the grip thirty-two wires were found completely eroded through and loose. The thirty-two wires I hand you herewith, marked "E." The condition of the test piece was evidently so bad that the load was applied in smaller increments than in the other tests. At 2,800 lb. load wires were heard to break in the interior. The successive loads applied were: 3,000 lb., 5,000 lb., 7,000 lb., 10,000 lb., when the elastic limit was reached at 20,000 lb. and 25,000 lb. At 19,500 lb. a number of wires were heard to break; at 22,000 lb. more wires broke; at 26,700 lb. load three strands parted 12 inches below the grip. The three remaining strands broke at 8,800 lb.

I submit herewith samples "F" and "G," which together make up the broken test piece. I also submit "H," the hemp cord from the same locality. I return to you sample "I," the lower end of the break as received from you. Also "J," the upper end of the break, which I have left unopened and which is as received from you. All the remaining parts of the exhibits entrusted to me I have returned to you by express.



OPINIONS AS TO THE RESULTS OF THE TESTS.

First: The original cable, as represented by Exhibit No. 13, was a first-class cable in every particular, well made, and of excellent material. It was of "Lang's lay" build and apparently up to specifications. (See test No. 1.)

NOTE.—The Report of the Transvaal Commission, 1907, shows that 416 mines out of 427 there were using "Lang's lay" cables.

Second: The microscopic tests show conclusively that no crystallization had taken place in the steel of the cable. (See Dr. Stansfield's report and microphotographs.)

Third: The steel in the damaged part of the cable, after removing oxide from the exterior of the wires, was the same as in Exhibit No. 13, showing no chemical deterioration of steel had taken place. (See Dr. Stansfield's report.)

Fourth: Exhibit No. 7, water from the shaft. There was no free acid in the water that would dissolve the steel, but the water was of such composition as to rust the steel more rapidly than pure water would, and would also be apt to wash off any external lubrication of cable faster than would pure water. (See Dr. J. T. Donald's report.)

Fifth: Exhibit No. 9, the oil used in lubricating the cable. This was non-injurious to the steel. My opinion is that if applied superficially it would wash off quickly, and if applied cold to a cold rope it would not penetrate to the interior of the rope.

NOTE.—The Report of the Transvaal Commission, 1907, page XXI., shows that the accepted practice there is to apply the lubricant hot every week or two weeks, and then only certain oils penetrated the cable. Ben Thayer, chief mining engineer of all the Amalgamated Copper Company's properties (Butte), whom I went to see in New York, told me it was their practice to lubricate their cables by passing through a trough filled with oil kept very hot by a steam-jacket.

Sixth: Exhibit No. 13, rope from the drum. The external wires were slightly flattened or worn—it would be hard to say which—by contact with the drum. Such wear was insignificant. No projecting wire ends visible. Very little external oxidation had taken place; the wires were bright and covered with hardened oil; they had been lubricated. In the interior of this part of the cable the wires were all bright and free from rust. (See sample submitted, marked "C.") The interior hemp core was slightly greasy. (See sample submitted, marked "B.") The cable was in perfect condition.

Seventh: Exhibit No. 11, cable above break. Externally no wire ends were visible or projecting. The mechanical wear on the cable was not great; not sufficient to cause apprehension as to strength of the cable. The amount of rust visible on the surface was serious and showed when the cable was dry, but if the cable as it hung in the shaft was dirty, an inspection by passing the rope through the hand or against a stick would fail to reveal defect in the rope and was useless in this case.

In a shaft where the cable was subjected to heavy and constant work the wear on the external wires would probably be so great as to wear certain strands through, thus producing projecting ends, and these would be the first indications of deteriorations of such a cable. The hand test might then be of value.

In the Protection Island shaft the mechanical wear on the cable was slight, the failure being internal, and hence not discernible by the method of inspection in vogue. This piece of cable showed more surface oxidation toward its lower end.

Eighth: Exhibit 12. The same remarks apply as in seventh, with the exception that within 8 to 10 feet below the break a number of external wires were completely corroded through just where they fold under, which were visible on clean dry rope, but probably would not have been on dirty, wet rope; no loose ends stuck out.

Ninth: The failure of the cable was, in my opinion, entirely due to the oxidizing of the wires, chiefly internally, caused "by the apparent absolute lack of any internal* lubrication, leaving the wires exposed to the action of a more than normally corrosive water and a humid atmosphere."

The internal hemp core, which under a sufficiently effective lubrication system would serve as a reservoir of oil to keep the wires oiled and protected from corrosion, not being supplied with oil, became a reservoir of moisture and so hastened the corrosion of the wires. It is a well-

* Compare this with verdict of jury, in Mr. Wilkinson's report, page 351.

known fact that if rust gets started in a steel structure, such rust will continue despite any surface application of anything that may exclude the atmosphere. Hence, only a thorough soaking of the hemp core with oil before it is installed and a frequent renewal of the oil-supply would be necessary to ward off corrosion.

The fact that the tests showed the cable to be more corroded in certain parts than in others, and these not in any regular progression (*see sketch herewith*), may be accounted for by local conditions in the shaft of which I have no knowledge. The Transvaal Commission's Report recommends the cutting-off of a short piece of the cable every few months from the end next the cage and testing this for tensile strength. The location of weak spots in this cable would render this test futile, as it broke 179 feet above the cage.

A reference to the sketch showing tests will show that the section of cable about 4 or 5 feet from the fracture broke under a load of a little over 13 tons, and it stands to reason that the rope at the fracture had a lesser strength.

The weight of the empty cage is given by the company as 4,357 lb.; the rope, 179 feet, weighed about 540 lb.; sixteen men at average of, say, 170 lb., 2,720 lb.; making a known dead load of 7,617 lb., or approximately 4 tons. I understand the cable broke just about the time that portion of the cable passed over the sheave.

From a standard text-book, "Winding Engines and Winding Appliances," published in 1912, I have copied a table which I append hereto, which shows that when a cable of this description passes over a 10-foot sheave, it is by reason of the bending subjected to an additional load of 9,360 lb., or say, roughly, 5 tons. This, in addition to the dead load as above, would give a strain in the cable, if travelling slowly, of approximately 9 tons, which approaches so near to the breaking strain shown in test No. 5 that it is scarcely necessary to assume extraordinarily rough handling by the hoistman to account for the break.

As an indication that this sort of interior corrosion is not confined to the case in hand, I produce for your inspection a piece of 1¼-inch cable from a Sudbury mine which was tested at McGill in my presence. It broke at 58,600 lb., whereas the new cable had a breaking strength of about 128,000 lb. I think you will agree with me that this cable shows but little deterioration discernible externally, whereas in the broken end, also exhibited, the internal corrosion is excessive.

Springs.—Professor Mackay's report of these tests is submitted herewith, and shows that Exhibit No. 16, two unusual spiral springs, were of excellent quality, capable of a safe extension of about 30 per cent. of their length, and having a pulling power when so extended of about 1,250 lb.

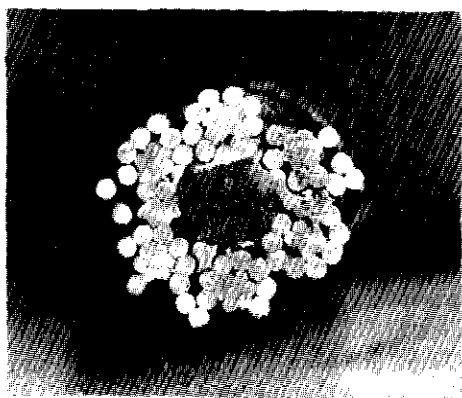
These springs were all that could be desired. The various springs composing Exhibit No. 14 were so damaged by falling with the cage that but portions of them were available for testing. These portions tested, however, imperfect as the test was, showed a pulling power when extended of about 400 lb., which, if the clutches had been free to act, should have been enough to bring the clutches into action. These springs had been made of steel rod ½ inch in diameter, but were so corroded that there was in some places only metal of ⅜ inch left. The absence or lack of any protective covering, such as oil, paint, or tar, is thus in evidence.

P.S.—Since writing the preceding report certain tests made as to the electrical resistance of various parts of the cable have been studied out, and these indicate that the sectional area of the steel wires remaining unoxidized in any particular part of the cable corresponds very closely with the breaking strength of that part. This corroborates the statement made that the steel unoxidized in the wires had still retained the strength it originally had, and that the cable throughout was of uniformly good quality of steel. These electrical tests are indicated in the accompanying sketch.

The fact that the proportionate electrical resistance of any part of a cable corresponds very closely to the amount of oxidization that has taken place in that part offers a very good indicator of the strength remaining in that part of the cable.

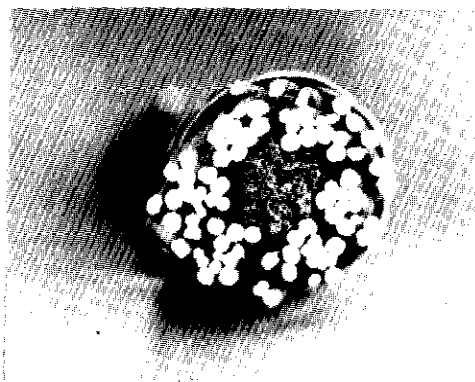
These facts have been fully set out in a paper prepared by the writer for the Canadian Mining Institute meeting, March, 1919, and further experiments are being made in the expectation of developing a method by which cables may be thus tested for strength by their electrical resistance in cases such as the present instance, where no external indication was given of the excessive oxidization that had taken place internally.

Specimen B
(unused Cable)



Section of Cable nearly full size.

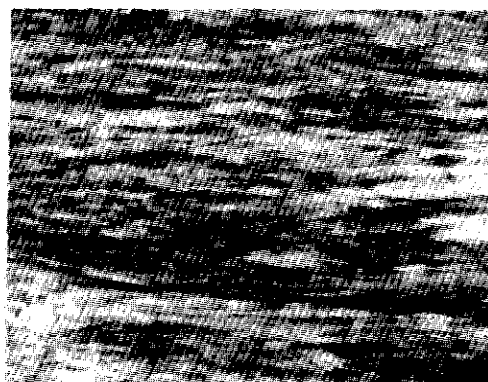
Specimen A
(Cable near break)



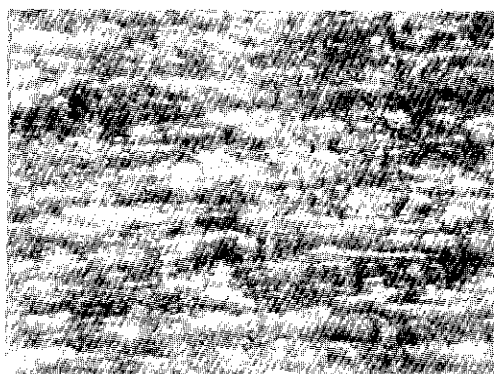
Section of Cable nearly full size.



Large Wire x80 dias.
(unused cable)



Large Wire x80 dias.
(Cable near break)



Small Wire x80 dias.
(unused cable)



Small Wire x80 dias.
(Cable near break.)

Copied from

Winding Engines and Winding Appliances,
by
McCulloch and Futers

Published by Edward Arnold, London, 1912
on page 345

TABLE X

Assumed total additional load (p), in pounds, on ropes
with 6 strands, 19 wires per strand and fibre core, if the stress on
outermost fibres due to bending is $6,270,000 \frac{p}{R}$ lbs. per square inch.

Approximate Circumference of rope in inches	Approximate diameter in inches	Diameter of wire in inches	Sectional area each wire	Total sectional area	Diameter of drum or sheave, in feet, around which the rope is bent.							
					8'	9'	10'	11'	12'	13'	14'	15'
$\frac{3}{4}$ "	0.050	0.004	0.224	1,465	1,300	1,170	1,065	976	904	836	780	
$\frac{7}{8}$ "				2,280	2,025	1,885	1,660	1,520	1,405	1,305	1,217	
1"				3,520	3,128	2,820	2,560	2,350	2,165	2,015	1,875	
$1\frac{1}{8}$ "				4,900	4,370	3,925	3,578	3,275	2,800	2,625	2,460	
$1\frac{1}{4}$ "				6,700	5,945	5,350	4,865	4,460	4,120	3,820	3,570	
$1\frac{3}{8}$ "				9,100	8,100	7,300	6,650	6,090	5,600	5,215	4,840	
$1\frac{1}{2}$ "				11,700	10,400	9,350	8,500	7,800	7,200	6,680	6,230	
$1\frac{5}{8}$ "				14,750	13,100	11,780	10,750	9,850	9,070	8,410	7,860	
$1\frac{3}{4}$ "				18,300	16,250	14,650	13,300	12,190	11,200	10,460	9,780	
2"				27,500	24,500	22,000	20,500	18,350	17,000	15,720	14,680	
$2\frac{1}{4}$ "				39,500	35,100	31,600	28,700	26,300	24,300	22,500	21,000	

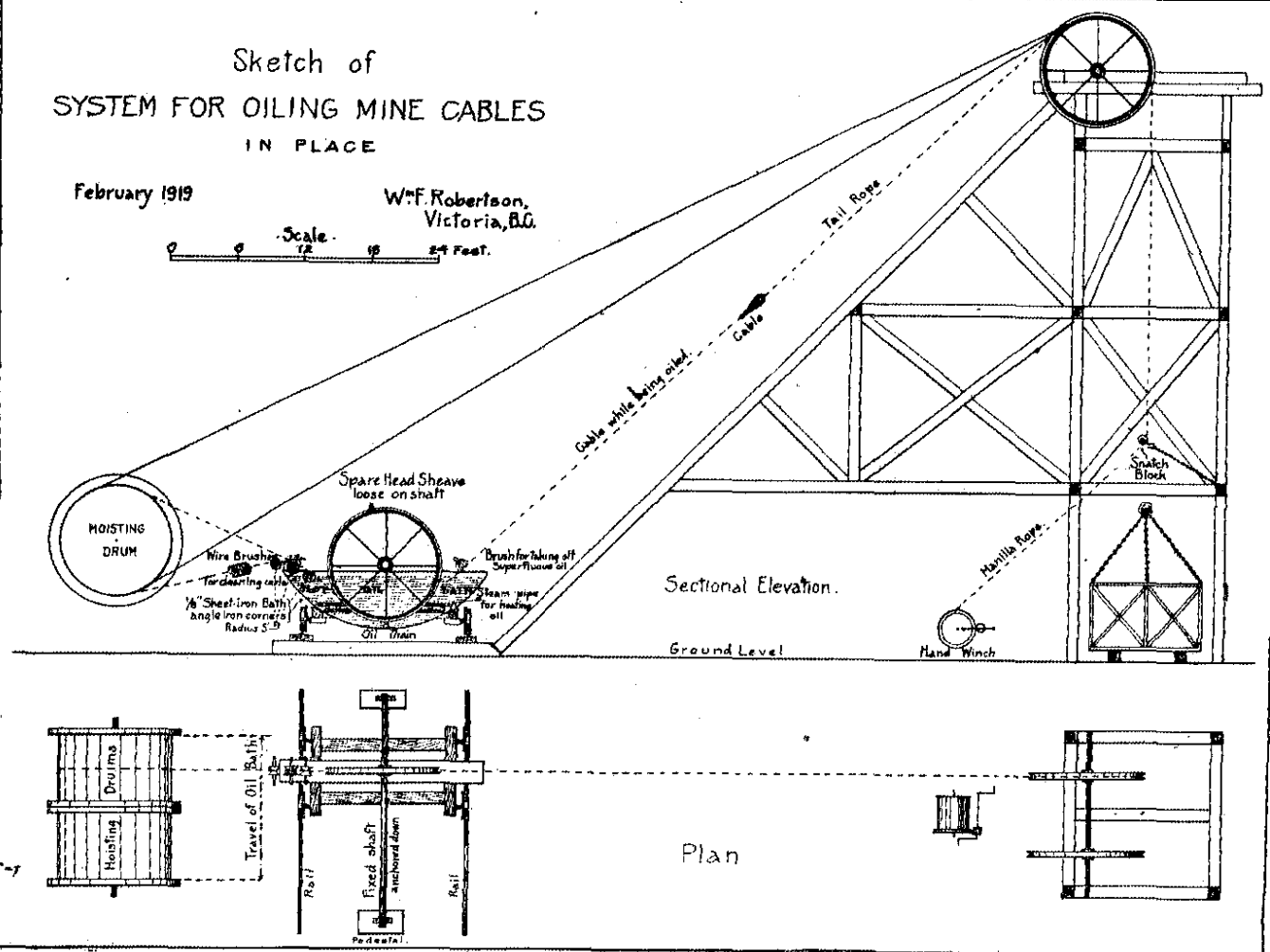
M. Robertson
Prof. Mineralogist

Sketch of SYSTEM FOR OILING MINE CABLES IN PLACE

February 1919

W.F. Robertson,
Victoria, B.C.

Scale.
0 12 24 Feet.



The evidence at the trial showed that a lubricant had been applied externally with some regularity, but the investigation demonstrated that such had not penetrated the cable. That penetration of the cable by the lubricant can only be accomplished when both are heated seems certain. The accompanying sketch is a suggestion as to how this can be cheaply accomplished at any colliery.

McGILL UNIVERSITY.

REPORT BY PROFESSOR H. M. MACKAY.

October 25th, 1918.

W. Fleet Robertson, Esq.,

Provincial Mineralogist, Victoria, B.C.

DEAR SIR,—I beg to report as follows upon the samples of wire cable and upon the helical springs from Nanaimo, B.C., submitted by you for test:—

I. WIRE CABLE.

Three lengths of cable were received in the laboratory:—

- (1.) Described as taken from the winding-drum, marked "Exhibit No. 13."
- (2.) Described as taken from the cable immediately above the break, marked "Exhibit No. 11."
- (3.) Described as the length immediately below the break and attached to the cage, marked "Exhibit No. 12."

The cable was approximately $1\frac{1}{2}$ inches in diameter and was made up of six strands. Each strand consisted of nine wires (average diameter 0.1255 inch), about a centre of six wires (average diameter 0.0852 inch, about a soft wire).

Test No. 1.—This sample was cut from the least-worn end of Exhibit No. 13 taken from the drum. The sample was in apparently good condition, although the oil was dried up and would not flow at ordinary temperatures. The sample was $36\frac{3}{4}$ inches long between the grips of the testing-machine. The load was applied in increments of 10,000 lb. and the extension over the clear length noted under each increment of load. These extensions were as follows:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	36.76	....	....	90,000	37.14	0.38	0.05
10,000	36.80	0.04	0.04	100,000	37.20	0.44	0.06
20,000	36.84	0.08	0.04	110,000	37.27	0.51	0.07
30,000	36.88	0.12	0.04	120,000	37.35	0.59	0.08
40,000	36.92	0.16	0.04	130,000	37.45	0.69	0.10
50,000	36.96	0.20	0.04	140,000	37.61	0.85	0.16
60,000	37.00	0.24	0.04	150,000	37.87	1.11	0.26
70,000	37.04	0.28	0.04	160,000	Failed	....	....
80,000	37.09	0.33	0.05				

The ultimate strength was thus 160,000 lb., or 80 tons, and the behaviour of the sample was quite normal, the elongations especially being very uniform.

Thirty-six specimens of the larger wires and eighteen of the smaller cut from the section adjacent to sample No. 1 were tested individually. The larger wires (average diameter 0.1255 inch) gave an ultimate strength on the average of 208,000 lb. per square inch, or 2,540 lb. per wire. The smaller wires (average diameter 0.0852 inch) gave an average ultimate strength of 206,000 lb. per square inch, or 1,165 lb. per wire. The strength of the individual wires ran very uniformly. The fractures were well-developed "cups" or "semi-cups," indicating an excellent quality of material. The aggregate ultimate strength of all the wires composing the cable based on these tests was 179,100 lb. The ultimate strength of the cable was thus 89.35 per cent. of the aggregate ultimate strength of the component wires, which is quite satisfactory.

Test No. 2.—This sample was cut from Exhibit No. 11, and its position in the cable was about 4 feet away from and above the break. In brooming the ends for mounting the specimen a number of the small interior wires broke, being corroded away. All wires were badly rusted. In the section taken for test no broken wires showed on the surface. The outside wires were worn away to approximately half their original diameter. Loads were applied as in test No. 1. Elongations are given in the following table:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	37.68	....	....	50,000	37.95	0.27	0.06
10,000	37.73	0.05	0.05	60,000	38.01	0.33	0.06
20,000	37.78	0.10	0.05	70,000	38.11	0.43	0.10
30,000	37.83	0.15	0.05	80,000	38.20	0.52	0.09
40,000	37.89	0.21	0.06	81,900	Failed	....	....

Four strands failed simultaneously, throwing out a cloud of dust. Above 77,000 lb. the cracking of wires was heard. The two remaining strands broke at 21,000 lb.

Test No. 3.—The specimen cut from Exhibit No. 12 was taken about 11 feet from the end attached to the cage, which was as near thereto as a representative specimen could be obtained. No broken wires showed on the outside, but a number of the small interior wires broke while brooming the ends for mounting. Practically all wires were much corroded, and the rope was quite dry and dusty, in much poorer condition than that in test No. 2. The results are as follows:—

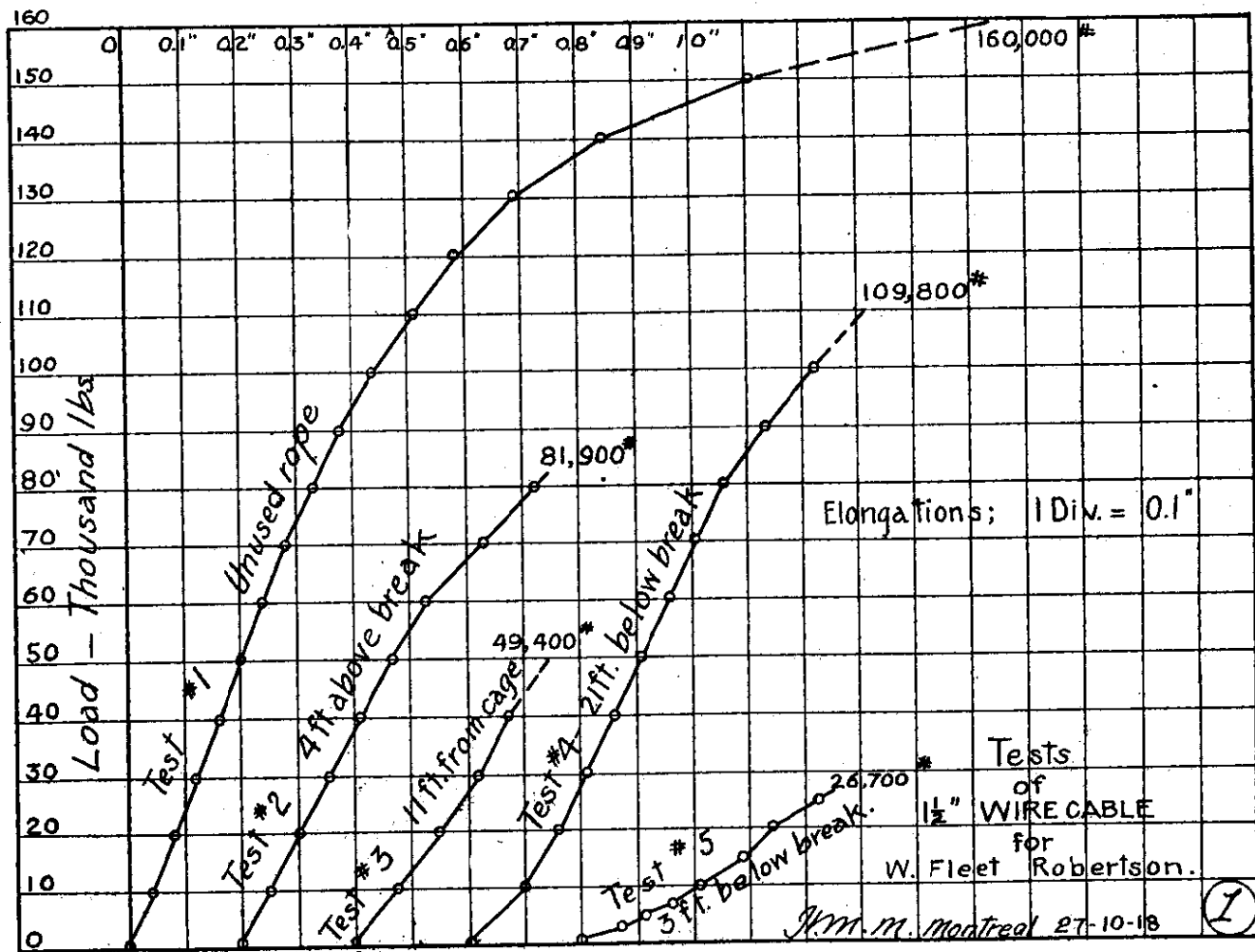
Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	38.93	....	....	30,000	39.15	0.22	0.07
10,000	39.01	0.08	0.08	40,000	39.20	0.27	0.08
20,000	39.08	0.15	0.07	49,400	Failed	....	....

Two strands failed simultaneously. The first audible cracking occurred at 39,800 lb. The wires at the point of failure were much reduced in section through corrosion.

Test No. 4.—This specimen was also cut from Exhibit No. 12, about 21 feet from the broken end. No broken wires were encountered in mounting the specimen. The results of the test follow:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	38.34	....	....	70,000	38.75	0.41	0.05
10,000	38.44	0.10	0.10	80,000	38.80	0.46	0.05
20,000	38.50	0.16	0.06	90,000	38.87	0.53	0.07
30,000	38.55	0.21	0.05	100,000	38.96	0.62	0.09
40,000	38.60	0.26	0.05	106,000	1st crack	...	....
50,000	38.65	0.31	0.05	109,800	Failed	....	....
60,000	38.70	0.36	0.05				

Two strands broke at the last-mentioned load. Of the four remaining strands, one broke at a renewed load of 55,000 lb., a second at 55,400 lb., and the two remaining ones at a renewed load of 43,700 lb.



Test No. 5.—This specimen was also cut from Exhibit No. 12, but as near as possible to the broken end; that is, about 3 feet from the break. The specimen was very badly corroded, and while mounting the specimen it was found that more than one-third of the wires were entirely eaten away, some of them being visible on the outside. The following are the results:—

Load.	Length.	Elongation.	Difference.	Load.	Length.	Elongation.	Difference.
Lb.	Inches.	Inches.		Lb.	Inches.	Inches.	
1,000	30.74	....	....	15,000	30.97	0.23	0.06
3,000	30.80	0.06	0.06	20,000	31.01	0.27	0.04
5,000	30.83	0.09	0.03	25,000	31.08	0.34	0.07
7,000	30.87	0.13	0.04	26,700	Failed	....	....
10,000	30.91	0.17	0.04				

Three strands broke at 26,700 lb. and the remaining strands broke at a renewed load of 8,800 lb.

Fig. 1 shows graphically the results of the five tests plotted approximately to the same scale.

The specimens taken from the vicinity of or below the break thus gave ultimate strengths varying from 58.5 to 16.6 per cent. of the strength of the specimen taken from the drum. This great falling away in strength was, beyond any question, due to the badly corroded state of the wires, and particularly the interior wires composing the cable. In the opinion of the writer the failure of any lubricating agency which may have been applied to penetrate the interior of the cable was the principal factor in permitting such corrosion.

II. HELICAL SPRINGS.

Ten springs were submitted, eight of which, marked "Exhibit No. 14," had been in service at the time of the accident. The two remaining ones, marked "Exhibit No. 16," were new and unused. All of the old springs, with one exception, were so distorted as to preclude the possibility of a fair test of the spring as a whole. Only one test, therefore, was made on the springs included in Exhibit No. 14. Loads were added in suitable increments applied in the same way as in service, and the elongations were noted as well as the permanent set, if any, when each load was released, until the elastic limit was well passed. This spring, originally $\frac{1}{2}$ inch in diameter, as appeared from measurements at the end, was so corroded that the diameter throughout its length was in general reduced to $\frac{3}{8}$ inch, and in some places where the remaining section was oval the shorter diameter was about $\frac{5}{16}$ inch. Six of the seven remaining old springs were in approximately the same condition as regards corrosion. The seventh, however, was affected but little and retained approximately its original diameter. The results of the test follow:—

Outside diameter of coil 2.94 inches.

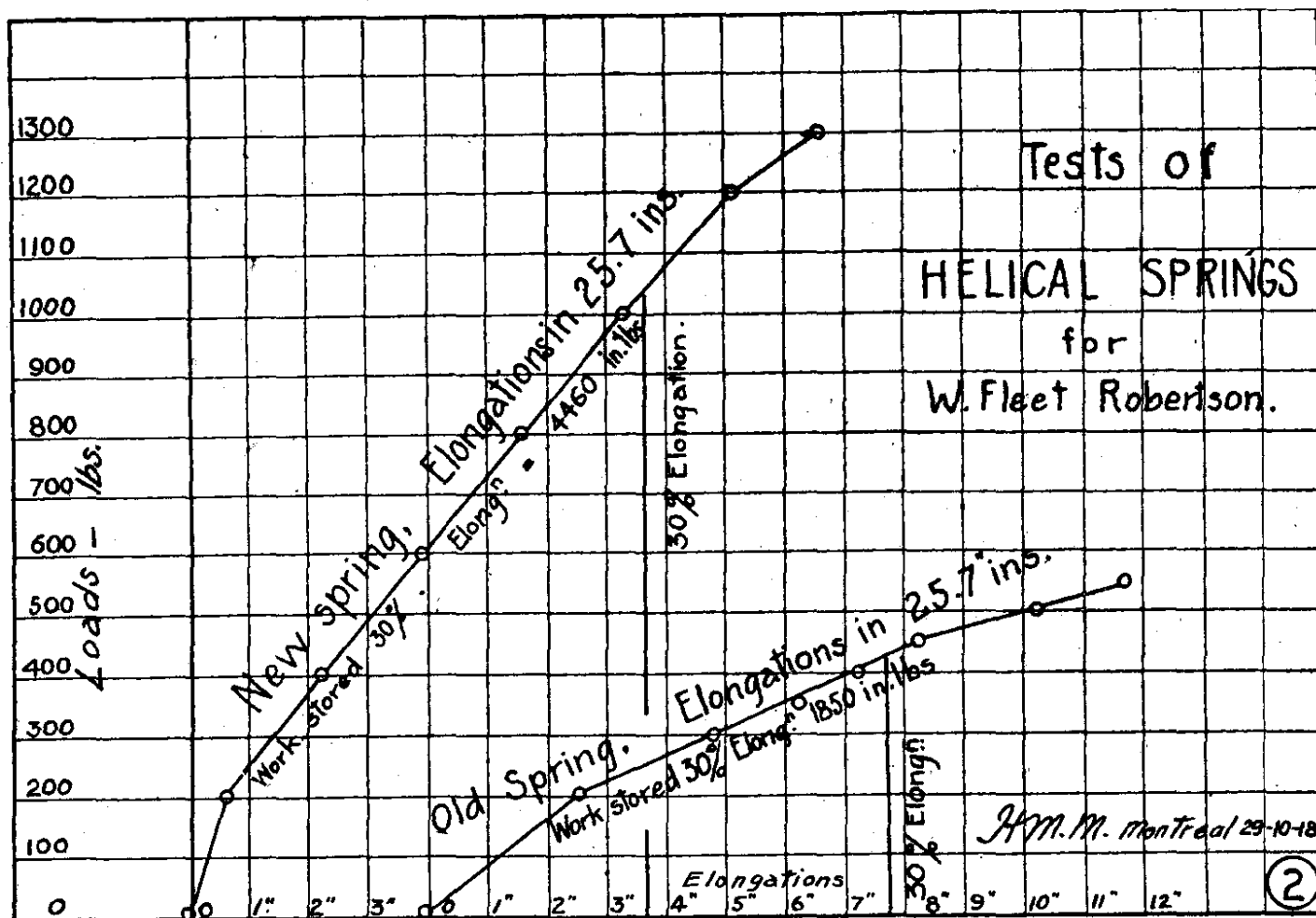
Diameter of wire $\frac{3}{8}$ inch (approx.)

Number of coils between gauge-points = 52

Loads.	Length between Gauge-points	Elongation.	Permanent Set.	Loads.	Length between Gauge-points	Elongation.	Permanent Set.
Lb.	Inches.	Inches.	Inches.	Lb.	Inches.	Inches.	Inches.
.....	26.70	....	....	400	32.94	7.24	0.11
200	28.28	2.58	0.03	450	33.95	8.25	0.20
300	30.52	4.82	0.07	500	35.95	10.25	0.60
350	31.95	6.25	0.09	550	37.44	11.74	1.33

It will be noted that the elasticity of the spring was imperfect, as indicated by the permanent set following the application of each load.

The two new springs, Exhibit No. 16, were tested in a similar manner. In the case of the first the loads were applied by a testing-machine, while in the case of the second weights were hung on the suspended spring. The results of the two methods were in practical agreement. The elastic limit in the one case was reached at a load of 1,200 lb. and in the other at a load of 1,300 lb. There were no permanent sets until these loads were applied, the elasticity at lower loads being perfect. The maximum shearing stresses at the elastic limit were 61,100 lb. per square inch and 66,200 lb. per square inch respectively, which is quite satisfactory. It was



(2)

noticed that the first indications of overstrain appeared in the coils adjacent to the castings to which the springs were attached, and for this reason measurements of elongation on different springs are not strictly comparable unless made between gauge-points similarly situated in each case. In testing the second of the new springs, measurements were taken from points corresponding exactly to those of the old spring. The following results for the unused springs are, therefore, comparable with the data obtained from the old one given above.

Outside diameter of coil 3.02 inches.

Diameter of rod $\frac{1}{2}$ inch.

Loads.	Distance between Gauge-points	Elongation.	Permanent Set.	Loads.	Distance between Gauge-points	Elongation.	Permanent Set.
Lb.	Inches.	Inches.	Inches.	Lb.	Inches.	Inches.	Inches.
.....	25.70	....	....	800	31.34	5.64	....
200	26.31	0.61	....	1,000	33.01	7.31	....
400	27.99	2.29	....	1,200	34.83	9.13	....
600	29.65	3.96	....	1,300	36.32	10.62	0.04

The results of these two tests are plotted in Fig. 2. It will be seen that for a given elongation the pull exerted by the old spring is rather less than 40 per cent. of that exerted by the new, while the energy stored is in about the same ratio. Thus, while the old springs may possibly have been sufficient for the work required of them, the tests indicate that they have lost, through corrosion or otherwise, about 60 per cent. of their efficiency. Theoretical conclusions based on the difference of section are in close agreement with the results of the tests.

It may be noted that an elongation of 30 per cent. causes stresses in the springs approaching the elastic limit.

Yours faithfully,

H. M. MACKAY,

Professor of Civil Engineering.

MICROSCOPIC EXAMINATION OF SOME WIRES FROM A STEEL CABLE.

BY DR. ALFRED STANSFIELD AND A. GORDON SPENCER.

The following is a report of microscopic examination of wires from parts of a steel-wire cable received from Wm. Fleet Robertson, Esq., Provincial Mineralogist of British Columbia:—

These samples were selected from parts of the cable which had been brought to McGill University by Mr. Robertson and were given to us by him personally.

Mr. Robertson supplied us with the following information with regard to the cable:—

Length of cable: 910 feet.

Diameter: $1\frac{1}{2}$ inches.

Construction: Six strands of sixteen wires each, hemp centre, "Lang's lay."

Quality: Best patent improved crucible cast steel.

Manufacturers: T. & W. Smith, Limited, Newcastle-on-Tyne.

Ordered from: Evans, Coleman & Evans, Limited, agents.

Date ordered: October 2nd, 1914. Order No. 8820.

Received: February, 1915.

Placed in service: Immediately after being received.

The samples given to us by Mr. Robertson were as follows: Specimen A, from Exhibit No. 11, a piece 10 inches long taken from the cable at a point eight feet above the break; specimen B, from Exhibit No. 13, a piece 8 inches long taken from that part of the cable which had remained on the winding-drum.

Specimen A was badly rusted. No free oil or grease was visible, but the interstices were filled with a dry brownish material as if composed of a mixture of rust and dirt. The outer large wires were flattened from wear, and all the wires in every strand were very much corroded and reduced in diameter.

Specimen B was well impregnated with grease and the wires appeared to be quite round, smooth, rust-free, and generally in excellent condition. Both specimens had been cut from the cables with an acetylene torch, but all samples for microscopic examination were taken from points sufficiently removed from the heated ends of specimens. Two large and two small wires from each of two opposite strands in each specimen were taken for this purpose, or sixteen wires in all.

Chemical analyses were made of one large and one small wire from one strand of specimen A and from one large and one small wire from specimen B. The results were as follows:—

	Carbon, per Cent.	Manganese, per Cent.
Large wire, specimen A, used cable just above break	0.59	0.70
Small wire, specimen A, used cable just above break	0.58	0.62
Large wire, specimen B, unused cable from drum	0.58	0.70
Small wire, specimen B, unused cable from drum	0.59	0.62

This chemical examination was made as a guide for the interpretation of the microscopic structure of the wire. The tests were not intended to show whether the wire was or was not of suitable chemical composition, but, as far as they go, the results of these analyses show the wires to be of suitable and uniform chemical composition.

The wires selected for microscopic examination were suitably mounted, and each was ground down so as to expose a longitudinal section. The wires were examined microscopically, both in the polished condition and after the usual etching with nitric acid. The microscopic examination was made at magnifications of from 50 to 500 diameters. The structure observed in all cases was the normal structure of cold-drawn steel wire, and we have been unable to detect any evidence of crystallization or of any internal deterioration of the wire such as might have been caused by strain while in service.

We append photographs showing the structure of four of these wires—one large and one small wire from specimen A and one large and one small wire from specimen B; all of these being magnified to an equal extent. We also give photographs, nearly full size, of complete cross-sections of specimen A and specimen B. These photographs give an idea of the extent to which the wires in specimen A had been corroded.

ALFRED STANSFIELD,
A. GORDON SPENCER.

McGill University, Montreal, October 28th, 1918.

CHEMICAL TESTS OF WATER AND OIL.

REPORT BY J. T. DONALD & CO., CONSULTING CHEMISTS AND ANALYSTS, MONTREAL.

318 LAGAUCHETIERE STREET WEST,

MONTREAL, October 16th, 1918.

W. F. Robertson, Esq.,

Provincial Mineralogist, Victoria, B.C.

DEAR SIR,—We have examined the sample of water marked "Exhibit No. 7, H.H." received from you on the 8th inst. We have obtained the following figures in our examination:—

	Grains per Imp. Gal.
Total solids	1,569.89
Chlorine	773.00
Sulphuric anhydride	8.40
Lime	54.87
Magnesia	79.61
Carbonic acid	Traces

These figures indicate that this water is a highly saline one, and that the saline matter consists almost fully of the chlorides of lime, magnesia, and soda. These saline matters render this water very corrosive, and if it were allowed to drip repeatedly on the same point in a cable the same would be rapidly corroded. You can understand what we mean when you recall the action of salt water on metal surfaces.

If the supply of water had been larger we could have gone somewhat more fully into detail, but such detail would not alter the conclusion above stated—namely, that this is a highly saline water, and as such markedly corrosive in its action on iron and steel.

Yours faithfully,

J. T. DONALD & Co.

318 LAGAUCHETIERE STREET WEST,

MONTREAL, October 24th, 1918.

W. F. Robertson, Esq.,

Provincial Mineralogist, Room 1818, Windsor Hotel, Montreal.

DEAR SIR,—We reply to your inquiries concerning the mode of combination of the various radicals in the sample of water to which we referred in our letter of the 16th inst. It is probable the radicals are grouped so as to form the following:—

	Grains per Imp. Gal.
Calcium sulphate	14.15
Calcium chloride	103.00
Magnesium chloride	190.00
Alkali chlorides	1,262.00

As regards your second question, we record that if this water were coming in contact with a cable that is coated with lubricating-oil, the saline matters are not likely to saponify the oil or that part of it that may be saponifiable. It is probable the oil is largely, if not entirely, mineral oil, and therefore unsaponifiable. If, however, conditions are such that this water would drop continuously on the same point of the cable, the frequent dripping would tend to brush aside the oil and corrosion might follow. If, however, this water would drip for any length of time on the same part of the cable unlubricated, there would be rapid corrosion.

If this does not answer your questions or any points are not clear, we trust that you will communicate with us.

Yours faithfully,

J. T. DONALD & Co.

318 LAGAUCHETIERE STREET WEST,

MONTREAL, October 16th, 1918.

W. F. Robertson, Esq.,

Provincial Mineralogist, Victoria, B.C.

DEAR SIR,—We have examined the sample of lubricating-oil marked "Exhibit No. 9, H.H.," and received from you on the 8th inst.

We find nothing in this oil that would cause corrosion of iron or steel cables. It is a heavy mineral oil with a small percentage of saponifiable oil and containing only a very slight amount of free fatty acid. It is a good oil for this purpose—namely, heavy lubrication.

Yours faithfully,

J. T. DONALD & Co.

EXPERIMENTAL TESTS OF SAFETY-CATCHES.

REPORT BY GEORGE WILKINSON, CHIEF INSPECTOR.

I beg to submit the following report on tests of the efficiency of safety-catches made at Reserve mine, Nanaimo, B.C., on October 21st and November 11th, 1918:—

PREPARATIONS FOR TESTS.

Preparations were made at the Reserve mine for carrying out a series of tests for demonstrating the efficiency of the safety-catches in use at the Canadian Western Fuel Company's mines by subjecting them to tests which are as near as possible the conditions that would be met in the occurrence of accidents during working conditions, namely: (1) Rope breaking with ascending cage; (2) rope breaking with cage stationary; (3) rope breaking with descending cage. For this purpose a full-dimensioned shaft was made between the bents of the trestle-work at the Reserve mine, guides and buntons being placed just the same as actual conditions in a shaft. A full-sized cage was used under the same conditions as it would be used in a shaft. A small hoist of the friction-clutch type driven by compressed air was installed for the purpose of hoisting up the cage. An automatic slip-link was used between the connecting-link on the cage and the cone of the rope. This slip-link was so made that its position could be reversed and the rope cut off on the ascending or descending cage. The bottom of the shaft was filled up with sacks of straw to absorb the shock in case of the cage falling to the bottom of the shaft.

METHODS OF TESTING.

Test No. 1.—The cage was stationary and rope cut off by the automatic trip and cage allowed to fall. The cage dropped $1\frac{1}{4}$ inches and catches came into operation, stopping the cage in the above-mentioned distance.

Test No. 2.—The cage was hoisted to the top of the shaft, and a hemp rope was attached to the arm of the automatic slip-link, and the other end attached to a buntion at the top of the shaft and sufficient slack rope left to give the cage a free drop of 7 feet; the friction and brake were then thrown off the engine, allowing the cage to suddenly drop. When the cage reached the point the slack rope allowed the rope was automatically cut off, allowing the cage to descend rapidly, similar to what would happen with a rope breaking close to a descending cage. The catches failed to operate under this test and the cage fell to the bottom of the shaft. There were no signs of the catches gripping until the fall of the cage was partially arrested by the sacks of straw; then the catches gripped for about a foot in length along the guides, or just about the amount the sacks were compressed by the weight of the cage.

It would appear as though just as the resistance of the sacks of straw came into operation against the floor of the cage, then the catches started to operate, which would indicate there was not a slackening of the chains until the speed of the cage was arrested.

Test No. 3.—Another test of disconnecting the rope when cage was descending, the operations were practically the same as test No. 2, the only difference being the rope was disconnected sooner, giving the cage a shorter drop. In this test the safety-catches failed to operate and the cage again fell to the bottom of the shaft.

Test No. 4.—Cage stationary as in test No. 1; catches came in operation but failed to stop the cage; it kept sliding gently to the bottom of the shaft, which I think was due to the fact of the teeth of the cams being full of wood gouged out of the guides in previous tests.

Test No. 5.—The cage was ascending as quickly as the hoist could run. The slip-link was reversed in position and the hemp rope attached to a buntion in the shaft, so that when the cage reached a certain position in the shaft the hoisting-rope would be automatically cut off. This point was selected at about two-thirds the distance up the shaft. When the cage was hoisted to this point the hoisting-rope was automatically cut off and the cage allowed to fall. The safety-catches immediately came into operation and arrested the fall of the cage in a distance of 1 inch.

Test No. 6.—The cage was hoisted to the top of the shaft; the slip-link was attached with sufficient slack rope to allow a fall of 9 feet. The cage was then allowed to fall as fast as the loose drum could turn with the weight of the cage, the rope disconnected, and the cage allowed to fall. The safety catches failed to operate and the cage fell to the bottom of the shaft.

In all the tests with the cage descending the catches failed to arrest the fall of the cage to the bottom of the shaft. In the test with the cage ascending and the first test with the cage stationary, the catches operated successfully and stopped the cage in a very short distance.

In test No. 4, the second test with the cage stationary, the cage slipped to the bottom of the shaft, but I think the failure to stop the cage was due to the fact (as mentioned previously) of the teeth of the cams being full of wood gouged out of the guides in previous tests.

The failure of the catches on the descending cage led to considerable discussion as to the cause, and it was suggested that with sharper teeth and stronger springs the difficulty might be overcome. So with this end in view Thomas Price, master mechanic for the Canadian Western Fuel Company, designed a new cam with one tooth. In preliminary trials this cam gripped, but the weight of the cage turned the cam completely around. To prevent this a piece of angle-iron was riveted to the side of the cage to prevent the cams from turning over, and all was in readiness for a second series of tests.

SECOND SERIES OF TESTS.

The second series of tests was made on November 11th at the Reserve mine. The method of tests were as follows:—

Test No. 1.—The cage was placed in a stationary position and the hoisting-rope automatically cut off. The catches immediately came in operation and arrested the fall of the cage in a distance of 1 inch.

Test No. 2.—The slip-hook was attached and approximately 10 feet of slack rope given and the end fastened to a buntion in the shaft. The cage was then hoisted as quickly as possible. When the end of the slack rope was reached the hoisting-rope was automatically cut off. The catches immediately came into operation and arrested fall of the cage in 1 inch.

Test No. 3.—The cage was hoisted to the top of the shaft and the slip-hook reversed and about 7 feet of slack rope allowed, so that there would be a drop of the cage that distance before the hoisting-rope was detached. The cage was then dropped quickly, the hoisting-rope cut off, and the cage allowed to fall. The catches came into operation and arrested the fall of the cage in 5 inches. The stopping of the cage was very violent, the tooth of the cam biting into the guides nearly 2 inches.

Test No. 4.—This test was similar to test No. 3, but the cage was allowed to run a greater distance before the hoisting-rope was cut off. The catches again came into operation and stopped the cage in a short distance, but the stop was very violent and the teeth of the cams bit very deeply into the guides.

In all the second series of tests the safety-catches operated successfully and were effective in arresting the fall of the cage. The stopping of the cage in Nos. 3 and 4 tests with the descending cage was very violent, even at the slow speed the cage was travelling, and it would be difficult to imagine what would be the result if these catches came into operation with the cage travelling at a high speed, of, say, 30 or 40 feet per second.

THIRD SERIES OF TESTS.

A third series of tests was made on November 22nd, which did not work out very good.

Test No. 1.—The cage was placed in a stationary position and the rope automatically cut off. The catches operated successfully and stopped the fall of the cage in a distance of $1\frac{1}{4}$ inches.

Test No. 2.—The cage was hoisted up the shaft and the rope was automatically cut off while the cage was in motion. The catches operated successfully and stopped the fall of the cage in 2 inches.

Test No. 3.—The cage was allowed to descend quickly with the intention of having the rope cut off automatically when it reached a given point, but the catches came into operation and stopped the cage while it was descending before the rope was cut off.

Test No. 4.—The cage was allowed to descend again with the intention of cutting off the rope when in motion, but too long a length of rope (slack) was allowed and the cage struck the bottom of the shaft before the slip-hook came into operation and detached the rope. During the test the hoist was unfortunately broken and the cage could be hoisted only by means of rope around the counter-shaft.

Test No. 5.—The cage was hoisted to a certain position in the shaft and the rope automatically cut off, allowing the cage to fall. The safety-catches successfully operated and stopped the fall of the cage in 2 inches.

After watching the various tests the writer's opinion is that cam catches operated by springs similar to the ones tried cannot be relied on to effectually stop the fall of the cage under all circumstances. There seems to be no doubt about their successful operation in a case of overwind, or even in case of a rope breaking on the ascending cage, but in the case of a descending cage it is doubtful if they would successfully operate in any case.

It would seem that the spring tension required to overcome the drag of a length of rope that may be left between the cage and the break and also the drag of the chains is an unknown quantity. In the tests made it seemed that if too much tension pull is given there is danger of the catches coming in operation with a quickly descending cage without the rope breaking, which would be a very dangerous factor in shafts where quick hoisting is done. To give the springs the right tension pull and keep them in the same condition at all times for a successful operation on a descending cage would be practically impossible.

Some interesting facts were developed by a series of experiments carried out by a Commission in the Transvaal, and the following tests are quoted and may be of interest:—

SUCCESSFUL SAFETY-CATCHES.

Report of the Transvaal Commission on Safety-catches for Mine-cages—Results of a Series of Experiments.

The Commission appointed by the Transvaal Government to investigate the use of "winding" or hoisting-ropes, safety-catches, and appliances in mine-shafts has recently made public its report. This Commission consisted of twenty-three engineers and experienced mine managers, among them a number of well-known Americans.

Methods of Testing.

Cages equipped with the safety appliances to be tested were usually submitted to the following experiments in the order given:—

(1.) *Cage with no Velocity.*—(a) Empty cage lifted a little above the chain and then let go by means of a slip hook; (b) cage loaded with 3,000 lb. tested as in (a).

(2.) *Cage falling with a 3-foot Head Velocity.*—(a) Empty cage; (b) cage loaded with 3,000 lb. In this test safety-catches were by various devices kept from acting until the cage had fallen 3 feet freely.

(3.) *Test with Cage descending, Rope attached.*—In this test the usual hoisting-rope was attached to the drum of the engine by means of a light hemp rope. The engine was then run back sharply, allowing the cage to rapidly descend for various desired distances, when the hoist-rope would be attached by the breaking of the hemp rope and allow the cage to fall freely with the hoist-rope attached.

Tests of the Ordinary Cam Safety-catches.—The first experiments conducted by the Commission were on the cage equipped with the ordinary toothed cam device commonly in use on the Rand. When the cage was overwound and when dropped both empty and loaded from rest, the cams acted immediately and were entirely satisfactory. When the empty cage was given a 3-foot free fall, however, although the cams acted promptly and stopped the cage in a distance of 6½ inches, they cut into the guides 1 inch on each side, damaging them considerably. In addition, the shock of the sudden stop was great.

The test of the loaded cage given a 3-foot free fall was a failure, as the cams cut the guides enough to allow their turning completely around, and thus let the cage fall to the stops, consisting of 10-inch timbers covered with bags of ashes. Heels were then added to the cams to prevent their turning around and all tests except the last proved satisfactory.

In this last test the loaded cage was sharply lowered a distance of 106 feet and had a speed of 1,100 feet per minute at the time of rope disconnection. As a result the cams gripped the guides violently and broke them, the cage tilted across the shaft and fell 40 feet to a point where it became firmly wedged in the shaft timbers.

NOTE.—These tests seem to indicate the reliability of cams to act promptly, stop a cage suddenly (if at all), and thus damage the guides considerably. In the case of no or small velocity at the time of action the suddenness of stop may result in only a harmless shock to cage passenger. With high velocity, however, not only is the shock dangerous to passengers, but may break the guides and allow the cage to fall.

In the same manner that the British Board of Trade permits the use of certain safety-valves for marine boilers, and just as the British Home Office has published a list of "Permitted Explosives" for use in coal-mines, so, it is considered, should the Mines Department prescribe which safety-catches are to be classed as suitable for the various kinds of shaft.

The Commission, while not wholly satisfied that any of the safety-catches tried entirely meets the requirements of such an appliance, considers that, of the designs submitted, the following give the most satisfactory results: for vertical shafts with wooden guides, the Undentsch; for vertical shafts with wooden guides, the Schweder; for vertical shafts with steel guides, the Schweder; for inclined shafts with steel rails, none at present, but advise early trials of suitable designs.

The Commission recommends that no safety-catch should be placed on a "permitted" list until its reliability has been thoroughly established by tests similar to those carried out at the Marcus shaft, such tests to be conducted at Government expense and under the direction of the Government mining engineer, notice of which tests should be advertised previously in the daily press. It is also considered that the inventor should supply and deliver at the testing-station, free of cost to the Government, the full-sized working appliances ready to be fitted to a cage of standard dimensions.

EXPERIMENTAL TESTS OF SAFETY-CATCHES.

REPORT BY ANDREW BRYDEN.

Acting under instructions received from the Minister of Mines on September 11th, 1918, to proceed to Nanaimo with the object of examining and making a report on the rope and safety device the failure of which caused sixteen fatalities in Protection shaft on September 10th, 1918:

On arrival in Nanaimo I went to Protection shaft, the scene of the accident, in company with the Minister of Mines, the Chief and District Inspectors, also the jury empanelled to ascertain the cause of the death of sixteen of their fellow-men. On examining the rope at the point of rupture, the outside wires had no appearance of weakness, little or no surface wear, and their tensile strength but very little impaired, but the inside wires of each strand were in a really bad condition from internal corrosion, so much so that they could easily be picked out with the fingers; the rope, in fact, was in a very dangerous condition. But its real condition could not possibly be ascertained by the usual superficial method of examination—that is, by running the rope through the hands—as there were no broken wires or surface wearing that would indicate that the rope was in any way out of its normal condition.

The usual recapping of the rope at frequent intervals would not in this case have avoided accident, although very much to be commended. The tests made under the supervision of Mr. Robertson, the Provincial Mineralogist, have demonstrated the fact that the rope was in much better condition near the cage than at points distant from the cage. The use of the thin splicing-spike would have been the only method of ascertaining the inside condition of the rope. A flat spike can be inserted and the heart of a rope exposed without the slightest injury to a rope that has retained its flexibility and tensile strength; but to the rope that is somewhat impaired from corrosion it would probably be injurious, yet, in my opinion, it is the only way of being sure that the rope is fit for the onerous duty imposed on it.

Mr. Robertson's report no doubt has eliminated from the minds of a great many people—let me say myself, among others—that the hoisting engineer had probably contributed largely towards the accident by the rough handling of the engine, as the evidence given to the jury to a certain extent left that impression. The shortness of the break in the rope in comparison to that of a strain had almost confirmed me in believing so too, but Mr. Robertson's report sets that idea at rest, as he has demonstrated the fact that the rope was not capable of standing the abuse attributed to his work.

To be fair and impartial, I do not mind placing myself on record in saying that had I made the examination of the surface appearance of the rope—I mean the usual superficial method—I would have stepped on the cage in all confidence that the rope was safe. After examining the rope in company with the Chief and District Inspectors, we examined the guides in the shaft to ascertain whether the safety-catches had made any attempt to perform the work they were designed for and expected to do, but at no place in the whole distance through which the cage had passed after the parting of the rope was there shown any indication that the catches had come into the slightest operation. This determined the Minister of Mines to have the device subjected to a series of tests with the object of ascertaining their value as a factor of safety where lives were entrusted to their efficiency.

On October 19th I was informed by the Chief Inspector that he was prepared to begin on Monday, the 21st, the tests of the safety-catches as ordered by the Minister of Mines. On that date we went to the Reserve mine of the Western Fuel Company, where a perfect lift was rigged up with cage-catches and winch such as would be used in the ordinary working of a mine. The tests we made were no doubt under ideal conditions favouring the device, altogether different from those obtained in a shaft under working conditions; the guides were new, the corrugation of the cams clean, the springs newly overhauled, and, I may say, everything in favour of the device.

The tests made with the cage ascending were fairly successful, but with the descending cage the catches failed entirely to operate; and one test with the cage at rest, when the detaching-hook was cast loose, the cage staggered momentarily from guide to guide and then dropped to the bottom.

Needless to say that in my opinion the term "safety" is a perfect travesty to the name.

I am so thoroughly convinced that after the tests were made, with everything favouring the device, and found wanting, that under ordinary conditions where the cams are blocked with grease and dirt, the guides wet and slimy, and in many cases worn below their original size through many years of work, this particular device is rather a menace than a source of safety.

In conclusion, let me say that we were afforded every assistance and co-operation by Mr. Hunt and other officials of the Western Fuel Company to honestly establish the standing of safety-catches as a factor of safety.

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 Managers' Board.

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 Managers' Board, the Act further provides that every coal-miner shall be the holder of a certificate of competency of 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 for a miner's certificate are held each month at each colliery by a Board of Examiners, known as the Miners' Board, and consisting of an examiner appointed by the owners, an examiner elected by the miners of that colliery, and an examiner appointed by the Government.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES.

Report of Tully Boyce, Secretary of Board.

I beg to submit the annual report covering the transactions of the above Board for the year ending December 31st, 1918.

The Board consists of Thos. R. Stockett, of Vancouver, Chairman; Andrew Thomson, of Nanaimo, Vice-Chairman; Tully Boyce, of Nanaimo, Secretary; Geo. Wilkinson, of Victoria, Chief Inspector of Mines; Andrew Bryden, of Vancouver; and Bernard Caufield, of Coal Creek.

An examination for First-, Second-, and Third-class Certificates was held on the 14th, 15th, and 16th days of May at Nanaimo, Cumberland, Merritt, and Fernie, at which there were 47 candidates, as follows: For first-class there were 16 candidates, 4 of whom passed and 12 failed; for second-class there were 16 candidates, 6 of whom passed and 10 failed; for third-class there were 15 candidates, 12 of whom passed and three failed.

Another examination was held for First-, Second-, and Third-class Certificates on the 17th, 18th and 19th days of December at Nanaimo, Cumberland, Fernie, and Princeton, at which there were 29 candidates, as follows: For first-class there were 8 candidates, 5 of whom passed and 3 failed; for second-class there were 8 candidates, all of whom passed; for third-class there were 13 candidates, all of whom passed.

Certificates of competency have been applied for and issued to all the successful candidates, and to a successful candidate for first-class who passed at the examination held November, 1917, but failed to apply for his certificate in time to have his name recorded in the report for that year. The names of the successful candidates are herewith enclosed.

LIST OF CANDIDATES TO WHOM CERTIFICATES WERE ISSUED AT THE EXAMINATIONS HELD ON MAY 14TH, 15TH, AND 16TH, 1918, AT NANAIMO, CUMBERLAND, MERRITT, AND FERNIE; AND ON DECEMBER 17TH, 18TH, AND 19TH, 1918, AT NANAIMO, CUMBERLAND, FERNIE, AND PRINCETON.

First-class Certificates.

Name.	Date.	No.
Higgins, Alexander.....	Dec. 19th, 1918....	
Ramsay, Peter Millar.....	May 16th, "	
Smith, Thomas Edwin.....	Dec. 19th, "	
Taylor, James.....	May 16th, "	
Walker, William.....	May 16th, "	
Wesmedge, William.....	Dec. 19th, "	
Whittaker, John.....	Dec. 19th, "	
Williams, John Samuel.....	Dec. 19th, "	
Wilson, William.....	May 16th, "	

Second-class Certificates.

Name.	Date.	No.
Barlow, Benjamin Robert.....	Dec. 19th, 1918....	B 229
Brown, George.....	Dec. 19th, "	B 225
Brown, William Gold.....	Dec. 19th, "	B 228
Coupland, George.....	May 16th, "	B 217
Gourlay, Robert.....	Dec. 19th, "	B 227
Greenwell, Archibald.....	May 16th, "	B 220
Hastings, Andrew Peacock.....	Dec. 19th, "	B 223
Holliday, William.....	Dec. 19th, "	B 230
Jones, Samuel.....	May 16th, "	B 221
Morgan, William.....	Dec. 19th, "	B 224
Rowbottom, Thomas.....	May 16th, "	B 222
Rutherford, Jasper.....	May 16th, "	B 219
Scarpino, Francis.....	Dec. 19th, "	B 226
Sutherland, John.....	May 16th, "	B 218

Third-class Certificates.

Name.	Date.	No.
Ainsworth, Edward	May 16th, 1918....	C 674
Blinkhorn, Thomas	Dec. 19th, 1918....	C 681
Bysouth, Thomas	May 16th, 1918....	C 673
Caufield, Edward	May 16th, 1918....	C 670
Colgrove Charles Henry	Dec. 19th, 1918....	C 679
Cooper, John Andrew	Dec. 19th, 1918....	C 689
Davis, John David	May 16th, 1918....	C 669
Dean, Andrew	Dec. 19th, 1918....	C 688
Farrow, John William	Dec. 19th, 1918....	C 683
Francescini, Louis	May 16th, 1918....	C 672
Gillies, William	May 16th, 1918....	C 668
Herd, William	Dec. 19th, 1918....	C 682
Hilton, Mathias	Dec. 19th, 1918....	C 677
Holdsworth, William	May 16th, 1918....	C 671
Park, William	Dec. 19th, 1918....	C 684
Puckey, John Thomas	Dec. 19th, 1918....	C 687
Shields, Thomas	May 16th, 1918....	C 667
Smith, John Watterson	May 16th, 1918....	C 665
Snow, Aubrey	May 16th, 1918....	C 675
Taylor, Jonathan	Dec. 19th, 1918....	C 680
Tolley, John	Dec. 19th, 1918....	C 678
Webster, James Stewart	Dec. 19th, 1918....	C 685
West, James Gloag	May 16th, 1918....	C 676
Whalley, William	Dec. 19th, 1918....	C 686
Young, Alexander	May 16th, 1918....	C 666

Delinquents from Previous Examinations who have since received Certificates.
First-class Certificates.

Name.	Date.	No.
Davis, Stephen	Nov. 15th, 1917....	

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, 1905
Wilkinson, Geo.	January 21st, 1905
Wright, H. B.	January 21st, 1905
Coulthard, R. W.	January 21st, 1905
Roaf, J. Richardson	January 21st, 1905
John, John	January 21st, 1905
Manley, H. L.	January 21st, 1905
Bathey, Richard	May 27th, 1913
Baxter, Andrew	June 40th, 1911

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	NAME.	DATE.
Biggs, J. G.	July 22, 1908	McMillan, J. H.	Sept. 10, 1910
Bonar, Robert.	Oct. 23, 1911	McVicar, Samuel.	May 1, 1909
Brace, Tom.	May 13, 1915	Mazey, William John.	Oct. 31, 1912
Bridge, Edward.	July 22, 1908	Miard, Henry Ernest.	May 9, 1912
Brown, David.	May 21, 1914	Michell, Dudley.	Nov. 15, 1917
Brown, Robert Joyce.	May 13, 1915	Millar, John K.	Nov. 22, 1906
Caulfield, Bernard.	May 1, 1909	Miller, Andrew Anderson.	Oct. 31, 1912
Church, James A. H.	June 10, 1911	Montgomery, John W.	May 1, 1909
Cox, Richard.	May 13, 1915	Moore, Wm. H.	May 17, 1917
Crowder, James.	June 10, 1911	Mordy, Thomas.	Sept. 10, 1910
Cunningham, John Howard.	May 9, 1912	Mottishaw, Sam. K.	Nov. 15, 1917
Davidson, W. A.	May 1, 1909	Musgrove, J. T.	Oct. 28, 1911
Davies, David.	June 10, 1911	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
Fairfoul, 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, Alex.	Nov. 14, 1905
Garman, Morris W.	Nov. 15, 1917	Shaw, William.	May 9, 1912
Gascoyne, Rowland B.	May 21, 1914	Shenton, T. J.	Sept. 10, 1910
Glover, Francis.	Oct. 31, 1912	Shone, Samuel.	May 1, 1909
Graham, Charles.	Nov. 14, 1905	Smith, A. E.	Oct. 28, 1911
Graham, Thomas.	Nov. 9, 1907	Smith, Joseph.	July 22, 1908
Gray, James.	Nov. 27, 1909	Smith, Thos. Edwin.	Dec. 19, 1918
Henderson, Robert.	Nov. 27, 1909	Spicer, J. E.	Oct. 28, 1911
Hewlett, Howe.	May 27, 1913	Spruston, T. A.	Nov. 27, 1909
Higgins, Alexander.	Dec. 19, 1918	Stevens, L. C.	Nov. 27, 1909
Holden, James.	May 1, 1909	Stewart, R. T.	Sept. 10, 1910
Howden, Archibald.	May 27, 1913	Strachan, Robert.	Mar. 4, 1905
Howells, Nathaniel.	Oct. 28, 1911	Strang, James.	June 10, 1911
Hughes, John C.	May 17, 1917	Taylor, James.	May 16, 1918
Humphries, Clifford.	June 10, 1911	Thomas, J. D.	Sept. 10, 1910
Hunter, Alex. B.	July 8, 1916	Thorne, B. L.	Sept. 10, 1910
Jackson, Thos. R.	Nov. 9, 1907	Touhey, James.	May 21, 1914
James, William.	July 22, 1908	Walker, William.	May 16, 1918
Jaynes, Frank.	May 13, 1915	Wallbank, J.	Sept. 10, 1910
Jemson, Jas. W.	May 27, 1913	Warburton, Ernest Leonard.	July 8, 1916
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
Macauley, D. A.	June 10, 1911	Wilson, Ridgeway R.	Nov. 15, 1917
McCulloch, James.	Sept. 10, 1910	Wilson, William.	May 16, 1918
McGuckie, Thomas.	July 22, 1908	Wylie, John.	July 22, 1908
McKendrick, Andrew.	May 27, 1913		

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
McClement, 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, Hugh.....	July 29, 1905	B 24
Allan, Alex. McDairmid...	May 27, 1913	B 167	Gillespie, John.....	Oct. 23, 1906	B 36
Almond, Walter.....	Nov. 15, 1917	B 213	Gould, Alfred.....	May 13, 1915	B 190
Barclay, Andrew.....	July 29, 1905	B 25	Gourlay, Robert.....	Dec. 19, 1918	B 227
Barlow, Benjamin Robert...	Dec. 19, 1918	B 229	Graham, Chas.....	Mar. 4, 1905	B 1
Baybutt, Thomas.....	July 8, 1916	B 206	Gray, David.....	May 1, 1909	B 76
Bell, John.....	May 17, 1917	B 212	Gray, George.....	July 8, 1916	B 207
Bevis, Nathaniel.....	Sept. 10, 1910	B 123	Greenwell, Archibald.....	May 16, 1918	B 220
Biggs, John.....	May 1, 1909	B 94	Hamilton, Robert N.....	May 21, 1914	B 175
Biggs, John G.....	Nov. 2, 1907	B 40	Hastings, Andrew Peacock...	Dec. 19, 1918	B 223
Blair, James.....	May 13, 1915	B 197	Henderson, Robert.....	July 22, 1908	B 60
Brace, Tom.....	Nov. 27, 1909	B 96	Holliday, William.....	Dec. 19, 1918	B 230
Bridge, Edward.....	Oct. 23, 1906	B 33	Horrocks, Abner G.....	June 10, 1911	B 130
Brown, David.....	Sept. 10, 1910	B 108	Howells, Nathaniel.....	Nov. 27, 1909	B 97
Brown, George.....	Dec. 19, 1918	B 225	Huby, Norman W.....	May 13, 1915	B 198
Brown, James L.....	Oct. 28, 1911	B 136	Hudson, George.....	Sept. 10, 1910	B 121
Brown, John C.....	Oct. 23, 1906	B 39	Hughes, John C.....	Sept. 10, 1910	B 109
Brown, John Todd.....	May 9, 1912	B 150	Hutton, Isaac.....	May 21, 1914	B 185
Brown, R. J.....	Oct. 28, 1911	B 134	Hutton, John.....	May 9, 1912	B 154
Brown, Robert.....	May 21, 1914	B 183	Jackson, Thos. R.....	Mar. 4, 1905	B 5
Brown, Robert Sneddon.....	May 13, 1915	B 196	James, David.....	Nov. 2, 1907	B 58
Brown, William Gold.....	Dec. 19, 1918	B 228	Jarrett, Fred.....	May 1, 1909	B 84
Brownrigg, John H.....	May 17, 1917	B 124	Jaynes, Frank.....	Sept. 10, 1910	B 111
Bushell, J. P.....	May 1, 1909	B 81	John, Francis.....	July 8, 1916	B 200
Carroll, Henry.....	July 22, 1908	B 62	John, Howell.....	Sept. 10, 1910	B 122
Caufield, Bernard.....	Oct. 23, 1906	B 30	Johnson, Moses.....	May 1, 1909	B 75
Caufield, John.....	July 8, 1916	B 199	Jones, Samuel.....	May 18, 1918	B 221
Cawthorne, L.....	May 1, 1909	B 93	Jones, William T.....	July 22, 1908	B 66
Challinor, Jno. Thomas.....	May 27, 1913	B 169	Jordan, Thos.....	Nov. 27, 1909	B 104
Challoner, Jno. Arthur.....	May 21, 1914	B 178	Joyce, Walter.....	May 27, 1913	B 168
Churchill, James.....	July 22, 1908	B 65	Kirkwood, John Robertson	Oct. 31, 1912	B 160
Clarkstone, Wm. W.....	May 21, 1914	B 180	Knowles, James E.....	Oct. 28, 1911	B 137
Commons, Wm.....	Sept. 10, 1910	B 115	Laird Robert.....	May 17, 1917	B 210
Coupland, George.....	May 16, 1918	B 217	Lancaster, William.....	Nov. 2, 1907	B 50
Courtney, A. W.....	Oct. 28, 1911	B 138	Lander, Frank.....	May 13, 1915	B 195
Cox, Richard.....	May 9, 1912	B 143	Lane, Joseph.....	May 9, 1912	B 142
Crawford, David.....	May 1, 1909	B 88	Lee, Robert John.....	Sept. 10, 1910	B 110
Cunliffe, Thomas.....	May 1, 1909	B 78	Littler, Matthew.....	Oct. 31, 1912	B 157
Dando, John.....	May 27, 1913	B 164	Luck, George.....	June 10, 1911	B 128
Daniels, David.....	Nov. 2, 1907	B 53	Manifold, Albert.....	May 9, 1912	B 145
Derbyshire, James.....	Oct. 23, 1906	B 32	Marsh, John.....	Nov. 15, 1917	B 216
Davidson, Hugh.....	May 27, 1913	B 165	Mason, Joseph.....	May 13, 1915	B 193
Davies, Stephen.....	Sept. 10, 1910	B 113	Massey, H.....	Nov. 27, 1909	B 99
Dennis, Fred. W.....	May 21, 1914	B 174	Mather, Thomas.....	June 10, 1911	B 127
Devlin, Ernest H.....	May 21, 1914	B 179	Matusky, A.....	May 1, 1909	B 91
Devlin, Henry.....	Nov. 2, 1907	B 44	Mayer, Ralph Waldo.....	May 9, 1912	B 144
Dewar, Alexander.....	Oct. 31, 1912	B 162	Mazay, W. J.....	Nov. 27, 1909	B 101
Dickenson, Clifford.....	May 13, 1915	B 189	Merryfield, William.....	July 22, 1908	B 61
Dunsmuir, John.....	Nov. 14, 1905	B 26	Miard, Hy. E.....	Sept. 10, 1910	B 107
Dykes, J. W.....	May 1, 1909	B 77	Michek, John.....	May 17, 1917	B 188
Eccleston, Wm.....	May 1, 1909	B 87	Michell, Dudley.....	May 13, 1915	B 187
Ewart, Alexander.....	May 17, 1917	B 208	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, Enoch.....	May 1, 1909	B 86	Mottishaw, S. K.....	Oct. 28, 1911	B 135
Francis, James.....	July 22, 1908	B 63	Musgrave, J.....	May 1, 1909	B 90
Frater, George.....	July 8, 1916	B 204	Myers, Peter.....	May 9, 1912	B 149
Freeman, Henry N.....	Nov. 2, 1907	B 45	McDonald, J. A.....	Oct. 28, 1911	B 133
Garbett, Richard.....	Oct. 31, 1912	B 161	McDonald, John.....	May 27, 1913	B 172
Garman, Morris Wilbur...	Oct. 31, 1912	B 155	McFegan, W.....	Nov. 31, 1909	B 106

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Concluded.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
McGarry, Martin	Oct. 31, 1912	B 156	Shaw, Alex	July 29, 1905	B 19
McGuckie, Thomas M.	Oct. 23, 1906	B 35	Shaw, Thomas John	May 27, 1913	B 166
McKelvie, J.	May 1, 1909	B 92	Somerville, Alex.	Mar. 4, 1905	B 4
McKendrick, And.	Sept. 10, 1910	B 112	Spruston, Robert Lecce	July 8, 1916	B 202
McMillan, D.	June 10, 1911	B 125	Spruston, Thos. A.	Nov. 2, 1907	B 46
McNay, Carmichael	May 9, 1912	B 151	Stafford, Matthew	June 10, 1911	B 131
McPherson, James E.	July 22, 1908	B 73	Stewart, J. M.	May 1, 1909	B 95
Neen, Joseph	June 10, 1911	B 129	Stobbart, Jacob	May 9, 1912	B 153
Newbury, Arthur	May 21, 1914	B 184	Stockwell, William	Nov. 2, 1907	B 56
Newton, John	Oct. 23, 1906	B 31	Strang, Thomas	Oct. 31, 1912	B 158
Newton, Wm.	Sept. 10, 1910	B 116	Sutherland, John	May 16, 1918	B 218
O'Brien, Charles	May 9, 1912	B 148	Taylor, James	May 13, 1915	B 194
O'Brien, George	May 1, 1909	B 82	Taylor, Thomas	July 8, 1916	B 203
Ovington, John	Nov. 2, 1907	B 52	Thomas, J. B.	Nov. 27, 1909	B 105
Parkinson, T.	May 1, 1909	B 80	Thomas, Joseph D.	Oct. 23, 1906	B 38
Parnham, Charles	Nov. 2, 1907	B 49	Thompson, Joseph	Sept. 10, 1910	B 114
Quinn, James	May 21, 1914	B 181	Touhey, James	May 9, 1912	B 147
Quinn, John	May 9, 1912	B 146	Touhey, William	July 8, 1916	B 205
Ramsay, Peter Millar	May 17, 1917	B 209	Tonge, Thomas	July 22, 1908	B 71
Rankin, Geo.	Nov. 27, 1909	B 103	Tully, Thomas	Nov. 15, 1917	B 214
Raynes, M. T.	Oct. 28, 1911	B 139	Vanhulle, Peter	Nov. 2, 1907	B 54
Reid, Wm.	Oct. 28, 1911	B 132	Virgo, John	May 1, 1909	B 89
Renny, James	Oct. 28, 1911	B 140	Walker, William	May 13, 1915	B 192
Richards, Thomas	Nov. 2, 1907	B 57	Warburton, Ernest L.	May 27, 1913	B 170
Richards, Samuel	May 9, 1912	B 152	Watson, Adam G.	Nov. 14, 1905	B 28
Rigby, John	July 29, 1905	B 29	Watson, Arthur W.	May 17, 1917	B 211
Roberts, Ebenezer	Sept. 10, 1910	B 117	Webber, John Frank	Mar. 4, 1905	B 3
Robinson, William	July 22, 1908	B 69	Wesledge, William	Nov. 27, 1909	B 98
Rogers, George	May 1, 1909	B 79	White, John	Nov. 2, 1907	B 48
Roper, William	May 9, 1912	B 141	Whitehouse, William	Oct. 31, 1912	B 163
Rowbottom Thomas	May 16, 1918	B 222	Williams, John Samuel	Nov. 15, 1917	B 215
Russell, John	Nov. 2, 1907	B 47	Wilson, Robinson	May 21, 1914	B 177
Rutherford, Jasper	May 16, 1918	B 219	Wilson, Thomas	July 22, 1908	B 74
Saville, Luther	May 2, 1907	B 51	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

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 Blane	Nov. 15, 1917	C 660	Bell, John	May 9, 1912	C 477
Anderson, Robt.	Oct. 14, 1914	C 599	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	Blowett, 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	Doney, John	Mar. 4, 1905	C 211
Broderick, Matthew	Jan. 21, 1913	C 525	Donnachie, John	June 10, 1911	C 425
Brown, Arthur A.	Oct. 14, 1914	C 596	Doodson, Robert	Oct. 28, 1911	C 455
Brown, David	Nov. 1, 1909	C 348	Dorrance, Orlin William	Jan. 21, 1913	C 517
Brown, George	July 8, 1916	C 626	Douglas, D. B.	Oct. 23, 1906	C 235
Brown, James	Sept. 10, 1910	C 364	Dow, And. Y.	May 21, 1914	C 587
Brown, James	June 10, 1911	C 412	Dunn, Wm.	Oct. 14, 1914	C 606
Brown, James	July 8, 1916	C 625	Dykes, Isaac	June 10, 1911	C 409
Brown, Jas. Millie	May 13, 1915	C 615	Dykes, Joseph W.	Oct. 1, 1907	C 248
Brown, John	Sept. 10, 1910	C 392	Eccleston, Thomas	May 17, 1917	C 482
Brown, Robert	Oct. 28, 1911	C 451	Edwards, John	May 27, 1913	C 542
Brown, Robert D.	June 10, 1911	C 423	Elliott, John	May 27, 1913	C 541
Brown, Robert S.	June 10, 1911	C 408	Elmes, George	Oct. 31, 1912	C 511
Brown, Wm. A.	May 21, 1914	C 576	Evans, D.	July 22, 1908	C 284
Brown, William Gold	July 8, 1916	C 629	Ewart, Alex.	Sept. 10, 1910	C 374
Brownrigg, J. H.	July 22, 1908	C 276	Ewing, Robert	May 13, 1915	C 608
Bullen, Thomas	Sept. 10, 1910	C 379	Fairfoull, James	Oct. 28, 1911	C 453
Bushell, Jas. P.	Oct. 1, 1907	C 264	Farrow, John William	Dec. 1, 1918	C 683
Bysouth, Thomas	May 16, 1918	C 673	Fitzpatrick, T. J.	Oct. 2, 1911	C 452
Cairns, Andrew	June 10, 1911	C 420	Flockart, David	Jan. 21, 1913	C 531
Cairns, Robert	May 27, 1913	C 539	Ford, Allen	Oct. 28, 1911	C 445
Caldwell, Daniel	May 17, 1917	C 639	Fowler, Robert	Oct. 31, 1912	C 495
Calverly, Joseph	Sept. 10, 1910	C 375	Francescini, Louis	May 16, 1918	C 672
Camamile, Hollis	Oct. 28, 1911	C 443	Francis, David Morgan	Oct. 28, 1913	C 558
Campbell, Samuel	Nov. 15, 1917	C 662	Francis, James	Oct. 1, 1907	C 250
Carr, Peter	Oct. 31, 1912	C 497	Frater, George	May 13, 1915	C 616
Carson, George	Mar. 17, 1917	C 663	Freeman, H. N.	Nov. 14, 1905	C 230
Catchpole, Charles	July 29, 1905	C 227	Frew, Andrew	Nov. 27, 1909	C 360
Caulfield, Edward	May 16, 1918	C 670	Frodsham, Vincent	July 22, 1908	C 282
Caulfield, John	May 1, 1909	C 321	Furbow, John	Jan. 21, 1913	C 528
Challoner, Arthur	Oct. 28, 1911	C 433	Garbett, Richard	Sept. 10, 1910	C 377
Charnock, John	Nov. 15, 1917	C 653	Gascoyne, Rowland B.	Jan. 21, 1913	C 513
Cheetham, Ben	July 22, 1908	C 311	Geater, Jas. Gordon	May 21, 1914	C 573
Chester, John	Oct. 28, 1911	C 440	Gemmell, James	Oct. 31, 1912	C 505
Clark, Lewis	June 10, 1911	C 405	Gillham, John	May 13, 1915	C 623
Clark, Walter Pattison	May 9, 1912	C 480	Gillies, William	May 16, 1918	C 668
Clarkstone, Wm. W.	Oct. 28, 1911	C 431	Glenn, James	Oct. 28, 1911	C 435
Cleaves, Walter	May 9, 1912	C 475	Gordon, Davis John	May 9, 1912	C 474
Clifford, William	July 22, 1908	C 313	Gourley, Robert	May 9, 1912	C 470
Colgrove, Charles Henry	Dec. 19, 1918	C 679	Gray, George	May 9, 1912	C 467
Commons, William	July 22, 1908	C 304	Green, William	Nov. 15, 1917	C 659
Cooke, Joseph	Mar. 4, 1905	C 209	Greenhorn, John	May 21, 1914	C 575
Coomb, Alexander	May 27, 1913	C 533	Griffiths, Edward	Oct. 31, 1914	C 508
Cooper, John Andrew	Dec. 19, 1918	C 689	Gunniss, Matthew	May 9, 1912	C 460
Cope, Frank	Oct. 28, 1913	C 549	Hallinan, William	May 1, 1909	C 343
Coulthard, James	June 10, 1911	C 407	Halsall, J.	July 22, 1908	C 307
Crawford, David	Mar. 4, 1905	C 298	Hamilton, John	Oct. 28, 1911	C 444
Cunningham, G. F.	Nov. 11, 1905	C 229	Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550
Cunliffe, Thos	Oct. 1, 1907	C 265	Hampton, Samuel	Nov. 15, 1917	C 650
Dabb, Owen	May 21, 1914	C 578	Hancock, Arthur	Nov. 15, 1917	C 656
Dando, John	May 9, 1912	C 465	Hartley, Thomas	Oct. 31, 1912	C 510
Davidson, Hugh	May 9, 1912	C 464	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
Devoy, William	May 17, 1917	C 638	Hilley, Fred	July 22, 1908	C 290
Dickenson, Clifford	May 27, 1917	C 582	Hilton, Mathias	Dec. 19, 1918	C 677
Dingsdale, Geo.	Oct. 28, 1911	C 459	Hilton, R. G.	Sept. 10, 1910	C 376
Doherty, J. J.	May 1, 1909	C 340	Hodson, R. H.	Mar. 4, 1905	C 216

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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 526	McKenzie, Peter.....	June 10, 1911	C 427
Jaynes, Frank.....	July 22, 1908	C 277	McKibben, Matthew.....	May 21, 1914	C 580
Jemison, 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 646	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	Mercer, Jas.	Oct. 14, 1914	C 600
Lancaster, William	Oct. 23, 1906	C 243	Merrifield, George.....	Oct. 23, 1906	C 239
Lane, Joseph.....	Oct. 1, 1907	C 254	Merrifield, William.....	Oct. 23, 1906	C 236
Leeman, T.	May 1, 1909	C 345	Michak, John.....	May 21, 1914	C 563
Lewis, Benj. J.	Sept. 10, 1910	C 386	Miles, John.....	June 10, 1911	C 414
Leynard, Paul.....	May 17, 1917	C 637	Mitchell, Charles.....	May 1, 1909	C 322
Liddle, John.....	July 29, 1905	C 228	Mitchell, Henry.....	Sept. 10, 1910	C 366
Lindsay, William.....	May 17, 1917	C 642	Monks, James.....	Nov. 14, 1905	C 234
Littler, John.....	June 10, 1911	C 410	Moore, George.....	Oct. 23, 1906	C 242
Littler, Matthew.....	June 10, 1911	C 417	Moore, John.....	May 1, 1909	C 335
Littler, Robert.....	June 10, 1911	C 418	Moreland, Thomas.....	July 22, 1908	C 299
Livingstone, Alex.....	Oct. 28, 1911	C 436	Morgan, John.....	July 29, 1905	C 224
Loxton, George.....	June 10, 1911	C 428	Morgan, William.....	May 17, 1917	C 636
Loxton, John.....	June 10, 1911	C 416	Morris, David.....	May 9, 1912	C 472
Luck, George.....	May 1, 1909	C 318	Mottishow, Samuel K.	Oct. 23, 1906	C 237
Lynch, Stewart.....	Oct. 28, 1911	C 432	Murdock, Jno. Y.	May 21, 1914	C 564
Mackie, John.....	June 10, 1911	C 421	Myers, Peter.....	Oct. 28, 1911	C 446
Makin, J. Wm.	Sept. 10, 1910	C 385	Nanson, T. H.	July 22, 1908	C 280
Malone, John.....	May 21, 1914	C 585	Nash, George William.....	May 17, 1917	C 565
Malone, Patrick.....	Oct. 1, 1907	C 247	Neen, Joseph.....	Nov. 27, 1909	C 352
Maltman, James.....	Oct. 31, 1912	C 501	Nelson, Horatio.....	Oct. 1, 1907	C 263
Mansfield, A.	May 1, 1909	C 336	Neilson, William.....	May 9, 1912	C 481
Marrs, John.....	May 17, 1917	C 640	Newman, John.....	Oct. 14, 1914	C 603
Marsh, Daniel Parks.....	May 27, 1913	C 543	Nicholson, James.....	May 9, 1912	C 469
Marsh, John.....	Oct. 1, 1907	C 270	Nimmo, James.....	May 9, 1912	C 461
Martin, James.....	June 10, 1911	C 398	Norris, Joshua.....	Oct. 28, 1913	C 557
Mason, Joseph.....	July 22, 1908	C 297	Oakes, Robert.....	Oct. 31, 1912	C 498
Massey, Henry.....	May 1, 1909	C 317	O'Brien, Charles.....	Nov. 27, 1909	C 349
Mather, Thomas.....	July 22, 1908	C 293	Odgers, Alfred.....	Jan. 21, 1913	C 529
Matusky, Andrew.....	Oct. 1, 1907	C 259	Odgers, Eli.....	Jan. 21, 1913	C 523
Mawson, J. T.	Nov. 27, 1909	C 359	Orr, Alexander.....	Oct. 28, 1911	C 434

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NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Osborne, Hugh	Oct. 28, 1913	C 555	Skelton, Thos	May 1, 1909	C 344
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
Rennet, 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 231
Richardson, J. H.	Oct. 28, 1911	C 458	Thomas, Joseph	Mar. 4, 1905	C 220
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
Seggie, Robert	Jan. 21, 1913	C 524	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 635
Sinclair, William	Jan. 21, 1913	C 527	Weeks, John	Mar. 4, 1905	C 214

* C 314 issued in lieu of C 253 destroyed by Fernie fire.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Concluded.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
West, James Gloag	May 16, 1918	C 676	Wilson, William	May 17, 1917	C 617
Whalley, William	Dec. 19, 1918	C 686	Winstanley, H.	July 22, 1908	C 283
White James	Oct. 31, 1912	C 499	Wintle, Thomas A.	July 29, 1905	C 222
White, John	Oct. 22, 1906	C 245	Witherington, George.	Oct. 28, 1913	C 554
Whitehouse, Wm.	June 10, 1911	C 402	Wood, Thos. James.	Oct. 31, 1912	C 491
Wilkinson, Edward.	Oct. 28, 1911	C 438	Worthington, J.	July 22, 1908	C 295
Williams, John Sam.	June 10, 1911	C 404	Wright, John.	May 21, 1914	C 593
Williams, Watkin	June 22, 1908	C 301	Wright, Robert.	May 21, 1914	C 589
Wilson, Robinson.	June 10, 1911	C 397	Wright, William	Jan. 21, 1913	C 522
Wilson, Thomas M.	Oct. 1, 1907	C 272	Young, Alexander	May 16, 1918	C 666
Wilson, William	Oct. 1, 1907	C 262			

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.	Certifi- cate No.	Name.	Date.	Certifi- cate 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
Allsop, 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	Perrie, 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
Hescock, 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.

INSPECTION OF METALLIFEROUS MINES.

WEST KOOTENAY AND BOUNDARY DISTRICTS.

REPORT OF 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 1918.

NELSON DISTRICT.

This has not been a busy year in mining throughout this district, nothing new of importance having been opened. Diamond-drilling and other development-work has been carried on to a considerable extent on some of the older properties. The shipping mines which are now operating have not worked continuously during the year; prospecting, as usual, has been steadily followed, with promising results. Upon inspecting these mines they have at all times been found in a safe condition.

AINSWORTH DISTRICT.

The mines of this district have operated intermittently during the year owing to shortage of water-supply during the cold weather; also the shortage of labour has had a depressing effect during the whole of the year. At the present time most of the shipping mines are operating with reduced crews. I have always found these mines in a safe and sanitary condition.

SLOCAN DISTRICT.

There has been considerable increase in mining and developing. The same trouble existed here as in some other districts—namely, shortage of water and labour; but even with those drawbacks there has been considerable increase in many ways. Great energy has been displayed in opening up old properties and rushing development. Systematic development in opening up new ore-bodies has been successfully carried on in many of the older mines which have been operated for years. From my own inspections and from the reports of H. H. Johnstone, Inspector of Mines, special care has been exercised in handling explosives and otherwise caring for the safety and sanitary conditions.

LARDEAU DISTRICT.

There has not been any increase in mining in this district. During the year a number of small shipments have been made from time to time from many parts of this large district, with encouraging results. During the summer season prospecting and development was active. From the reports of H. H. Johnstone, Inspector of Mines, who made several inspections of the mines in operation, they were found to be well equipped, safe, and sanitary.

BOUNDARY DISTRICT.

The mines of this district have operated continuously during the year with a decreasing output compared to previous years. One of the larger shippers, the *Mother Lode* mine, near Greenwood, ceased operating on November 25th, 1918; the smelter which treated the output also closed about that time. Some of the smaller mines under lease have been operated with good results, although the number of workmen employed in them is small. Considerable development-work has been accomplished in the larger mines; also diamond-drilling has been actively carried on in an endeavour to locate new ore-bodies.

The large quantities of explosives which are necessary to operate the mines in this district have been carefully thawed and transported to the mines; also carefully handled underground when blasting, as the accident list does not show any cases where an accident occurred from explosions of powder. Upon inspecting these mines I have always found the requirements of the "Metalliferous Mines Inspection Act" conformed with.

YALE DISTRICT.

For the first half of the year mining in this district was active. Owing to lack of milling and transportation facilities one of the larger mines had to temporarily close. There is every indication that the coming year will see some large mines operating in this district. The older shipping mines have been successfully operated during the whole year. I have always found, upon inspections made during the year, care being taken and an honest endeavour to comply with the "Metalliferous Mines Inspection Act."

ROSSLAND DISTRICT.

The principal mining done during the year in this district has consisted of development-work, of which a great deal has been accomplished in the different mines. Although quite a force has been employed at that work, it would not amount to nearly half of the usual number generally employed when these mines are shipping steadily.

The same care has been exercised as formerly in keeping the large hoisting machinery, shaft, and guides in safe condition. The many miles of travelling-ways have also been kept in good condition, and the workings generally have been on all occasions when inspected found to be as safe as unavoidable conditions would allow.

I have always found an effort made by the management to operate these mines in compliance with the "Metalliferous Mines Inspection Act." Enclosed please find a list of the accidents which occurred in and around the mines during the year 1918.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT OF ROBERT STRACHAN, INSPECTOR.

I have the honour to submit the annual report as Inspector of Metalliferous Mines for the East Kootenay District during the year ending December 31st, 1918.

The mines operating were the *Sullivan*, at Kimberley, and the *Lakeshore* and *St. Eugene*, at Moyie. Conditions around these mines are much the same as in 1917, work being retarded at the *Sullivan* owing to scarcity of workmen.

The extraction of ore proceeded fairly well at the *Sullivan*, but the development in the new tunnel was shut down twice during the year. Conditions around the mine are fairly good, care being taken to either secure or bar down all the loose pieces of rock, and where timbering is resorted to this was very well maintained. Ventilation in the upper working is by natural ventilation assisted by compressed air, and was fairly good; in the new tunnel a small power-driven fan produces ventilation.

So far as I could observe, the "Metalliferous Mines Inspection Act" is very well complied with, and a safety committee makes an inspection once every month, creating a better co-operation between the workmen and the officials in maintaining the safety of the mine. This committee, which is composed of officials and representatives appointed by the workmen, has resulted in maintaining a condition around this mine that we have not had a single accident report during the year, reflecting great credit on all the parties concerned.

Four samples of mine-air were taken in this mine during the year, and the resultant analyses showed conditions to be fairly good, not more than a trace of carbon monoxide showing. Detail sheets of these have already been sent you. The officials at the *Sullivan* are H. C. Montgomery, superintendent; J. Lindsay, mine foreman.

At the *St. Eugene* and *Lakeshore* mines the work consists of recovering ore which could not have been very successfully mined with machines; there is no machinery, all the work being accomplished by hand-steel. The ore is sorted inside the mine, sacked and trammed outside, and is teamed down the hill to the railway for shipment to the smelter.

In the *Lakeshore* part the work is under the charge of L. Horne, and I have generally found the conditions very good, places well timbered, and the Act well complied with.

At the *St. Eugene* only a very few men were employed during the year under John Taylor. The conditions here were very good, so far as safety was concerned, and the Act well complied with. The explosive generally used is Polar Ammonia Dynamite, and at each place is kept in a well-protected magazine, only such quantities taken out as were required for blasting purposes.

Like the *Sullivan* mine, no accidents have been reported during the year, which in itself reflects great credit on both the officials and workmen at these mines.

COAST INSPECTION DISTRICT.

REPORT OF 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, 1918.

J. W. D. Moodie, general manager; E. J. Donohue, secretary-treasurer;
Britannia. E. P. Browning, general superintendent. The *Britannia* mine, the property of the Britannia Mining and Smelting Company, is situated on Howe sound, about twenty-eight miles from the city of Vancouver, and is reached by a daily steamship service. During the year a large amount of development-work has been done in this mine, as the following tabulation shows:—

Drifts	Feet. 9,837
Crosscuts	4,427
Raises	8,754
Chutes	1,541
Winzes	36
Total	24,595

The *Fairview* mine drifts have been extended on previously developed veins; also new ones have been opened up to the south, on which stoping operations have started. The outside glory-holes were worked during the open season (seven months), breaking ore on top of the mountain into large transfer rock-chutes, delivering it to the underground crushers with but one handling.

The *Bluff* mine to the west and the *Empress* mine to the east of the *Fairview* have been extensively developed during the year and stoping has been started. Two drifts are being driven west under the *Jane* mine on the 1,200-foot level, developing this ore-body 200 feet below any previous working-level.

During the year another connection through Britannia mountain was made, this being on the 600-foot level, making the fourth level to have portals on both the north and south side of the mountain. Two other levels, the 1,200- and 1,600-foot, are being driven through for connection, the former having approximately 1,600 feet to go and the latter 700 feet.

Work is progressing for the extension of No. 1 shaft from the 1,000-foot level to the 700-foot level, and also the extension of the Grandview shaft (No. 3 shaft) from the 500- to the 700-foot level. This construction will in time supplement the No. 2 shaft, now operating between the 1,000- and 500-foot levels.

A crosscut adit, 8 x 8 feet, known as the Victoria tunnel, to the east of the present *Empress* workings at the elevation of the 1,800-foot level, has been advanced 400 feet, prospecting the extension of the veins in that section of the property.

Another crosscut, 8 x 8 feet, known as the Hillside tunnel, is being driven at a point west of the present *Jane* mine at the elevation of the 1,000-foot level. This has advanced approximately 200 feet.

Considerable diamond-drilling has been done during the year, prospecting new areas and also to prove the extension of known ore-bodies. The footages driven in the different mines are as follows:—

Fairview mine	Feet. 15,062
Empress mine	4,897
Bluff mine	2,404
Jane mine	2,071
3,100-foot tunnel	690
2,700-foot tunnel	1,558
Total	26,682

The 4,100-foot level tunnel was advanced 1,735 feet during the year, making the total length 4,220 feet. A raise has been started at this level and driven a distance of 100 feet. This raise will be continued to the 3,100-foot level, a distance of 1,130 feet, and from there to the 2,700-foot level, 370 feet. This raise is 7 x 12 feet and is being driven on a 65 degree slope.

The 3,100-foot level east drift was advanced 659 feet, and from this drift another drift 260 feet long has been driven to the location of the proposed raise from the 4,100-foot level, from which point it is proposed to raise to the Armour crosscut, 2,700-foot level, at the westerly end of the tunnel railway. The Armour crosscut has been driven a distance of 502 feet.

The raise from the 4,100-foot level to the 2,700-foot level will be used to transfer the mine ore to the 4,100-foot level, and thence a distance of about 5,000 feet by railway to the mill.

The 2,200-foot Daisy tunnel was advanced 910 feet, making the total length 1,309 feet, and a crosscut 106 feet long driven to the south.

The Harp tunnel was advanced 811 feet to completion during the year. This tunnel is 2,246 feet long and will be used to divert water for power purposes.

The following tunnels driven for development-work were advanced during the year:—Lantz tunnel: Advance for year, 60 feet; footage to date, 890 feet. Lloyd tunnel: Advance for year, 71 feet; footage to date, 134 feet. Copper Mountain tunnel: Advance for year, 152 feet; footage to date, 324 feet.

Equipment.—Four Westinghouse $3\frac{1}{2}$ -ton storage-battery mine locomotives were added to the previous equipment of eight, in addition to which there are in the mine one 6-ton General Electric trolley locomotive and two $3\frac{1}{2}$ -ton Westinghouse trolley locomotives.

Fifty-four 2-ton automatic side-dump cars were added to the mine equipment, making a total of approximately 150 cars of this type. Besides these, twenty cars of the same type and size, but built for a 3-foot gauge, were added to the equipment for handling ore broken on the 2,200-foot level and for outside tunnels having 3-foot gauge.

The present equipment of the tunnel railway consists of two 20-ton bottom-dump cars, twelve 20-ton side-dump cars, two flat cars, four 15-ton electric locomotives, one 8-ton electric locomotive, and one 40-ton electric locomotive. The 40-ton locomotive was added during the year.

The present equipment of machine-drill sharpeners, including those located at outside tunnels as well as at the mine proper, consists of nine Leyner machines, four Sullivan, and one Waugh. A 3,600-cubic-foot-per-minute compressor, driven by a 600-horse-power output motor, was installed in the Beach power-house.

No new buildings were erected at the mine, with the exception of a concrete storage or root house; outside dimensions 38 x 30 feet, with an inside height of 9 feet at the crown of the arched roof. This is located at the tunnel cook-house and affords an excellent place for the storage of winter vegetables.

On my last examination I found the mine well ventilated and in a safe condition.

This mine is situated on Texada island and is operated by the Tacoma Steel Company, with E. F. Eastman as managing director and D. C. Stephens as general superintendent. The mine has been developed down to the 1,600-foot level. A winze was driven down from the 1,500-foot level to the 1,600-foot level, with very good results. During the year two new 84-horse-power return-tubular boilers have been installed with mechanical stokers. The machinery installed is the same as in my previous report. When I last examined the mine I found it well ventilated and in a safe condition.

This group is situated on the west side of the island, with Mr. Lee in charge. **Retriever Group.** A small concentrator and ore-bunkers have been installed at the beach, connected to the mine by an incline about 1,200 feet in length. When I visited the mine I found the same in a safe condition; ventilation good.

This mine is situated about three miles and a half north-east of Vananda. **Loyal.** The company has unwatered the mine ready for operations in the near future. This mine is operated by the Clayburn Company, of Clayburn, B.C. The mine **Clayburn.** is situated about four miles and a half from Clayburn and is reached by an electric tram-line. When I visited the mine I found it in a very safe condition; ventilation good.

NORTHERN INSPECTION DISTRICT.

REPORT OF J. H. McMILLAN, INSPECTOR.

I have the honour to present my annual report as Inspector of Coal and Metalliferous Mines for the Northern Inspection District for the year 1918.

The mineral production of the aforementioned district has been quite up to that of former years, notwithstanding a marked scarcity of labour and other incidental conditions. The production of the Omineca Division suffered considerably through the closing-down of the *Rocher Déboulé* mine, which up to the present time was the largest producer of the district.

This district has also temporarily lost the production of the *Silver Standard* mine, which, owing to the excessive freight charges on concentrates shipped to the United States, has closed down for the winter months. This mine, however, has considerable ore reserves, and will be reopened just as soon as conditions will permit of the mine being operated profitably. The outlook in the Portland Canal and Alice Arm districts is very bright, and the incoming year should see considerable mining activity in each of these districts.

Coal is now being shipped from the Telkwa River coalfield, and is supplying points along the Grand Trunk Pacific Railway, also the city of Prince Rupert, with a good grade of coal. The mine as yet is only in the first stages of development, and while the field is more or less faulted and broken up, there is sufficient coal available to meet the requirements of this northern country for a number of years.

The following is a list of the producing mines coming under my jurisdiction, together with a brief review of the prevailing conditions in each case:—

OBSERVATORY INLET.

Granby Consolidated Mining, Smelting, and Power Co., Ltd.

The general conditions prevailing at this mine are satisfactory and in full accord with the requirements of the "Metalliferous Mines Inspection Act" and amending Acts. Considering the large tonnage produced at this mine, the nature of the operations, and the class of labour available during the year, the number of fatal and major accidents at this mine have been comparatively small. First-aid and safety-first work have been kept up during the year, the company paying the employees taking part in the meetings full time while they are so engaged. The results of the first-aid and safety-first work at this mine, while comparatively good, could be improved if the miners and other labourers in the mine would follow up the instructions given them more closely, and apply them to their respective duties while at work.

The groundwork, however, is firmly set, and as soon as conditions become normal and the working force more permanent, the results will more than justify the interest taken in the movement by the local management. During the year I have received every assistance from those in charge of the underground work in the prevention of accidents, and any suggestions made by me during the year have been given immediate consideration by the management.

The ventilation of the mine has been considerably improved during the year by further connections having been made with the 385-foot level and the upper workings. The 150-foot level, which is the lowest level now being developed, has been extended to a distance of 2,700 feet. About 100 feet from the face of this tunnel, and a short distance to the right, a station has been cut out and a shaft driven upwards and connected with the 385-foot level. This shaft is 6 x 22½ feet in the clear and is divided into four compartments, two of which will be used for hoisting ore and the other two used as a manway and for hoisting or lowering supplies. The shaft is timbered with 12 x 12 timbers dipped in creosote; the sets are at 5 feet centres and lined close with 2 x 12 plank.

Two new drifts are being extended on this level into the ore-bodies, which continue to maintain a uniform grade. All ore mined on the 150-foot levels will be hoisted to the 385-foot level through the new shaft. The connection made by this shaft has not only improved the ventilation on the 150-foot level, but has also simplified the ventilation of the upper levels.

Samples of the mine-air were collected by me during the year at various points throughout this mine, and an analysis of these shows the atmosphere of the mine to be comparatively free from injurious gases. Sanitary conditions in and around the mine are all that could be desired.

Quartz Point. The conditions at this mine have been entirely satisfactory during the year, no accidents of a serious nature having occurred. During the year I collected several samples of the mine-air at this mine, and in each case these show the ventilation to be exceptionally good. The sanitary conditions in and around the mine are well looked after and the general requirements of the "Metalliferous Mines Inspection Act" strictly observed. During my several visits to this mine I have always found the daily reports of the mine-workings and machinery in order and entered up to date.

Macy. The general conditions at this property are very good and in full accord with the requirements of the "Metalliferous Mines Inspection Act." The daily examination of the mine-workings, ropes, and machinery is carefully attended to and the reports of same duly entered to date. Samples of the mine-air were taken by me during the year, the analysis of which shows the ventilation of the mine to be excellent.

Swamp Point. Conditions at this mine are quite satisfactory and the general requirements of the "Metalliferous Mines Inspection Act" strictly observed. Being an open-cut, the ventilation is always good. Sanitary conditions at the camp are excellent.

Dolly Varden. The underground workings at this mine were not extended any during the year. Operations were centred chiefly on the railway leading from tide-water to the mine, a distance of eighteen miles. The railway is now completed, but owing to some financial tangle the further development of the mine is not being proceeded with. The mine and, I might say, the whole district has great possibilities, and as soon as the present financial condition of the company improves we can expect considerable development.

OMINECA DIVISION.

Rocher Deboule. This mine was temporarily closed down early in October. Development-work on the lower levels failed to locate a continuation of the higher-grade ore found on the upper levels, and for the present further prospecting has been discontinued. There is still a considerable tonnage of milling-ore left in the mine and dumps, and it is quite possible that as soon as conditions become more favourable a small flotation plant will be installed to treat this ore. During the period of operation the general conditions at this mine were at all times excellent, and strictly in accord with the requirements of the "Metalliferous Mines Inspection Act."

Silver Standard. This mine operated more or less steadily up until December, when the management decided to temporarily cease operating on account of the present high transportation rates and other abnormal conditions which make mining in this particular case practically unprofitable. The general conditions throughout this mine are very good and at all times in strict accord with the requirements of the "Metalliferous Mines Inspection Act."

Hazelton View. This mine, which is situated on the north side of Rocher Déboulé mountain, operated more or less steadily during the year. The main tunnel was extended for a short distance and some stoping done. Some work has also been done on a copper-showing west of the No. 1 tunnel. The general conditions in and around this mine are in full accord with the requirements of the "Metalliferous Mines Inspection Act."

Golden Wonder. This mine is situated at the base of the north side of the Rocher Déboulé mountain and operated only for a few months during the year. The workings were not extended for any considerable distance during the period of operation and nothing further of importance can be reported. The conditions at all times were satisfactory and in accord with the requirements of the "Metalliferous Mines Inspection Act."

Telkwa Collieries, Ltd. This company is opening up a 6-foot seam of coal on Mud creek, a tributary of the Telkwa river, and to date has shipped approximately 500 tons. The coal finds a ready market along the line of the Grand Trunk Pacific Railway, also at Prince Rupert, and appears to be an excellent steam-fuel. A tunnel has been driven in on the strike of the seam for a distance of 200 feet. Several stalls have also been turned off and connected with an air-shaft to the rise of the tunnel. The mine is in as good condition as could be expected, and the ventilation for the present quite sufficient. So far no gas has been detected. Suitable buildings have been installed at the mine to accommodate twenty men.

COAST DISTRICT.

Drum Lummon. This mine, which is situated near the head of Douglas channel, has been further developed during the year, and at the time of my visiting the property looked quite promising. The general conditions are satisfactory and the requirements of the "Metalliferous Mines Inspection Act" fully observed.

Surf Inlet. This mine has operated steadily throughout the entire year, with marked success. The general condition of the underground workings has improved greatly as compared with previous years, and present an excellent example of how results can be obtained where efficiency and safety work together. The mine generally is in splendid shape and the ore-bodies on the lower levels show up very well, both with regard to width and values. The underground workings, ropes, and machinery are examined daily by competent men and the reports kept entered up to date. The sanitary conditions in and around the mine are well looked after and the general requirements of the "Metalliferous Mines Inspection Act" fully observed. During the year I collected several samples of the mine-air at this mine, and in each case the analysis shows that the ventilation is comparatively free from injurious gases.

Pugsley. This mine is situated a little south of and on the same mineralized zone as the Surf Inlet mine. The main tunnel is now in over 900 feet, and at the time of my last visit was following a 2-foot vein carrying considerable copper and gold sulphides. The general conditions at this property are satisfactory and in accord with the "Metalliferous Mines Inspection Act."

ATLIN DIVISION.

Engineer. This mine, which is situated on the southern end of Tagishe lake, was operated for a few months during the summer. The general conditions in and around the mine are fair and the requirements of the "Metalliferous Mines Inspection Act" observed.

PLACER-GOLD MINING.

While in the Atlin district I visited the majority of the placer mines now being operated on the creeks adjacent to the town of Atlin. On several of the creeks the gold is recovered by drifting methods. The method of mining is somewhat similar to the pillar-and-stall method of mining coal. The original river-channels on which the pay-dirt is found are from 20 to 50 feet vertically below the present creek-beds. Inclined drifts, and in some cases vertical shafts, are driven down to bed-rock, and from these drifts prospect-drifts are driven in various directions until the original channel containing the gold is located. This pay-streak varies in width from a few feet to 100 or more, and when located is blocked out into pillars which are later extracted and the overlying gravel allowed to cave behind. The narrow work or drifts, as they are termed, run from 8 to 15 feet in width, according to the overhead pressure, and are closely timbered by sets which are lagged tight on the top and sides. The workings of some of the mines are in over 1,500 feet from the bottom of the shaft or incline, as the case might be, and have only single openings. The overlying gravel, which runs from 80 to several hundred feet in thickness, is very strong and cohesive, and invariably the gravel immediately overlying bed-rock has to be blasted.

The general conditions prevailing at these mines cannot be termed either safe or sanitary. The miners, however, are a very competent class of men, and this without doubt accounts for the absence of serious accidents. The mines are very wet, and at several while making my examination I was compelled to walk up to the knees in running water, which percolates through the gravel from one mine to another. The latter condition to my mind is not safe by any means, more particularly where a mine is operating in ground adjacent to other mines that are filled with water and abandoned. The mines, with one or two exceptions, are operated by individual miners, and while some are making fair recoveries, others are not, and to place these mines under the jurisdiction of the "Metalliferous Mines Inspection Act" would work a hardship and eventually put the individual miner out of business. I would, however, suggest that special rules be adopted covering the placer mines of this district, more particularly drifting operations, touching chiefly on timbering, ventilation, and the maintenance of second openings.

LIST OF ACCIDENTS IN METALLIFEROUS MINES, 1918.

COAST DISTRICT.

REPORT OF J. H. McMILLAN AND JOHN NEWTON, INSPECTORS.

No.	Mine.	Date.	Name.	Occupation.	Details.
1	Hidden Creek, Anyox..	Jan. 31	John Holm....	Miner	Tripod weight fell on his foot, breaking bone in left foot.
2	Swamp Point.....	Feb. 22	Joe Maladoze..	Miner	Rock fell down face of quarry and struck left arm, breaking it between shoulder and elbow.
3	Hidden Creek, Anyox..	Feb. 24	A. Flore	Mucker-boss.	Crushed chest, lacerated scalp, compound fracture of nose; lost footing and slid down slope.
4	" " ..	Mar. 7	L. Comandini .	Chuteman..	Depressed fracture of skull, right side, cerebral hæmorrhage, caused by being struck by bar.
5	" " ..	Mar. 9	A. D. Wooler .	Mucker.....	Struck by rock, crushed pelvis, left leg, and left chest, with possible fracture of two former.
6	" " ..	Mar. 27	James Regan .	Miner	Struck by rock, which cut front of head and broke big toe of right foot.
7	" " ..	Apr. 12	Nick Macenko.	Mucker.....	Rock hit right hand and pinched off third finger.
8	" " ..	Apr. 16	G. Cossarin ...	Loader's [helper]	Slipped and twisted left ankle and tip of small bone was broken off.
9	" " ..	Apr. 26	Aime Rennie..	Barman.....	Crushed to death by fall of rock.
10	" " ..	May 2	Eli Utivich....	Chuteman...	Muck crushed skull and badly bruised body, which proved fatal.
11	" " ..	May 6	Pete Valison ..	Chuteman...	Struck by muck, which crushed right ankle; both bones broken.
12	" " ..	May 14	John Larson...	Chuteman...	Hand pinched between bar and chute-gate, breaking fifth metacarpal in right hand.
13	" " ..	May 14	G. W. Suther- [land]	Miner	Crushed right hand, index finger broken, and end of thumb crushed between two rocks.
14	" " ..	May 23	Geo. Drezgich .	Nipper	Fell and fractured skull.
15	" " ..	Sept. 15	Alex. Giyenec .	Mucker.....	Wheel of car passed over hand, crushed it, and broke some bones.
16	" " ..	Oct. 9	A. Martinson..	Steel- [sharpener]	Machine caught his right hand and cut off thumb.
17	Surf Inlet.....	Oct. 18	J. Post	Miner	Fatally injured by fall of rock in stope.
18	Hidden Creek, Anyox..	Oct. 19	J. MacDonald.	Miner	Using air-drill and rock fell, causing him to fall down slope; broke left collar-bone and ankle.
19	Hidden Creek, Anyox..	Dec. 30	Eric Anderson.	Barman.....	Rock struck bar which broke his left forearm.

KOOTENAY-SIMILKAMEEN DISTRICT.

REPORT OF JAMES MCGREGOR AND H. E. JOHNSON, INSPECTORS.

20	Granby, Phoenix	Jan. 2	N. Davidson ..	Shiftboss...	Caught right hand in electric shovel, crushing it.
21	Emma, Coltern.....	Jan. 3	James Cairns..	Miner	Cap exploded and blew off thumb, first and second finger at second joint.
22	Rambler, Slocan.....	Jan. 14	H. Sjöholm ...	Miner fore- [man]	Cage dropped and his left knee-cap was broken.
23	Bluebell, Ainsworth. .	Feb. 7	Jack Olufson .	Miner	Loose pipe crushed his right hand.
24	Granby, Phoenix	Feb. 17	Dan Voinovich.	Chuteman...	Broken and crushed left arm, caused by being struck by muck.
25	Nickel Plate, Hedley..	Feb. 17	Chas. Berto...	Mucker.....	Jammed between car and wall, right leg was broken between knee and ankle.
26	Florence, Ainsworth ...	Mar. 25	Chas. Ostrom..	Miner	Buried under muck; proved fatal.

KOOTENAY-SIMILKAMEEN DISTRICT—*Concluded.*

No.	Mine.	Date.	Name.	Occupation.	Details.
27	Copper Mtn., Princeton	July 3	V. A. Price....	Hoistman...	Struck on head by small rock, which crushed his skull and caused instant death.
28	Granby, Phoenix	July 19	T. Roderick...	Timberman..	Caught between car and side of drift, which crushed his chest.
29	Rambler-Cariboo	Aug. 5	T. McVeight..	Driver	Right leg broken, caused by car he was dumping turning over on him.
30	Mother Lode, Greenwood	Aug. 10	M. Plecash....	Barman.....	Right shoulder-blade and pelvis-bone fractured, intestines torn, caused by fall of rock.
31	Mother Lode, Greenwood	Aug. 18	[rovich S. Vukoni-	Miner	Instantly killed by falling rock.
32	Eastmont, Slocan	Oct. 18	J. T. Beau-	Miner	Broken back, terminating in death, caused by fall of rock from roof.
33	Le Roi No. 2, Rossland.	Nov. 30	[chesne A. Nyberg....	Contractor- [machineman	Injuries around upper part of thigh on left leg, caused by car forced upwards through cage.
34	Le Roi No. 2, Rossland.	Nov. 30	J. X. Hendric-	Contractor-	Injuries in lower part of body, caused by car forced upwards through cage.
35	Le Roi, Rossland	Dec. 20	[son Fred Graham..	[machineman Shiftboss ...	Killed by air-blast.

COAL-MINING IN BRITISH COLUMBIA.

BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

During the year 1918 there was mined in the various collieries of the Province 2,578,724 tons (2,240 lb.) of coal, an increase over the preceding year of 180,009 tons, equivalent to nearly 7.5 per cent.

That the total output of the Province is greater this year is attributable to increases in the Crowsnest District of 181,113 tons and in the Nicola District of 27,936 tons, which more than offset a decrease of 29,510 tons in the Vancouver Island collieries.

In addition to this, the output of coke shows an increase of about 18 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 Employee for Year.
1909	East Kootenay District	923,865	2,427	380	1,737	532
	Coast District.....	1,476,735	3,991	370	2,976	496
	Whole Province.....	2,400,600	6,418	374	4,713	509
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

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, and 1915 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 Crowsnest 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 1918 in the Coast District the production *per capita* of men employed underground has decreased from 656 tons to 645 tons; while in the Crowsnest District such production *per capita* has increased phenomenally, from 584 tons to 900 tons, the highest it has ever been, which raises the *per capita* for the whole Province to 705 tons, the highest it has ever been.

Owing to war conditions the operation of all the collieries in the Crowsnest field, in Alberta and British Columbia, has been placed under the control of a Commissioner—W. H. Armstrong—appointed by the Federal Government.

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.

During the past year a new coalfield on the Telkwa river, in Omineca Division, has been opened up, and produced some 470 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 (operated

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 Company), 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 1918 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 1918.

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	1,010,938		172,276	
" export to United States	752,821		17,404	
" " other countries	58,417			
Total sales		1,822,176		189,680
Lost in washing	238,469			
Used in making coke	276,479			
" under colliery boilers, etc.	200,698		115	
Total for colliery use		715,646		115
		2,537,822		189,795
Stocks on hand first of year	34,110		2,947	
" last of year	75,012		2,119	
Difference { added to* } stock during year.....		*40,902		†828
Output of collieries for year.....		2,578,724		188,967

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	200		126		326	
Whites—Miners	1,494				1,494	
Miners' helpers	126				126	
Labourers	703		479		1,182	
Mechanics and skilled labour	523		557		1,080	
Boys	77		92		169	
Japanese—Miners	58				58	
Helpers	26				26	
Labourers	13		2		15	
Chinese—Miners	94				94	
Helpers	124				124	
Labourers	220		513		733	
Totals	3,658		1,769		5,427	

COLLIERIES OF THE COAST DISTRICT.

The gross output of the Coast District collieries, including the Nicola valley and Telkwa, for the year 1918 was 1,845,860 tons (of 2,240 lb.) of coal actually mined, while some 22,845 tons was added to "stock," making the actual consumption of coal 1,823,015 tons.

Of this gross consumption 1,402,316 tons was sold as coal, 142,058 tons was consumed by the producing companies as fuel, and 238,469 tons was lost in washing; while 40,172 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.

The following table gives an aggregate summary of the output of the Coast collieries for the year 1918, and shows the disposition made of such product:—

RETURNS FROM THE CANADIAN COLLIERIES, LTD., MINES FOR YEAR 1917.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	933,296	.....	24,501	.....
" export to United States	416,603	.....	.....	.....
" " other countries	58,417	.....	.....	.....
Total sales.....	.....	1,402,316	.....	24,501
Lost in washing	238,469	.....	.....	.....
Used in making coke	40,172	.....	.....	.....
Used under colliery boilers, etc.....	142,058	.....	115	.....
Total for colliery use.....	.....	420,699	.....	115
.....	.....	1,823,015	.....	24,616
Stocks on hand first of year	34,046	.....	1,473	.....
" last of year	56,891	.....	1,744	.....
Difference added to stock during year .....	.....	22,845	.....	271
Output of collieries for year .....	.....	1,845,860	.....	24,887

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	155	.....	99	.....	254	.....
Whites—Miners	1,103	.....	.....	.....	1,103	.....
Miners' helpers	126	.....	.....	.....	126	.....
Labourers	585	.....	180	.....	765	.....
Mechanics and skilled labour	273	.....	386	.....	659	.....
Boys	67	.....	76	.....	143	.....
Japanese—Miners	58	.....	.....	.....	58	.....
Helpers	26	.....	.....	.....	26	.....
Labourers	13	.....	2	.....	15	.....
Chinese—Miners	94	.....	.....	.....	94	.....
Helpers	124	.....	.....	.....	124	.....
Labourers	220	.....	513	.....	733	.....
Totals	2,844	.....	1,256	.....	4,100	.....

The following tables show the output of coal and the disposition made of it in the subdivisions of the Coast District:—

COAL-OUTPUT, ETC., 1918, VANCOUVER ISLAND SUB-DISTRICT.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	782,147	.....	24,501	.....
" export to United States	398,631	.....	.....	.....
" " other countries	58,417	.....	.....	.....
Total sales .....	.....	1,239,195	.....	24,501
Lost in washing	236,905	.....	.....	.....
Used in making coke	40,172	.....	.....	.....
" under colliery boilers, etc	128,191	.....	115	.....
Total for colliery use .....	.....	405,268	.....	115
Stocks on hand first of year	33,772	1,644,463	1,473	24,616
" last of year	55,520	.....	1,744	.....
Difference added to stock during year .....	.....	21,748	.....	271
Output of collieries for year .....	.....	1,666,211	.....	24,887

COAL-OUTPUT, ETC., 1918, 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.....	150,679			
" export to United States.....	11,972			
Total sales.....		162,651		
Lost in washing.....	1,564			
Used in making coke.....	13,867			
" under colliery boilers, etc.....				
Total for colliery use.....		15,431		
		178,082		
Stocks on hand first of year.....	274			
" last of year.....	1,371			
Difference added to stock during year.....		1,097		
Output of collieries for year.....		179,179		

COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1918 was 732,864 tons (2,240 lb.) of coal actually mined, while 18,057 tons was added to stock, making the actual consumption of coal 714,807 tons. Of this gross consumption of coal, 419,860 tons was sold as coal, 58,640 tons was consumed as fuel by the producing companies, while 236,307 tons was converted into coke, producing 164,080 tons of coke, while 1,099 tons was taken from stock, making the coke sales for the year 165,179 tons.

The East Kootenay collieries exported to the United States about 80 per cent. of the coal sold and about 10 per cent. of the coke.

The following table gives an aggregate summary of the output of the East Kootenay collieries for the year 1918 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	77,642	.....	147,775	.....
" export to United States	342,218	.....	17,404	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	419,860	.....	165,179
Used in making coke	236,307	.....	.....	.....
" under colliery boilers, etc.	58,640	.....	.....	.....
Total for colliery use .....	.....	294,947	.....	.....
Stocks on hand first of year	64	714,807	1,474	.....
" last of year	18,121	.....	375	.....
Difference { *added to + taken from } stock during year .....	.....	*18,057	.....	+1,099
Output of collieries for year .....	.....	732,864	.....	164,080

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	.....	27	.....	72	.....
Whites—Miners	391	.....	.....	.....	391	.....
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	118	.....	299	.....	417	.....
Mechanics and skilled labour	250	.....	171	.....	421	.....
Boys	10	.....	16	.....	26	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	814	.....	513	.....	1,327	.....

INSPECTION OF COAL-MINES, 1918.

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.

JOHN NEWTON, 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.

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 OF JOHN NEWTON, INSPECTOR.

I have the honour to submit my annual report for the year ending December 31st, 1918, 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.

RESCUE AND FIRST-AID WORK.

I am pleased to say that the interest in this work mentioned in my last report has been maintained. All the mines in the district have a number of fully efficient men and equipment ready for any emergency.

The Government station, with J. D. Stewart in charge, which is in a central position, is always ready to meet any demands that can be made upon it.

During the year samples of the mine-air have been taken in every mine, every split, and every return airway in my Inspectorate. Copies of same have been forwarded to your office in Victoria.

The Canadian Western Fuel Company.

Head Office—Nanaimo, B.C.

Capital, \$1,500,000.

Officers.

Address.

G. W. Bowen, Vice-Chairman,	Nanaimo, B.C.
Mark Bate, Jr., Secretary-Treasurer,	Nanaimo, B.C.
John Hunt, General Superintendent,	Nanaimo, B.C.
T. R. Jackson, Mine Manager, No. 1 Mine,	Nanaimo, B.C.
James Dickenson, Mine Manager, Reserve Mine,	Nanaimo, B.C.
Richard Battey, Harewood Mine,	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 1918.

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	375,612	.....	.....	.....
" export to United States	193,480	.....	.....	.....
" " other countries	19,810	.....	.....	.....
Total sales .....	.....	588,902	.....	.....
Lost in washing	31,272	.....	.....	.....
Used under colliery boilers, etc.	76,463	.....	.....	.....
Total for colliery use .....	.....	107,735	.....	.....
Stocks on hand first of year	8,008	696,637	.....	.....
" last of year	43,293	.....	.....	.....
Difference added to stock during year .....	.....	35,285	.....	.....
Output of collieries for year .....	.....	731,922	.....	.....

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	36	.....	29	.....	65	.....
Whites—Miners	437	.....	.....	.....	437	.....
Miners' helpers	9	.....	.....	.....	9	.....
Labourers	262	.....	48	.....	310	.....
Mechanics and skilled labour	107	.....	129	.....	236	.....
Boys	50	.....	43	.....	93	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese—Labourers .....	.....	.....	168	.....	168	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	901	.....	417	.....	1,318	.....

No. 1 mine of the Canadian Western Fuel Company is situated at the south end of the Esplanade, in the city of Nanaimo, and has been in operation for many years, with good prospects for many years to come.

The present operations are at a depth of 600 to 1,000 feet below the surface, with a large submarine area. This shaft has three openings—namely, the No. 1 hoisting-shaft, Protection shaft, and Newcastle Island shaft. These shafts are all connected underground by good travelling-roads and are all equipped by hoisting apparatus in case of emergency.

The general operations of the mine as far as development-work is concerned are identical with my report of 1917, with the exception that the main South side slope, which has been standing for several years past, is now being cleaned up. It is the intention to develop this hitherto unworked area of ground as quickly as possible.

In the Long-wall slope information has been obtained by means of levels, etc., which will finally lead to driving a rock drift on a grade suitable for motor-haulage to tap the Newcastle seam of coal at a point on the north side of the present slope, and will be considerably lower than any working section engaged at present. This will increase the big machine run considerably, render a larger output, and greatly facilitate the haulage system.

During the year the company has introduced more Edison electric head-lamps, mostly to drivers, pushers, and timbermen, which greatly reduced the number of mine accidents. Open lights have been eliminated in all the mines, with the exception of the Nanoose Collieries and a few in and around the shaft-bottoms in the other mines, but within the near future all open lights will be abolished in all the mines in British Columbia.

Number of electric lamps in operation in the mine: Edison head-lamps, 450; Wico, 45; Ceag, 20.

In addition to all these improvements towards "safety first," the company has erected dust-zones in all intake and return airways; also two men constantly on night shift, watering and cleaning up all haulage-roads and working places. There is also a line of water-pipes all along the Main and Tail haulage-roads, with sprays at intervals—two at the foot of the Diagonal slope, one at foot of the Right incline, and two at the bull-wheel siding. A boy is stationed on an elevated platform at the outside end of this siding with a hose attached to the discharge-pump and sprays all loaded trips as they pass outside.

MINE-RESCUE WORK.

Regarding this branch of work, I am pleased to say that some of the companies in my district, especially the Canadian Western Fuel Company, have taken up this branch of work, which reflects a great deal of credit to both managers and workmen alike.

In my report of last year I commented upon the work that this company was doing along the lines of "safety first" and "first-aid." It is a pleasure to report that the company is continuing this good work, with most gratifying results.

In addition to the active interest this company has displayed in promoting "first aid," it has purchased six new apparatus of the Gibbs type, and quite a number of workmen will avail themselves of the opportunity to take a course of training in mine-rescue work.

NEW WAKESIAH MINE.

W. Moore, Manager; J. A. Challoner, Mine Foreman; Geo. Carson, Fireboss.

This mine is situated on the Wakesiah Farm of the Canadian Western Fuel Company, about two miles from Nanaimo Post-office and immediately adjoining the British Columbia Mining Company's property. Railroad connection is made with the Harewood branch line.

Sinking was commenced on No. 2 shaft on June 17th, 1918. This shaft is 7 x 10 feet, finished, with 6- x 12-inch sawn timbers. Bed-rock was struck at 7 feet and at 85 feet; the conglomerate was reached when the shaft was stopped to allow concrete rings to be put in. Sinking was then commenced on No. 1 shaft, which is 150 feet from No. 2 shaft centres; this shaft is 9 x 18 feet, finished, timbered with 6- x 12-inch sawn timbers. The bottom of the conglomerate being reached at about 82 feet, it was decided to stop and concert to the surface. Sinking was recommenced on No. 2 shaft and continued until the Wellington seam was reached at 325 feet on September 19th. A small sump was made and drifting commenced. Sinking was again started on No. 1 shaft and continued without interruption (except for eight days' delay owing to shortage of water for boilers) until the Wellington seam was reached at 320 feet, when, after a small sump was made, drifting was begun to connect up with No. 2 shaft, and prospect-levels driven off north-west and south-east to ascertain the continuity of the pitch and strike.

In sinking through the conglomerate three Denver Dreadnaught drilling-machines were in operation and did good work, being replaced in the softer rocks with the Denver Clipper drilling-machine, which also gave good satisfaction. The shafts were each ventilated by a small Sirocco force-fan, 12 x 24 inches, running at 600 revolutions a minute, which supplied ample ventilation while sinking. The permanent fan to be installed will be a 90-inch Sirocco, rope-driven, with the usual housing, etc.

During the sinking of No. 1 shaft a pit-head was erected at No. 2 and a Parke & Lacey 10- x 15-inch engine, geared 5 to 1, having a 60-inch drum, was installed. The rope is a 6/19 1½-inch plough steel. Development is being carried on at No. 1 shaft with a Parke & Lacey 9- x 12-inch engine, geared 5 to 1, while the permanent engine is a 14- x 18-inch first-motion engine by the Sandycroft Foundry Company, of Chester, England. Steam is supplied by two 80-horse-power tubular boilers at 120 lb. pressure, with stacks 52 and 60 feet high. Power is supplied by two compressors—one by Canadian Rand Drill Company and one compound by Chicago Pneumatic Tool Company. Light is supplied by a small 7-kw. Curtis steam-turbine generator.

It is the intention of the management to drive levels in some distance, to be assured of the pitch and strike, before laying out a permanent shaft-bottom at No. 1 shaft. A small Cameron pump has been installed at both shafts. Development-work will be carried on from No. 2 shaft while No. 1 pit-head is being erected, which will shortly be proceeded with, and which will embody some absolutely new idea in safety of operation.

Both shafts have been sunk and whole operations so far carried on without a single serious accident, notwithstanding the fact that the shafts were sunk in record time, as much as 152 feet being sunk and timbered in a month. The top of the shaft was completely covered by a carriage operated by compressed air during the dumping of the buckets, making it impossible for materials to fall back in the shaft. Permanent extensions to railway sidings, new tipples, screens, and fans, with all the necessary equipment thereto, will be installed in the near future.

There is now on the ground office and store buildings, blacksmith and machine shop, in which is installed a No. 8 Waugh drill-sharpener among other features, and a carpenter-shop.

The one outstanding feature of the whole operation is the fact that, notwithstanding the many dangers incidental to shaft-sinking and construction-work in general, it has been possible to make such provision for the safety of the employees as to eliminate practically the serious dangers. For this the company should be congratulated, for it has spared neither trouble nor expense in carrying out its policy of "safety first."

NANAIMO COLLIERY.

Thomas R. Jackson, Manager.

No. 1 SHAFT, ESPLANADE.

David Brown, Overman of the North Side of the Mine; Robert Adam, William Neave, William Johnson, James McMeekin, William Holliday, Ernest Kelly, George Jardine, Robert Seggie, George Gray, James Brown, Alex. Parke, William Lindsey, Thomas Brace, George Perry, J. Sullivan, and George Stewart, Firemen.

The seams worked are the Douglas and Newcastle. The coal produced from the No. 1 North level is all from the Newcastle seam, which lies 70 feet below the Douglas, and is penetrated by three slopes—namely, Nos. 1, 2, and 3—varying from 4,000 to 5,000 feet between each slope, and covers an extensive working-face.

The seam varies from 3 to 3½ feet in thickness, is of a very hard nature, and is worked on the long-wall system, to which it is well adapted. Mining-machines of the "pick quick" (or bar machine) and puncher types, operated by compressed air, are used to undercut the coal, the cut varying from 5 to 6 feet in depth.

A large staff of officials is employed in these sections, as shotlighters, facemen, and timbermen, to look after the safety of the workmen engaged.

For every four loaders there is a certificated coal-miner engaged to break the coal down, and for every eight loaders there is one timberman employed and a certificated fireman, who is in charge of the section; in addition, notices are posted in all sections of the mine, warning workmen against the violation of the general and special rules.

During the year Chief Inspector of Mines Wilkinson approved of the Burrell gas-tester as a standard for the testing of marsh-gas in coal-mines of British Columbia.

I have taken tests with the above gas-tester in every split and every return airway in my Inspectorate, a record of which has been forwarded to the office in Victoria.

The ventilation of these sections is produced by a Gulbal force-fan, 9 x 18 feet, and 100 horse-power, rope-driven, making 70 revolutions a minute, producing 100,000 cubic feet of air a minute, with a water-gauge of 2 inches. There is also an emergency exhaust-fan stationed at Newcastle Island shaft ready for use.

The coal is hauled out of No. 1 level to No. 1 shaft by six electric motors of the trolley type—four Edison, one Westinghouse, and one tandem of the Jeffery type—all doing very efficient work.

On my last examination I found 63,000 cubic feet of air a minute passing into this section, divided into three splits.

No. 3 Slope.

There was 13,000 cubic feet of air a minute passing into the slope for the use of fifty-eight men and eight horses, or an average of 159 cubic feet of air for each unit employed.

No. 1 Split, North Side of No. 2 Slope.

There was 12,200 cubic feet of air a minute passing into the split for the use of forty men and seven horses, or an average of 200 cubic feet of air for each unit employed.

No. 2 Split, No. 2 Slope.

There was 6,000 cubic feet of air a minute passing into the split for the use of thirty men and four horses, or an average of 142 cubic feet of air for each unit employed.

No explosive gas found in these sections; timbering and roadways good. The sections are free from coal-dust.

Protection Pillars, Protection Shaft.

I examined all available parts of the pillars and found them free from gas, well ventilated, and the faces well cogged up.

This shaft is used only for the rising and lowering of the workmen engaged in the North side of the mine. The only operations carried out are extracting of pillars for generating power supplied to mining-machines and winches, etc.

Machinery installed: Three Canadian Rand compressors, two 2,500 and one 1,800 cubic feet of air a minute.

Safety-lamps are used in all parts of the mine. Permitted explosives are used for breaking the coal, fired by electric batteries. The section is fairly free from coal-dust; no explosive gas found.

No. 1 Slope.

There was 5,000 cubic feet of air a minute passing into the section for the use of twenty men and three horses, or an average of 172 cubic feet of air for each unit employed. Timbering and roadways good. The section is free from coal-dust; no explosive gas found.

South Side of No. 1 Mine.

Robert Laird, Overman of the Section; Moses Woodburn, Henry Ernest Devlin, James Richards, Joshua Norris, Ike Hill, Francis Green, Joseph William Dykes, William Brown, James Wardrope, Matthew Broderick, and James Gray, Firemen.

The ventilation of the south side is produced by a 72- x 90-inch double-inlet Sirocco fan, rope-driven, ratio $3\frac{1}{2}$ to 1, running 250 revolutions, producing 195,000 cubic feet of air a minute, with a 4-inch water-gauge, and an engine of 350 horse-power. A second Sirocco fan of the same size, in every way modernly equipped, is kept under steam in case of emergency.

Nothing but safety-lamps of the Wolf pattern and Edison electric head-lamps are used. Permitted explosives are used, fired by batteries.

The haulage from this section is by main-and-tail rope and endless-rope system. The production of the mine is 1,400 tons a day.

This section of the mine forms the deepest workings and is worked on the pillar-and-stall system. The South-east levels have reached the boundary which divides the Reserve mine and the South side of No. 1 mine, and are on the retreat.

To overcome the many dangers of being caught by cars in this district, all drivers, rope-riders, and trackmen are equipped with the Edison head-lamp.

On my last inspection I found 33,300 cubic feet of air a minute passing into the section, divided into two splits.

Simms Dips, No. 1 Split.—There was 7,580 cubic feet of air a minute passing into the split for the use of seventeen men and two horses, or an average of 326 cubic feet of air for each unit employed.

No. 2 Split, South-east Heading.—There was 10,500 cubic feet of air a minute passing into the split for the use of forty men and ten horses, or an average of 150 cubic feet of air for each unit employed. A little gas found at the head of Charnock's place; timbering and roadways fair. The section is fairly free from coal-dust.

No. 2 South Level.

There was 4,000 cubic feet of air a minute passing into the section for the use of eighteen men and three horses, or an average of 150 cubic feet of air for each unit employed.

No. 7 Level.

There was 9,000 cubic feet of air a minute passing into the section for the use of thirty-three men and four horses, or an average of 200 cubic feet of air for each unit employed. No explosive gas found; timbering and roadways good. The section is fairly free from coal-dust.

Workings above No. 1 North Level.

There was 4,000 cubic feet of air a minute passing into the section for the use of nine men and one horse, or an average of 363 cubic feet of air for each unit employed. No explosive gas found; timbering and roadways good. The section is fairly free from coal-dust.

The following are the official returns from the No. 1 shaft and Protection Island collieries for the year 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	192,053			
" export to United States.....	98,926			
" " other countries.....	10,128			
Total sales.....		301,107		
Used in making coke.....				
Used under colliery boilers, etc.....	50,071			
Total for colliery use.....		50,071		
Lost in washing.....		12,472		
Stocks on hand first of year.....	1,033			
" last of year.....	34,067			
Difference added to stock during year.....		33,034		
Output of colliery for year.....		396,684		

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.....	243	5.50-8.05			243	
Miners' helpers.....	8	4.96-5.50			8	
Labourers.....	170	4.96-7.10	27	5.01-5.50	197	
Mechanics and skilled labour.....	67	5.50-6.75	71	5.50-6.83	138	
Boys.....	28	2.73-4.96	23	1.98-3.92	51	
Japanese.....						
Chinese.....			84	3.30-3.94	84	
Indians.....						
Total.....	535		219		754	

The mine operated 300 days.

RESERVE MINE.

James Dickson, Manager; Francis John, Overman; Albert Manifold, Harry Allsopp, Robert Smith, John Ovington, George Oswald, Frederick Bell, J. Devoy, John McCourt, Alex. Young, George Frater, and Benjamin Cheetham, Firemen.

The mine is situated in what is known as the Cranberry district, about five miles south of No. 1 Shaft, Nanaimo, B.C. 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. 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 main development of the mine has been carried on by means of three pairs of headings, which have been driven due south, each pair being about 1,000 feet apart.

The coal in the No. 1 South 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 hoisting-shaft, and connect with the shaft about 150 feet from the present shaft-bottom.

The headings have been driven about 1,000 feet to date, and vary in pitch from 10 to 40 degrees, while between the bottom of these headings and the Main level there is a displacement of fully 100 feet. The coal is handled by means of chutes between the headings and the level, which causes considerable breakage of the coal.

A shaft has been raised 110 feet and fitted with a balance cage to allow the cars to be taken directly into one of the heading sections. The irregular pitch and varying thickness of the coal made it difficult to deal with the haulage from the face to the shaft with the large capacity car which was installed when the mine was started.

The mine-car had a capacity of 2 tons and the track-gauge was 42 inches, both of which were unsuited to the conditions as found. It was decided to change to a smaller capacity car and a narrower gauge, so the large cars were taken out of the mine and all the tracks changed to 36-inch gauge, and a smaller car with a capacity of 1 ton introduced. This allowed the cars to reach the faces in some of the sections which up to this time had depended on chutes to deliver the coal to the Main level.

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 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 returns shows a low percent.

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 were being withdrawn was stopped owing to striking a fairly large feeder of water.

On my last examination I found 63,000 cubic feet of air a minute passing into the mine, divided into four splits.

No. 1 Split, East Side.—There was 19,200 cubic feet of air a minute passing into the split for the use of forty men and four horses, or an average of 368 cubic feet of air for each unit employed.

No. 2 Split.—There was 6,000 cubic feet of air a minute passing into the split for the use of eight men, or an average of 750 cubic feet of air for each unit employed.

No. 1 Split, West Side.—There was 17,000 cubic feet of air a minute passing into the split for the use of forty men and three horses, or an average of 347 cubic feet of air for each unit employed.

No. 2 Split.—There was 2,200 cubic feet of air a minute passing into the split for the use of twenty-five men and three horses, or an average of 650 cubic feet of air for each unit employed.

Timbering and roadways good. A small cap of gas in the Main level, off No. 2 West incline. The mine is fairly free from coal-dust.

The following are the official returns of the Reserve Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	52,700			
" export to United States	27,165			
" " other countries	2,781			
Total sales		82,646		
Used in making coke				
Used under colliery boilers, etc.	18,615			
Total for colliery use		18,615		
Lost in washing		3,700		
Stocks on hand first of year	1,438			
" last of year	3,142			
Difference added to stock during year		1,704		
Output of colliery for year		106,665		

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	9	\$	8	\$	17	
Whites—Miners	80	5.50-8.13			80	
Miners' helpers						
Labourers	56	4.96-5.50	11	5.01-5.50	67	
Mechanics and skilled labour	26	5.50-6.18	31	5.50-6.59	57	
Boys	15	2.73-4.29	11	2.25-3.92	26	
Japanese						
Chinese			45	3.30-3.74	45	
Indians						
Totals	186		106		292	

The mine operated 302 days.

HAREWOOD MINE.

Richard Battey, Manager; John White, Overman; James Handlen, John Docherty, Thomas Reid, John Kirkwood, Alex. Bryden, John C. Hughes, William Watson, Harry Carroll, William Robinson, and Robert Henderson, Firemen.

Harewood mine was first opened about forty years ago, when the coal-outcropping at the bluff was worked for a small area and operations 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. Prospecting was continued, but up to the present time coal has not been found in any quantity, although an old prospect-tunnel about 1,000 feet ahead of the faces is supposed to have 5 feet of coal.

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.

At a distance of 800 feet from the bottom of this incline there is what is called No. 2 incline, where coal is also worked to the right and left. At the face of the incline, about 600 feet from the level, a large fault was encountered which cut out the coal entirely, and although prospected a short distance, no results were obtained. They are now trying to work around this roll from the left side of No. 1 incline. The coal at this point is 12 feet thick.

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 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. Pillars are now being drawn in this district to a line of gob formed by pillars drawn to the rise of No. 4 level, where operations in this section will stop.

A No. 7 level was commenced farther down the slope, but discontinued after two months' prospecting in rock. On the left side of the slope only two levels were started opposite Nos. 3 and 4 levels and driven in a northerly direction, but encountered rock, and the pillars were withdrawn, with the exception of three left as a barrier to the slopes; but as a new slope is now being driven from the dip road in No. 2 level up to No. 1 level, these pillars are now being extracted.

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 three 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 41,700 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.

The future operations greatly depend on the prospecting in No. 1 level and the prospect about to start in No. 2 level. The new slope from No. 2 level dips will be an improvement to the haulage being more direct.

Pillars will be drawn on both Nos. 1 and 2 inclines when the stalls are driven up to the outcrop, and barriers will be left for the protection of No. 1 level. When No. 2 level dip-workings hole into the old pillars, part of these may be withdrawn, but a roadway will be left to be used as a return airway and drainage.

On my last examination I found 41,700 cubic feet of air a minute passing into the mine, divided into three splits.

No. 1 Split.—There was 24,700 cubic feet of air a minute passing into the split for the use of sixty men and six horses, or an average of 303 cubic feet of air for each unit employed.

No. 2 Split.—There was 9,000 cubic feet of air a minute passing into the split for the use of eleven men and two horses, or an average of 539 cubic feet of air for each unit employed.

No. 3 Split.—There was 8,000 cubic feet of air a minute passing into the split for the use of twenty-four men and four horses, or an average of 222 cubic feet of air for each unit employed.

Timbering and roadways good. No explosive gas found. The mine is free from coal-dust.

The following are the official returns of the Harewood Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada.....	130,859			
" export to United States.....	67,389			
" " other countries.....	6,901			
Total sales.....		205,149		
Used in making coke.....				
" under colliery boilers, etc.....	7,777			
Total for colliery use.....		7,777		
Lost in washing.....		15,100		
Stocks on hand first of year.....	5,537			
" last of year.....	6,083			
Difference added to stock during year.....		546		
Output of colliery for year.....		228,572		

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 .	8		7		15	
Whites—Miners	114	5.50 - 9.13			114	
Miners' helpers	1	4.96			1	
Labourers	36	4.96 - 5.50	10	5.01 - 5.50	46	
Mechanics & skilled labour.	14	5.50 - 6.25	27	5.50 - 6.35	41	
Boys	7	2.73 - 4.29	9	2.25 - 3.92	16	
Japanese						
Chinese			39	3.62 - 3.84	39	
Indians						
Totals	180		92		272	

The mine operated 301 days.

British Columbia Coal Mining Co., Ltd.

(SUCCESSOR TO VANCOUVER-NANAIMO COAL MINING CO., LTD.)

Head Office—Nanaimo, B.C.

Capital, \$300,000.

Officers.

William Warner, President,
Howard Gallagher, Secretary-Treasurer,
S. K. Mottishaw, Superintendent,

Address.

17 Williams Bldg., Vancouver, B.C.
P.O. Box 834, Nanaimo, B.C.
Nanaimo, B.C.

Value of plant, \$100,000.

NEW EAST WELLINGTON COLLIERY.

Samuel K. Mottishaw, Manager; Joseph Thompson, Overman; Ike Nash and James Bullen, Firemen.

The mine is situated two miles due west from the city of Nanaimo, on Ranges 10 and 11, in the Mountain district, and is on the Old Wellington seam. It is penetrated by two slopes running N. 70° E., and pitching about 35 degrees, for a distance of 1,400 feet. At this point headings are turned off N. 65° E., which have reached the boundary. At a distance of 300 feet from the foot of the slope on No. 1 East level, dip-workings are driven N. 15° E. to the boundary.

All the solid work being finished, the pillars are now being drawn back. The coal varies from 4 to 8 feet in thickness and is worked by the pillar-and-stall methods.

Wolf safety-lamps and permitted explosives, fired by batteries, are used throughout the whole mine. The mine is equipped with two 2-hour and one ½-hour Draeger oxygen apparatus, one pulmotor, and four Ceag electric lamps.

The ventilation of the mine is produced by a Browning reversible fan, with a capacity of 100,000 cubic feet of air a minute, coupled to a 74-horse-power, 12 x 16 Houston, Stanwood & Gamble engine, making 250 revolutions a minute, with a 2½-inch water-gauge; also a 4 x 9 Sheldon fan, kept ready under steam in case of emergency.

A gob-fire broke out at 3 a.m. on the morning of October 5th, 1917, in the old worked-out area of No. 5 West level, and after an examination of the same, accompanied by Chief Inspector Wilkinson, we found that owing to the extracted area and the remaining pillars being so small it was utterly impossible to erect permanent stoppings near the fire area, and it was decided to erect the stoppings in the Main and Return slopes. This was successfully done on October 7th, 1917.

On November 22nd, 1917, after samples of the mine-air taken at the return stoppings, it was decided to open the stoppings again, and the work of removing the gases was proceeded with up to November 28th, when it was discovered that the fire was not extinguished; consequently the mine was sealed off again on November 29th, remaining closed until August 10th of the present year, when the mine was unwatered and operations begun.

On my last examination I found 80,600 cubic feet of air a minute passing into the mine for the use of forty men and four horses, or an average of 588 cubic feet of air for each unit employed. Timbering and roadways fair. A little explosive gas found in No. 3 East and at the top stopping at No. 5 West. The mine is fairly free from coal-dust.

The following are the official returns for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	4,815	.....	.....	.....
" export to United States.....	4,879	.....	.....	.....
" " other countries.....	.....	.....	.....	.....
Total sales.....	.....	9,494	.....	.....
Used in making coke.....	.....	.....	.....	.....
Used under colliery boilers, etc.....	3,970	.....	.....	.....
Total for colliery use.....	.....	3,970	.....	.....
Stocks on hand first of year.....	.....	.....	.....	.....
" last of year.....	604	.....	.....	.....
Difference added to stock during year.....	.....	604	.....	.....
Output of colliery for year.....	.....	14,068	.....	.....

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	\$	3	\$	8	\$
Whites—Miners.....	36	7.25	.....	.....	36	7.25
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	7	4.81	2	4.50	9	4.68
Mechanics and skilled labour.....	3	5.79	10	5.87	13	5.83
Boys.....	.....	.....	.....	.....	.....	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	13	3.27	13	3.27
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	51	.....	28	.....	79	.....

Name of seams or pits—Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—The coal varies in thickness from 4 to 8 feet, and is reached from the surface by two slopes running N. 70° E. and pitching about 35 degrees down a distance of 1,400 feet. At this point headings are turned off N. 65° E. and are driven up to the boundary. All of the work in this mine is devoted to the extraction of the pillars.

Description and length of tramway, plant, etc.—The hoisting plant consists of a direct-haulage 10- x 12-inch Washington hoist. The coal is screened over a Marcus screen. The power plant consists of three return-tubular boilers of 80 horse-power each and two Canadian Rand air-compressors having a capacity of 600 cubic feet of free air. The mine is connected by two miles of railway to a shipping-point situated on Newcastle townsite; the railway also connects with the Esquimalt & Nanaimo Railway. The coal is dumped into bunkers having a capacity of 1,000 tons, from which it is conveyed to ships by a self-acting incline. There is also a small sawmill at which the mine timber is cut. The ventilation of this mine is produced by a Browning fan, 4 x 10 feet, driven by a 10- x 12-inch Fairbanks-Morse engine making 165 revolutions a minute, with a water-gauge of 2.4 inches.

Pacific Coast Coal Mines, Limited.

Head Office—Victoria, B. C.

Capital, \$3,000,000.

Officers.

James Carruthers, President,
J. H. Paine, Vice-President and Managing Director,
Douglas Muir, Secretary-Treasurer,
Robert Bonar, Superintendent,

Address.

Montreal, Que.
Victoria, B.C.
Victoria, B.C.
South Wellington, B.C.

MORDEN MINE.

Robert Bonar, Manager; Thomas Taylor, Overman; John Donnachie, Edward J. Parrott, Neil McIntyre, and Peter Carr, Firemen.

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 13 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 penetrated 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, at from 3- to 3½-inch water-gauge, at 250 revolutions a minute. A 16- x 12-inch engine, made by the Vulcan Iron Works, drives this fan, the fan being 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, during the recent "flu" epidemic.

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 the coal; although only 4 feet high, it is of a 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; 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 I found 50,000 cubic feet of air a minute passing into the mine, divided into two splits.

No. 1 Split.—There was 20,000 cubic feet of air a minute passing into the split for the use of twenty men and one horse, or an average of 900 cubic feet of air for each unit employed.

No. 2 Split.—There was 25,000 cubic feet of air a minute passing into the split for the use of thirty men and four horses, or an average of 595 cubic feet of air for each unit employed.

A little gas found in Merriner's place, No. 4 Right. The mine is fairly free from coal-dust. Timbering and roadways fair.

The following are the official returns for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	33,934			
" export to United States.....	36,274			
" " other countries.....				
Total sales.....		70,208		
Lost in washing.....	16,525			
Used under colliery boilers, etc.....	17,905			
Total for colliery use.....		34,430		
		104,638		
Stocks on hand first of year.....	22,419			
" last of year.....	410			
Difference taken from stock during year.....		22,009		
Output of colliery for year.....		82,629		

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.....	9	\$ 5.75	6	\$ 6.25	15	\$ 5.75 - 6.25
Whites—Miners.....	65	5.82			65	5.82
Miners' helpers.....						
Labourers.....	38	4.30			38	4.30
Mechanics and skilled labour.....	2	3.87 - 4.70	38	3.87 - 5.90	40	3.87 - 5.90
Boys.....			3	2.30	3	2.30
Japanese.....						
Chinese.....			45	2.70	45	2.70
Indians.....						
Totals.....	114		92		206	

Name of seams or pits—Working on the upper Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—At the Morden mine coal is reached by means of shafts: No. 3 shaft, 655 feet in depth, 10 x 18 feet in the clear; No. 3 air-shaft, 630 feet in depth, 10 x 10 feet in the clear. Upcast air-shaft is also equipped

with steam-hoist and cage as the emergency outlet. All machinery for handling coal is electrically driven.

Description and length of tramway, plant, etc.—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 engine, also motor-driven as auxiliary. There is a thoroughly equipped machine-shop and also mine-rescue station, containing two sets 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 Nanoose Collieries Co., Ltd.

Head Office—Vancouver, B.C.

Capital, \$50,000.

Officers.

W. J. Vanhouten, President,
W. H. Wilson, Secretary-Treasurer,
J. J. Grant, Superintendent,

Address.

Vancouver, B.C.
Vancouver, B.C.
Wellington, B.C.

Value of plant, \$52,300.

NANOOSE COLLIERIES.

John John, Manager; John Michie, John McLeod, and Edward Bridges, 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 East level has been driven through the fault into the property of the Canadian Collieries Company, where good coal has been struck, varying from 4 to 6 feet in thickness, with a bench of rock running through the centre, varying from 1 to 3 feet.

A new head-frame has been erected with a capacity of handling 500 tons a day. The new loading-wharf has been completed. A number of cottages have been built on the Comox road to accommodate the workmen of the mine. A new hoist and boilers have also been completed.

The ventilation of the mine is produced by a small fan capable of producing 14,000 cubic feet of air a minute. The mine is worked on the pillar-and-stall system, with permitted powders, fired by batteries. Open lights are used, as there never has been any gas found.

On my last examination I found 14,000 cubic feet of air a minute passing into the mine for the use of twenty-seven men and two horses, or an average of 424 cubic feet of air for each unit employed. Timbering and roadways good. No explosive gas found. The mine is free from coal-dust.

During all examinations I examined all record-books under section 91, subsections (4) and (36), of the "Coal-mines Regulation Act," and found the provisions of the above Act carried out.

The following are the official returns for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	11,669	.....	.....	.....
" export to United States	12,587	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	24,256	.....	.....
Used in making coke, unsaleable slack	3,145	.....	.....	.....
Used under colliery boilers, etc	1,403	.....	.....	.....
Total for colliery use .....	.....	4,548	.....	.....
Stocks on hand first of year .....	.....	.....	.....	.....
" last of year .....	.....	.....	.....	.....
Difference { added to { stock during year .....	.....	.....	.....	.....
{ taken from { .....	.....	.....	.....	.....
Output of collieries for year .....	.....	28,804	.....	.....

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	.....	3	.....	6	.....
Whites—Miners	32	.....	.....	.....	32	.....
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	15	.....	4	.....	19	.....
Mechanics and skilled labour .....	.....	.....	4	.....	4	.....
Boys .....	.....	.....	3	.....	3	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	14	.....	14	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	50	.....	28	.....	78	.....

Name of seams or pits—Grant mine, Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Seam consists of two layers of coal, upper and lower bench, with clay and shale between, varying in thickness from 1 to 4 feet; total thickness of seam, from 8 to 10 feet. Method of working is pillar and stall. Entries driven on strike of seam 12 feet wide, height of seam. Stalls driven to rise, double-stalls track on each side, with gob in centre. Average dip of seam is about 7 degrees. Levels at present 1,800 feet long in a south-easterly direction from shaft-bottom. Shaft 8 x 16, three compartments, 120 feet deep. Return airway is rock-drift from coal-seam to surface on a 22-degree pitch; size 6 x 12.

Description and length of tramway, plant, etc.—Plant is located on beach, about four miles south of Nanoose Bay. Loading-wharf is 500 feet long. Working plant consists of return-tubular boiler, 88 horse-power, double-drum hoist, drums 30 inches in diameter, engine-cylinders 12 x 16 inches. Air-compressor, 225 cubic feet free air a minute. Revolving screen for nut and pea coal; lump screened over bar screen. Machine-shop is equipped with lathe,

drill-press, emery-wheels, and necessary tools, operated by 7-horse-power upright engine. Complete blacksmith-shop. Ventilation system operated by standard 8-foot fan, capacity 25,000 cubic feet, driven by Leonard engine, 25 horse-power. Electric-lighting plant, 125-light capacity.

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, 1918, together with a list of all accidents and colliery returns.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Capital, \$15,000,000.

Officers.

Henry S. Fleming, President,
F. Perry, Vice-President,
H. S. Adlington, Secretary-Treasurer,
J. M. Savage, General Manager,
Thos. Graham, General Superintendent,

Address.

New York.
Montreal, Que.
Montreal, Que.
Victoria, B.C.
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:—

RETURNS FROM THE CANADIAN COLLIERIES, LTD., MINES FOR YEAR 1918.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	343,707	.....	24,501	.....
" export to United States.....	151,611	.....	.....	.....
" " other countries.....	38,607	.....	.....	.....
Total sales.....	.....	533,925	.....	24,501
Lost in washing.....	185,963	.....	.....	.....
Used in making coke.....	40,172	.....	.....	.....
Used under colliery boilers, etc.....	27,747	.....	115	.....
Total for colliery use.....	.....	253,882	.....	115
.....	.....	787,807	.....	24,616
Stocks on hand first of year.....	3,345	.....	1,473	.....
" last of year.....	7,368	.....	1,744	.....
Difference added to stock during year.....	.....	4,023	.....	271
Output of collieries for year.....	.....	791,830	.....	24,887

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	82	.....	36	.....	118	.....
Whites—Miners	431	.....	.....	.....	431	.....
Miners' helpers	6	.....	.....	.....	6	.....
Labourers	181	.....	74	.....	255	.....
Mechanics and skilled labour	161	.....	174	.....	335	.....
Boys	17	.....	10	.....	27	.....
Japanese	97	.....	1	.....	98	.....
Chinese	438	.....	263	.....	701	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	1,413	.....	558	.....	1,971	.....

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. The new railway connects with the several mines in this district, thus doing away with the heavy grade on the old line. 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 present 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. The output of power shows the same steady increase as in former years.

UNION BAY.

At Union Bay the coke-ovens have been in continuous operation during the entire year.

A new machine-shop has been installed in Cumberland to take care of the small repair-work around the mines. This contains two lathes, drill-press, hack-saw, and punch and shear. The electrical winding department has been moved from Union Bay to this shop.

One diamond-drill has been running continuously in the field during the year. A new road has been opened from the Island highway up Tsaabl river, about five miles south of Union Bay, to take in a drill to prospect some territory about five miles up the river, where some very likely looking prospects are showing. This drill is expected to be working early in the new year.

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 William Watson, Thomas Richards, Arthur Phelan, Daniel Parks Marsh, Peter Myers, William Beveridge, Thomas Eccleston, Robert Reid, Robert Ewing, John George Biggs, Richard Henry Hodson, Louie Franscescini, John Liddle, Daniel McMillan, and Frederick Hutchinson, 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 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 electric head-lamp are used exclusively in this mine, and where blasting is permitted it is done with permitted explosives fired by electric battery.

New Work at No. 4 Mine.

On both Nos. 1 and 2 slopes tail-ropes were necessary to carry empty trips into the mine on account of an adverse grade near the mouth of the mine. A rock tunnel was started directly over the slopes, the thickness of strata being 15 feet between the roof of the old tunnel and the floor of the new tunnel.

At the turn-off to No. 2 slope a curve with a radius of 124 feet was put in. The tunnels were driven until the timbers on the old slope were struck. The roof was then brushed through on a week-end. A new tippie approach was built over the old tippie approach; this was built so as to conform with the new tippie plans. When the inside work was ready this new tippie approach was temporarily connected to the old tippie. This work was completed without any loss of time to the mine.

A new tippie is being erected at this mine. This tippie is being built alongside the present tippie and will be equipped with a Marcus screen. It is expected to have this in operation early in January. A new lamp-room has been completed and equipped with electric lamps, and all necessary appliances for charging and upkeep.

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, has been driven ahead and two levels turned off. These levels are in good coal ranging from 5 to 7 feet in height, with a band of rock running in the centre from 12 to 15 inches thick, having a fairly good roof. No. 1 slope has not advanced any during the year.

During my last inspection in December I measured 22,500 cubic feet of air a minute passing into No. 1 slope for the use of sixty-five men and eleven mules, or an average of 229 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in a crosscut off No. 20 West level and a 1-inch gas-cap in No. 22 pillar in No. 18 West level; also found a slight gas-cap travelling in the air-current between Nos. 18 and 20 West levels. I found the timbering and roadways in fair condition.

No. 2 Slope.

This slope branches off No. 1 slope a short distance from the mouth of the tunnel, 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 advanced any during the year. Considerable repair-work has been done in the return air-courses and stoppings built between the intake and return airways in No. 2 slope during the year.

Levels are turned off this slope east and west—Nos. 15, 16, 17, 18, 19, and 20 on the West side, and Nos. 15, 16, 17, 18, 19, and 20 on the East side. Nos. 20 East and 20 West are the only levels advancing, and are both in good coal ranging from 4 to 6 feet thick, with a band of rock in the centre from 12 to 15 inches thick. On all other levels pillars are being extracted.

When I made my last inspection in December I measured 48,000 cubic feet of air a minute passing into No. 2 slope, divided into two splits.

In the East side split there was 16,800 cubic feet of air a minute passing for the use of forty-seven men and seven mules, or an average of 247 cubic feet of air a minute for each unit employed.

In the West side split there was 14,300 cubic feet of air a minute passing for the use of twenty-three men and four mules, or an average of 317 cubic feet of air a minute for each unit employed.

I found explosive gas in No. 23 stall and a crosscut off No. 23 stall, along the fault-line in No. 19 East level, and a $\frac{1}{2}$ -inch gas-cap in Nos. 16 East and 17 West pillars; also found a slight gas-cap travelling in the air-current on the return side of No. 19 East level. Found timbering and roadways in fairly good condition.

This mine is fairly free from coal-dust. I made tests with the Burrell gas-detector in the several splits and main return airways of this mine, with the following results: Split in No. 1 slope showing 1.5 per cent. methane in 15,000 cubic feet of air a minute; split on East side of No. 2 slope showing 1.5 per cent. methane in 25,200 cubic feet of air a minute; split on West side off No. 2 slope showing 1.4 per cent. methane in 16,000 cubic feet of air a minute; main return showing 1.2 per cent. methane in 130,200 cubic feet of air a minute.

No. 5 MINE, COMOX.

William Walker, Manager; Robert Brown, Overman; Frank Crawford, Duncan Thomson, James Brown, Jasper Rutherford, Thomas Smith Wilson, John Ernest Spicer, William Bradley, Frederick Horwood, Thomas Shields, Samuel Jones, John D. Davis, and Robert Houston, Firebosses.

This mine has been in continuous operation during the year. The development of No. 1 dip is being carried on by four Sullivan type C.E. 7 coal-cutters. No. 2 dip is also being developed, this being the only new development in this mine during the year. A new lamp-room has been built and equipped for electric lamps. The full complement of lamps for this mine has not been yet received. The Sirocco fan for ventilating this and No. 6 mine has been in continuous service during the year and has proved satisfactory.

When I made my last inspection in December I measured 91,800 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 there was 17,800 cubic feet of air a minute passing for the use of fifty men and nine mules, or an average of 231 cubic feet of air a minute for each unit employed.

In the split on the West side of No. 1 dip there was 10,500 cubic feet of air a minute passing for the use of twenty men and one mule, or 456 cubic feet of air a minute for each unit employed.

In No. 2 dip split there was 20,000 cubic feet of air a minute passing for the use of forty men and three mules, or an average of 408 cubic feet of air a minute for each unit employed.

In the split on West side of shaft there was 25,000 cubic feet of air a minute passing for the use of forty-five men and eight mules, or an average of 362 cubic feet of air a minute for each unit employed.

I found timbering in good condition, with the exception of several places on the East side of No. 1 dip, which were not timbered in accordance with Special Rule No. 126. The attention of the manager was directed to this matter, with instructions to have same timbered properly. Roadways were in good order. I found no explosive gas in this mine. This mine is free from coal-dust.

I made tests with the Burrell gas-detector in the various splits and main return airways with the following results: Split on West side of No. 1 dip showing 0.3 per cent. methane in 11,000 cubic feet of air a minute; split on East side of No. 1 dip showing 0.5 per cent. methane in 19,200 cubic feet of air a minute; No. 2 dip split showing 0.3 per cent. methane in 21,200 cubic feet of air a minute; split on West side of shaft showing 0.2 per cent. methane in 23,400 cubic feet of air a minute. Combined return of Nos. 5 and 6 mines, between Nos. 1 and 2 inclines, showing 0.5 per cent. methane in 80,000 cubic feet of air a minute.

No. 6 MINE, COMOX.

William Walker, Manager; Thomas Mordy, Overman.

No coal has been hoisted at this mine during the year. New arrangements have been made at this mine for water-hoisting. New buckets have been installed and the dumping facilities considerably improved. Practically all the water made in Nos. 5 and 6 mines is hoisted from No. 6 shaft.

When I made my inspection in December I measured 25,000 cubic feet of air a minute passing into the mine. I found a small quantity of explosive gas issuing from a break in the roof in a slant of No. 2 East level. I found timbering and roadways in fair condition.

No. 7 MINE, COMOX.

John Graham Quinn, Manager; James Lawther Brown, Overman; Watkin Williams, James Monks, John Marsden, William James Keenan, Thomas Henry Nanson, Norman Wilson Huby, John McMurtrie, and Robert Walker, Firebosses.

This mine has been in continuous operation during the year. A borehole has been put down close to the bottom of the slope for water-discharge; the hole was put down by a churn-drill. A 6-inch pipe was put in and cemented. This will cut out the use of the discharge-line up the Main slope, a distance of over 5,000 feet. The depth of the drill-hole is 586 feet.

This mine is entered by means of two slopes, running N. 35° E., and is down a distance of 7,000 feet. The method of mining is the long-wall system. The seam varies from 2½ to 3½ feet thick and is of a very hard nature, being well adapted to this method of mining.

No. 1 Main Slope.

From this slope levels are turned off east and west—Nos. 3, 6, 7, 8, 9, and 10 on the West side, and Nos. 3, 7, and 9 on the East side.

No. 3 East Diagonal Slope.

This slope is driven off No. 3 East level at a distance of 500 feet from the Main slope and a distance of 2,000 feet from the entrance of the mine, running north-east. Levels are turned off on the East side only, owing to a fault running parallel to the slope on the West side; these levels are in good coal from 3 to 3½ feet thick.

The principal plant at this mine consists of a Sirocco fan with a capacity of 270,000 cubic feet of air a minute at a 5-inch water-gauge, driven by a 350-horse-power motor, and one electric haulage-engine driven by a 750-horse-power motor.

When I made my inspection in December I measured 89,000 cubic feet of air a minute passing into the mine, divided into four splits.

In No. 1 West split there was 7,400 cubic feet of air a minute passing for the use of twelve men and one mule, or an average of 493 cubic feet of air a minute for each unit employed.

In No. 2 West split there was 18,000 cubic feet of air a minute passing for the use of fifty men and seven mules, or an average of 253 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 thirty men and three mules, or an average of 384 cubic feet of air a minute for each unit employed.

In No. 2 East split there was 10,000 cubic feet of air a minute passing for the use of twelve men and one mule, or an average of 666 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in No. 1 gateway, off No. 8 slant, No. 9 West level. The workmen were withdrawn from this place and the place fenced off pending the gas being removed. I found timbering and roadways in good condition. This mine is free from coal-dust.

I made tests with the Burrell gas-detector in the several splits and main return airways of this mine, with the following results: No. 1 West split showing 0.2 per cent. methane in 8,000 cubic feet of air a minute; No. 2 West split showing 0.3 per cent. methane in 18,700 cubic feet of air a minute; No. 1 East split showing 0.2 per cent. methane in 16,500 cubic feet of air a minute; No. 2 East split showing 0.2 per cent. methane in 10,850 cubic feet of air a minute; main return showing 0.4 per cent. methane in 96,000 cubic feet of air a minute.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used exclusively in No. 7 mine; all blasting is done with permitted explosives and all shots fired by electric battery.

No. 8. MINE, COMOX.

This mine has not been operated during the year.

The following are the official returns from the Comox Collieries for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	191,190	.....	.....	24,501
" export to United States	128,041	.....	.....	.....
" " other countries	38,607	.....	.....	.....
Total sales .....	.....	355,838	.....	.....
Used in making coke	40,104	.....	.....	.....
Used under colliery boilers, etc.	11,709	.....	.....	115
Lost in washing	129,418	.....	.....	.....
Total for colliery use .....	.....	181,231	.....	.....
Stocks on hand first of year	2,455	536,069	1,473	.....
" last of year	3,752	.....	1,744	.....
Difference added to stock during year .....	.....	1,297	.....	271
Output of collieries for year .....	.....	538,366	.....	24,887

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	56	.....	22	.....	78	.....
Whites—Miners	157	.....	.....	.....	157	.....
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	167	.....	44	.....	211	.....
Mechanics and skilled labour	46	.....	96	.....	142	.....
Boys	17	.....	10	.....	27	.....
Japanese	97	.....	1	.....	98	.....
Chinese	433	.....	186	.....	619	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	973	.....	359	.....	1,332	.....

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 nine miles from Ladysmith and five miles from 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 17 feet in the clear and one mile long, with a double track running practically the whole distance, and operated by Westinghouse electric locomotives. A wood 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.

The new change and wash house which was built in the latter part of the year 1917 has given every satisfaction, being maintained up to the standard for the welfare of the men going and coming from their work. (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 smoke-room, observation-room, work-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, four electric safety-lamps (Draeger type), and one pulmotor.

LADYSMITH.

During the year shipping and railway-car service has been steady. The coal-washery has been in continuous operation throughout the year, with the exception of about three weeks in August, when operations were retarded owing to a shortage of water from the mountain source, caused by the long-continued dry weather. A new boiler and pumping plant has been installed to take care of any water-shortage in the future.

No. 1 OR TUNNEL MINE, EXTENSION.

James Strang, Manager, Nos. 1, 2, and 3 Mines; William Wilson, Overman; John Greenhorn, William Clifford, David John Gordon, William Wesnedge, Albert Radford, and James Glen, Firebosses.

This mine is worked on the long-wall system, hand-mining being employed. During the year development-work in No. 3 slope has been greatly retarded owing to the broken and disturbed ground met with in the slope, and levels turned off the same. Water has also retarded the operations in this slope. A new 5-inch wood-pipe line and a 4-stage turbine-pump have been installed during the year to deal with the large supply of water met with in this slope.

No. 2 slope is operated by the same hoist that now operates both the Main and No. 3 slopes. This district is looking very promising, the coal averaging about 4 feet in thickness. This slope has not advanced any for several months, it being the intention of the management to develop this territory from No. 3 slope.

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 a 40-horse-power Allis-Chalmers-Bullock motor.

When I made my last inspection in December I measured 25,450 cubic feet of air a minute passing into the mine, divided into two splits.

In the East side split there was 10,500 cubic feet of air a minute passing for the use of thirty men and three mules, or an average of 269 cubic feet of air a minute for each unit employed.

In the West side split there was 7,500 cubic feet of air a minute passing for the use of fifteen men and two mules, or an average of 357 cubic feet of air a minute for each unit employed.

I found explosive gas on a cave and along the fault-line in No. 5 West level pillars, off No. 2 slope. The workmen were withdrawn from this section and the section securely fenced off pending the removal of the gas. I found timbering and roadways in good condition and the mine fairly free from coal-dust.

I made tests with the Burrell gas-detector in the splits and main return airways in this mine, with the following results: East side split showing 0.2 per cent. methane in 11,450 cubic feet of air a minute; West side split showing 0.3 per cent. methane in 8,750 cubic feet of air a minute; main return showing 0.6 per cent. methane in 30,500 cubic feet of air a minute.

No. 2 MINE, EXTENSION.

Robert Leece Spruston, Overman; Owen Dabb, John Davidson, Joseph Mason, Joseph Watson, Robert N. Hamilton, and William Cosler, Firebosses.

During the year development-work has been carried out to a certain extent in No. 4 East district. The No. 1 incline has opened up a large area of pillar-work that has been abandoned since the labour troubles in 1912.

No. 17 incline has also been pushed ahead and opened up a promising section of long-wall work, the seam in this section averaging about 3 feet 9 inches in thickness. No. 3 dip slant is being driven with intention of opening up a large territory of solid coal to the dip side of this district.

In the Slope district a large amount of recovery-work has been done throughout the year, and some good coal has been taken out from the old abandoned workings in the several sections of the slope. No. 3 East level has been skipped where it has been heavily caved and cleaned up at other portions, which has improved the ventilation in this district and opened a large area of pillar-work.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used throughout the mine; 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 inspection in December I measured 31,100 cubic feet of air a minute passing into the mine, divided into three splits.

In the West side split there was 12,500 cubic feet of air a minute passing for the use of eight men and three mules, or an average of 462 cubic feet of air a minute for each unit employed.

In the East side split there was 5,400 cubic feet of air a minute passing for the use of seventeen men and two mules, or an average of 234 cubic feet of air a minute for each unit employed.

In No. 4 East split there was 13,200 cubic feet of air a minute passing for the use of twenty-eight men and six mules, or an average of 286 cubic feet of air a minute for each unit employed.

I found No. 2 mine free from explosive gas; 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 are as follows: West side split showing 0.4 per cent. methane in 13,850 cubic feet of air a minute; East side split showing 0.3 per cent. methane in 6,000 cubic feet of air a minute; No. 4 East split showing 0.2 per cent. methane in 13,600 cubic feet of air a minute; main return showing 0.5 per cent. methane in 33,600 cubic feet of air a minute.

No. 3 MINE, EXTENSION.

Thomas Strang, Overman; James Pollock Nommo, Jr., Patrick Malone, Daniel Campbell, David Davidson, George Smith, James Nelson, and Thomas Wilson, Firebosses.

Development-work in this mine during the year has been carried out principally in the No. 4 West Recovery district; levels and inclines having been driven through pillars and gobs, where some good coal has been recovered. The Main level will serve a double purpose in providing a new return airway from the Heading and McCoy's Incline districts and opening up a piece of solid coal which has been abandoned at a time when there was ample thick coal throughout the mine to work. Practically the whole of the mine is employed in pillar-extraction, with the exception of two levels off Malone's Dip section which are being driven in the solid.

Safety-lamps of the Wolf type and the Edison storage-battery electric lamp are used throughout the mine; all blasting is done with permitted explosives, fired by electric battery.

This mine is ventilated by a 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 in December I measured 22,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 13,250 cubic feet of air a minute passing for the use of forty-five men and seven mules, or an average of 200 cubic feet of air a minute for each unit employed.

In No. 2 split there was 8,750 cubic feet of air a minute passing for use of twenty-four men and five mules, or an average of 221 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in the face of Quigley's level, off Malone's dip. (Place fenced off.) Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in the splits and main return were as follows: Return from No. 1 split showing 0.4 per cent. methane in 13,900 cubic feet of air a minute; return from No. 2 split showing 0.3 per cent. methane in 9,000 cubic feet of air a minute; main return showing 0.5 per cent. methane in 28,400 cubic feet of air a minute.

The following are the official returns from the Extension Collieries for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	131,628			
" export to United States.....	25,570			
" " other countries.....				
Total sales.....		157,198		
Used in making coke.....	68			
Used under colliery boilers, etc.....	15,041			
Lost in washing.....	49,644			
Total for colliery use.....		64,753		
Stocks on hand first of year.....	890			
" last of year.....	3,616			
Difference added to stock during year.....		2,726		
Output of collieries for year.....		224,677		

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.....	22		10		32	
Whites—Miners.....	198				198	
Miners' helpers.....	6				6	
Labourers.....	14		22		36	
Mechanics and skilled labour.....	102		56		158	
Boys.....						
Japanese.....						
Chinese.....	5		57		62	
Indians.....						
Totals.....	347		145		492	

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 1, 2, and 3 mines connected by main tunnel.

No. 5 MINE, SOUTH WELLINGTON.

Thomas A. Spruston, Manager; David Martin, Overman; Joseph Lane, Albert Warren Courtenay, and Daniel Coldwell, Firebosses.

This new mine is situated at South Wellington, about 700 yards south of the entrance to the Old Alexandria mine, and is operating in the Douglas seam. Good progress has been made on the underground development-work and the installation of the surface plant in connection with the operation of the mine.

The Main slope is down a distance of 2,500 feet, being driven 14 x 8 feet in the clear. 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 method.

The levels on the South side of the slope have been in broken and disturbed ground up to the latter part of December, when 5 feet of good coal was struck in the Nos. 3 and 4 South levels.

The ventilation is produced by an 8-foot Stine fan, belt-driven by a 50-horse-power, type 3 Westinghouse motor, and is situated at the air-shaft, about 350 feet east of the Main slope. Heavy steel rails and switches are laid the full length of the slope. Safety-lamps of the Wolf type and the Edison storage-battery electric-lamps are used throughout the mine; blasting is done with permitted explosives, fired by electric battery.

The surface plant has been laid out on the most up-to-date methods for handling large quantities of coal with the least possible breakage. A marked feature is the compatible arrangements of the whole plant in close conjunction with the mine, water, and railway.

Railway connection has been made with the Esquimalt & Nanaimo Railway Company. The mine yard has been completed, together with empty and loaded sidings in connection with the Esquimalt & Nanaimo Railway. A main line runs throughout the yard with turnouts for full and empty cars under the tipple. A spur has been put in for loading box cars by special arrangements at the end of the picking-table and loading-boom. The tipple consists of a revolving dump, car-haul, shaker screens carrying two decks for the separate grades of coal, with suitable arrangements made for taking away boiler-fuel automatically when required. A loading-boom has been installed at the continuation of the picking-table, thus minimizing the breakage of the coal.

The power-house equipment consists of one 250-volt, d.c. Crocker-Wheeler generator of 112-kw. capacity, direct-coupled to a 15 x 14 Ideal engine; one Sullivan W.B. 2, size 22 x 24 x 14½, stroke 24 inches, air-pressure 90 lb.; one Ottuma 100-horse-power steam-driven hoist which operates the Main slope. Power is supplied by two Goldie & Bullock return-tubular 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. Other buildings consist of offices for manager and clerk and a suitable store-room, lamp-house, and mule-barn.

The water for the plant is obtained from the lake adjoining the colliery, and is pumped into a large Fairbanks tank with a capacity of 30,000 gallons, and stands at an elevation of about 50 feet.

When I made my last inspection in December I measured 56,000 cubic feet of air a minute passing into the mine for the use of thirty-two men and three mules, or an average of 14,000 cubic feet of air a minute for each unit employed. I found timbering and roadways in good condition and the mine free from explosive gas. The mine is free from coal-dust.

A test made with the Burrell gas-detector in the return airway showed 0.2 per cent. methane in 56,800 cubic feet of air a minute.

The following are the official returns from the South Wellington Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	20,889			
" export to United States.....				
" " other countries.....				
Total sales.....		20,889		
Lost in washing.....	6,901			
Used under colliery boilers, etc.....	997			
Total for colliery use.....		7,898		
Stocks on hand first of year.....				
" last of year.....				
Difference { added to } stock during year.....				
{ taken from }				
Output of colliery for year.....		28,787		

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		4		8	
Whites—Miners.....	76				76	
Miners' helpers.....						
Labourers.....			8		8	
Mechanics and skilled labour.....	13		22		35	
Boys.....						
Japanese.....						
Chinese.....			20		20	
Indians.....						
Totals.....	93		54		147	

Description of seams, tunnels, levels, shafts, etc., and number of same—One slope located south of Old Alexander mine.

Granby Consolidated Mining, Smelting, and Power Co.

GRANBY No. 1 COLLIERY.

James Hargreaves, Manager; Thomas James Shaw, Henry Winstanley, and Alexander Derbyshire, Firebosses.

This mine is situated at Cassidy, B.C., and is being opened up on the Douglas seam, which averages 10 feet in thickness. Three parallel slopes are being driven on the pitch of the seam at an angle varying from 14 to 18 degrees. The manway is down 1,146 feet and is timbered with 12-inch framed sets, 4-foot centres, collars 6 feet between notches.

The Main slope is developed to a point 1,196 feet from the surface and is timbered with 12- to 14-inch framed sets, 4-foot centres, and 12 feet between notches. In the Parallel slope, or return airway, connections are made from the fan-shaft to No. 2 South level, a distance of 720 feet. This is being enlarged and is timbered with 12-inch framed sets, 4-foot centres, and 8 feet between notches. Four levels are off with parallel counter-levels.

POWER-HOUSE.

The power-house equipment consists of the following units: One 500-kw. Allis-Chalmers-Bullock alternator, 2,300 volts, 3-phase, 60 cycles, running 360 r.p.m., and coupled direct to a vertical 2-cylinder compound condensing-engine.

One 250-kw. Allis-Chalmers-Bullock alternator, 2,300 volts, 3-phase, 60 cycles, running 450 r.p.m., direct-connected to a vertical 2-cylinder compound condensing-engine. These engines are equipped with C. W. Wheeler surface condensers.

One compound wound d.c. generator, 125 volts, capacity 200 amperes, running 625 r.p.m.; this is direct-coupled to a Goldie-McCulloch vertical single-cylinder high-speed engine.

One motor-driven generator. Motor, 220 volts, 3-phase, 60 cycles, 37½ horse-power; generator, 120 volts, d.c., 200 amperes, running 1,140 r.p.m.

A cross-compound condensing steam-driven Rand-Ingersoll compressor. Steam-cylinders, 16 and 28 inches by 24-inch stroke; air-cylinder, 15 and 25 inches diameter. This is connected with a Goldie-McCulloch jet condenser.

For fire-protection a Worthington duplex pump, 18 x 10 x 12 inches, has been installed; this pump has a capacity of 1,000 gallons a minute.

The water-supply is maintained by a twin set of Morris 4-stage centrifugal pumps, each driven by a 50-horse-power induction-motor. This water is delivered to two tanks, each having a capacity of 50,000 gallons.

The boiler-house equipment consists of two Badenhauer boilers, water-tube type, 260 horse-power each, and designed for 160 lb. pressure to the square inch. These are connected to a radial brick chimney 125 feet high. Forced draught is supplied by a Canadian Sirocco fan.

Twin Worthington simplex water-feed pumps supply the boilers from a Webster vacuum heater. Ashes are disposed of by a water-flush through a cement flume, extending into 10-inch glazed tile pipe.

The following buildings are constructed at Cassidy: Nineteen dwelling-houses, general office, mine office, rescue-station, mess-house, change-house, and lamp-house; a two-story rooming-house containing seventy-six rooms; each room is heated by steam and has hot- and cold-water connections; blacksmith-shop, machine-shop, and carpenter-shop.

TIPPLE.

The tipple has a capacity of 1,000 tons a day of eight hours. It consists of a revolving dump, Marcus screen, feeder for screen, chain-haul from ground-level, loading-boom, and car-retarder.

When I made my last inspection in December I measured 11,000 cubic feet of air a minute passing into the mine for the use of twenty-six men, or an average of 423 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in the face of No. 2 North level and No. 2 South level. Found timbering and roadways in good condition and the mine free from coal-dust.

I made a test with the Burrell gas-detector in the return airway of this mine, result showing nothing.

The following are the official returns from the Granby Colliery No. 1 for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.		COAL.		COKE.	
(Tons of 2,240 lb.)		Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada		12,410			
" export to United States					
" " other countries					
Total sales			12,410		
Used in making coke		703			
" under colliery boilers, etc.					
Total for colliery use			703		
Stocks on hand first of year		3,845			
" last of year					
Difference added to stock during year			3,845		
Output of colliery for year			16,958		

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	\$ 6.50	7	\$ 6.50
Whites—Miners	80	4.30	17	3.56	97	3.90
Miners' helpers						
Labourers						
Mechanics and skilled labour						
Boys						
Japanese			1	3.10	1	3.10
Chinese			10	3.10	10	3.10
Indians						
Totals	80		35		115	

Name of seams or pits—Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Douglas seam, 10 feet thick. Three slopes: Main slope, 1,196 feet; Manway slope, 1,146 feet; Air slope, 820 feet from surface.

Description and length of tramway, plant, etc.—Plant and equipment all modern.

Telkwa Collieries Co., Ltd.

TELKWA COLLIERY.

The following are the official returns from the Telkwa Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	470			
" export to United States.....				
" " other countries.....				
Total sales.....		470		
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 taken from } stock during year.....				
Output of colliery for year.....		470		

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			
Whites—Miners.....	3	5.50				
Miners' helpers.....	1	5.00				
Labourers.....						
Mechanics and skilled labour.....						
Boys.....						
Japanese.....						
Chinese.....						
Indians.....						
Totals.....	4		1			

Name of seams or pits—Goat creek.

Description of seams, tunnels, levels, shafts, etc., and number of same—Two tunnels in side-hill.

Description and length of tramway, plant, etc.—Nil.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT OF 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, 1918.

In the earlier part of the year this district was inspected from the Coast by Inspector Newton; in the latter part from this office by either Inspector Lancaster or myself.

The companies operating during the year were the Middlesboro Collieries, Limited, the Fleming Coal Company, the Princeton Coal and Land Company, and the Coalmont Collieries.

No active work was undertaken at either the Merritt Collieries, Limited (formerly the Diamond Vale Colliery Company, the Pacific Coast Collieries of British Columbia, the United Empire, or the Boundary Mining and Exploration Company, of Midway.

Two fatal accidents occurred during the year, both in the No. 3 mine, Coal Hill, belonging to the Fleming Coal Company, due to roof caving. Particulars of these and the other accidents have been sent to your office; as I have not investigated either, I cannot in any way determine the cause, but there is no doubt that stricter supervision and a more rigid enforcement of the special rules covering timbering and spragging of undermined coal would do a great deal to reduce these unfortunate occurrences.

During the year the inspection on behalf of the workmen, as required by section 91, Rule 37, of the "Coal-mines Regulation Act," has been carried out at No. 7, Middlesboro, but, so far, no such inspection has been made at the other mines. In this connection it should be considered that the other mines are small and the cost of such inspection would be heavy, and I should like to suggest that it would be in the interests of small mines if this rule was changed so that these could be grouped together for this purpose.

MINE-RESCUE WORK.

The standard in this work has been fairly well maintained during the year; quite a few took a course at the Princeton mine, and at the Middlesboro station the work was very well maintained. The importance of this work at some of the smaller mines does not seem yet to be realized, probably due to being out of touch, and I think the work of the Instructors appointed by the Department should be made elastic enough to reach these smaller mines.

The following is a brief description of the mines operating during the year 1918, accompanied by the official returns as required by section 58 of the "Coal-mines Regulation Act."

Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, \$1,107,700.

Officers.

E. W. Hamber, President,
G. S. Raphael, Vice-President,
Thomas Sanderson, Managing Director and Secretary,
C. M. O'Brian, Director and Treasurer,
Robert Fairfoull, Mine Manager,

Address.

Vancouver, B.C.
Vancouver, B.C.
Vancouver, B.C.
Vancouver, B.C.
Middlesboro, B.C.

Value of plant, \$250,000.

MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This colliery, consisting of Nos. 2, 4, 4 East, 7, 8, and 9 mines, is situated about a mile from the town of Merritt. A branch line of the Kettle Valley Railway about a mile long provides communication with the main line of the Canadian Pacific Railway and the Boundary country, to both points of which coal is shipped.

No. 4 MINE.

Alexander Ewart, Overman; William Hallinan, Geo. Hudson, Hugh Osborne, and Thos. Archibald, Firebosses.

This mine, which is reached by a rock tunnel crossing the measures, cuts Nos. 4, 5, 6, and 9 seams, and during the year the principal work has been confined to No. 4 seam, although some work was carried out on Nos. 6 and 9. No. 4 seam averages 18 feet; No. 6, 8 feet; No. 9, 7 feet; and they all lie at an angle of about 20 degrees, pitching to the south. The method of mining in all the seams is pillar and stall, pillars being left 30 x 60 feet, stalls being driven 10 feet wide. In the No. 4 seam the work during the year consisted of the extraction of pillars; in the other two seams, development-work.

The coal is mined by hand and very little blasting is needed; where required, permitted explosives are used and electric detonators. The haulage is by compressed air, the cars being hauled up the slopes by hoists, and taken from there to the tippie by a main- and tail-rope arrangement.

Ventilation is provided by a Sheldon type fan, 8.5 feet diameter, driven by a steam-engine, and can be used either as an exhaust or positive type. The general condition as to ventilation is very good, and very seldom is explosive gas found, while the mine is fairly free from coal-dust.

During the past two years trouble has been experienced with a gob-fire in the No. 4 seam; this has been stopped off and so far no attempt has been made to reopen it.

At my last inspection in December I found 44,800 cubic feet of air a minute for the use of eighteen men and three horses, with the fan running at a speed of 90 revolutions a minute. The working-places and roadways are all very well timbered and a plentiful supply of timber is provided for the use of the workmen.

No. 4 EAST MINE.

James Fairfoull, Overman; M. McKibben and Lewis Shearer, Firebosses.

This mine is situated a short distance to the east of the entrance to No. 4, and is also on the No. 4 seam. The Main slope is down a distance of about 1,300 feet; the pitch method of work and the haulage arrangements are very similar to those in No. 4 mine. Considerable trouble has been experienced with faulting in this mine, and most of the work is of a prospecting nature.

The ventilation is produced by a small quick-running fan, 4 feet diameter, driven by a Sheldon steam-engine, and at the time of my last inspection was producing 32,000 cubic feet of air a minute for the use of ten men, running at 330 revolutions a minute, and a water-gauge of 0.5 inch.

The mine was very well timbered and plenty of timber seemed to be provided convenient for the use of the workmen. Generally the mining conditions are very good and the mine is free from dangerous coal-dust, while explosive gas is very seldom found.

No. 7. MINE.

Jno. McDonald, Overman; Thos. Rowbottom, Jas. McGrath, Howell John, and Jonathan Henney, Firebosses.

This mine is situated in Coal gully and about 400 feet higher than the entrance to the No. 4 mine, and is now down about 3,000 feet. The seam, which is generally considered the same as the No. 4, is about 15 feet thick, of which only the top 8 feet has been extracted in the operation of development. The method of work is similar to that already described, but the size of the pillars has been increased with the depth of the slope or the amount of overhead strata.

For the present, the intentions are to begin the extraction of pillars and gradually to retreat; the coal below the present level will be extracted through the No. 4 mine at some future date.

Ventilation is produced by a small fan of the Gulbal type, driven by a compressed-air engine, and at the time of my last inspection was producing 35,000 cubic feet of air a minute for the use of twenty-four men and one horse. The speed of the fan was 200 revolutions a minute, and it showed a pressure of 0.3-inch water-gauge.

I found no traces of explosive gas and generally the mine was very well ventilated. All the places and roadways are very well timbered and plenty of timber is provided convenient for the workmen.

The cars are hoisted by compressed air to the surface, and then lowered to the tippie by a gravity-plane. Nos. 8 and 9 are as yet in the prospecting stage, but will soon be connected to the other mines.

While no fan is in use at either place, I found no trace of gas and, due to natural ventilation, there was a fair current of air travelling around the faces.

As mentioned in the case of No. 4, blasting is in practice at all the mines under the charge of competent officials, permitted explosives only being used with electric detonators.

All the lamps in use inside the mine are either Edison electric mine-lamp or of the Wolf type, and these are cleaned and recharged at the lamp-room near the tippie before being given out to the workmen, and are again examined by the fireboss before entering the mine.

All the coal is brought to a common tippie in cars having a capacity of about 1.75 tons. The dump is of the Phillips crossover style, a switchback and car-haul taking the cars back, so that they can be arranged into trips for whatever place required. After being dumped the lump coal passes over the screens to the coal-pocket, and slack to a hopper, where it is then sized for market purposes.

The main power plant is situated near the tippie, consisting of four return tubular boilers, each 160 horse-power; a Canadian Rand cross-compound air-compressor with a capacity of 2,000 cubic feet a minute provides power for operating the hoists and pumps and a generator for lighting purposes. There are also well-equipped machine, carpenter, and car-repair shops, also a commodious office for the management.

Copies of the "Coal-mines Regulation Act," special rules, and rules covering "systematic timbering" and plans of the mine are all kept posted at the mine entrances.

A well-equipped mine-rescue training-station is also maintained here, in which is maintained, in addition to the company's mine-rescue apparatus, that belonging to the Department of Mines, both of which are kept in a high state of efficiency. A great deal of credit is due the management for the interest taken in the work, which is reflected in the number of men who have been trained not only for the use of Middlesboro Colliery, but for the general use of the district.

The following are the official returns of the Middlesboro Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	95,781			
" export to United States				
" " other countries				
Total sales.....		95,781		
Used in making coke.....	5,747			
" under colliery boilers, etc.				
Total for colliery use.....		5,747		
Stocks on hand first of year	125			
" last of year.....	156			
Difference added to stock during year		31		
Output of colliery for year.....		101,559		

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	13	.....	5	\$	18	.....
Whites—Miners	42	.....	.....	6.75	42	.....
Miners' helpers	18	.....	.....	4.30	18	.....
Labourers	46	.....	16	4.20	62	.....
Mechanics and skilled labour .....	.....	.....	15	6.00	15	.....
Boys .....	.....	.....	13	2.65	13	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	119	.....	49	.....	168	.....

Name of seams or pits—No. 4 seam, operated by No. 4 East mine, No. 4 mine, and No. 7 mine; No. 8 seam, in which is operated No. 8 mine; No. 6 seam by No. 6 mine.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 4 mine is operated by a tunnel passing through a portion of No. 5 seam; then crosscut from No. 5 to No. 4; thence to No. 8 and No. 6 seams. No. 4 East: This mine is operated by means of a slope driven east, the distance from entrance to face being 1,600 feet, average dip being 15 degrees. No. 7 mine: The coal from this mine is hauled from a slope dipping 20 degrees south. The distance from the entrance to the face of the slope is 2,800 feet. The only method of working throughout is room and pillar. Thickness of No. 4 seam, from 10 to 18 feet; No. 6 is 5½ feet thick and No. 8 is 6 to 8 feet in thickness.

Description and length of tramway, plant, etc.—The power plant is situated at the tippie, and consists of four return-tubular boilers, each 150 horse-power; one Ideal feed-water heater, rated capacity, 500 horse-power; Canadian Rand cross-compound air-compressor, 2,215 cubic feet of free air a minute. A 27½-kw. generator is used for lighting purposes. The water for household, fire-protection, and steam-raising is supplied by a pump-station, the wells of which are situated near the Coldwater river.

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,
Joseph Martin, Secretary-Treasurer,
A. E. Smith, Manager,

Address.

Vancouver, B.C.
Merritt, B.C.
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.

John Brown, Overman; John Smith and Geo. Maxwell, Firebosses.

This mine, the only one operating during the year, consists of Nos. 3 and 5 seams, the first being about 12 feet and the other 5.5 feet thick, and identified with the Nos. 4 and 8 seams, Middlesboro. The methods of work are pillar and stall, but during the year the work has

consisted of extracting pillars in No. 3 seam, while both extraction of pillars and development-work has been carried on in the No. 5 seam.

The ventilation is produced by a fan of the Sheldon type, driven by a steam-engine, and producing about 30,000 cubic feet of air a minute, running at a speed of 300 revolutions a minute and a 0.5-inch water-gauge. At the time of the last inspection it was producing 30,000 cubic feet for the use of twenty-three men and two horses.

Conditions in the No. 3 seam were fairly good, but considerable improvement is required in the ventilation in the No. 5 seam, and some method of treating the coal-dust there is very necessary. The general conditions, apart from the above, are fairly good, the roadways and faces are fairly well timbered, and a plentiful supply of timber is provided convenient for the workmen.

The work in the No. 3 seam was greatly curtailed some years ago owing to a mine fire, but seems fairly well under control, and indications are that a great amount of this coal will be recovered.

The coal is all mined by hand, and blasted with Monobel with electric detonators under the supervision of certificated shotfirers. The haulage is by horse from bottom of chutes to the slope; then steam-hoist to surface; from here they are lowered to the top of a gravity-plane by another hoist. The gravity-tram consists of a 3-railed track, with passing in the middle 1,800 feet long, handling six 1-ton cars to the trip, using a 1-inch steel rope on a Stine wheel.

Safety-lamps of the Wolf type are used mainly; a few electric of the Edison type are used on haulage; all the lamps are cleaned and examined at the lamp-room, and are re-examined before being allowed to enter the mine.

The power plant at the mine consists of two Leonard type boilers, each 40 horse-power, which furnish steam for the fan, hoists, pumps, lighting, engine, and wash-house. An auxiliary plant at the tippie consists of a 25-horse-power boiler which furnishes steam for a small hoist which hauls the cars on the tippie, and for the pump used to deliver the water from the Coldwater river to the mine plant. The other surface equipment consists of machine, carpenter, and car-repair shops and office buildings. The tippie is connected to the Kettle Valley Railway by a spur about a mile long, affording access to the main line of the Canadian Pacific Railway.

The following are the official returns of the Fleming Coal Company for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	31,414			
" export to United States.....				
" " other countries.....				
Total sales.....		31,414		
Used in making coke.....	1,659			
Used under colliery boilers, etc.....				
Total for colliery use.....		1,659		
Stocks on hand first of year.....				
" last of year.....	130			
Difference added to stock during year.....		130		
Output of colliery for year.....		33,203		

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	\$ 6.00	2	\$ 5.00	7	.....
Whites—Miners.....	35	7.00	.....	.....	35	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	14	4.25	10	4.00	24	.....
Mechanics and skilled labour.....	.....	.....	7	5.00	7	.....
Boys.....	.....	.....	.....	.....	.....	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	54	.....	19	.....	73	.....

Name of seams or pits—Operated Nos. 3 and 5 seams.

Description of seams, tunnels, levels, shafts, etc., and number of same—Five seams have been opened on the property, consisting of No. 1, 3 feet thick, on which a slope 300 feet deep has been driven; No. 2 seam, 7½ feet thick, connected with No. 1 with a shaft and opened up on the pitch with a slope 500 feet deep. No. 3 is an average of 10 feet thick and has been operated extensively for seven years, though shut down the greater part of 1917 owing to low prices for coal paid by the railways. The operation during the year on this seam was chiefly confined to the extraction of pillars, which was quite successful, as the sandstone roof breaks clean, giving ample warning. The No. 4 seam has only been exposed on the surface. No. 5 seam was operated in conjunction with No. 3, and considerable development carried on, showing that it improves with depth; at the 600-foot level it is over 6 feet thick.

Description and length of tramway, plant, etc.—There has been no addition to the plant, but it has been altered to give better results and is well maintained. The main boiler plant consists of 240-horse-power Eclipse type Leonard boiler. The fan is an Aleos type, capacity of 50,000 cubic feet, belt-driven by a 60-horse-power engine. The winding-engine is a 60-horse-power Ottuma engine, and there is an 18-horse-power Beatty engine on the haul back from the tramway. The tramway is 1,800 feet long on a 40-degree slope and three rails, with Stine head-gear, handling 6-car trips of 1 ton each capacity. The water used is obtained from the Coldwater river, pumped against a 600-foot head by a Marsh pump.

Princeton Coal and Land Company, Ltd.

Head Office—15 Great St. Helens, London, E.C.

Capital, \$1,000,000.

Officers.

A. St. George Hamersley, Chairman,
E. S. Neave, Secretary,
Ernest Waterman, General Manager,
Francis Glover, Manager,

Address.

London, Eng.
London, Eng.,
Princeton, B.C.
Princeton, B.C.

Value of plant, \$77,000.

PRINCETON COLLIERY.

Francis Glover, Manager; Andrew McKendrick, Overman; Robert Baxter, Robt. Gourlay, Ben. J. Barlow, and Robert Roughead, Firebosses.

This company's property is situated near the town of Princeton, on the right-hand side of the Similkameen river, near its junction with the Tulameen, and is in the Similkameen Mining Division.

This mine, the only one at present working, reaches the coal through a covering of gravel, the slope dipping about 14 degrees until it reaches the coal; then continues on the seam for about 2,500 feet on a pitch of about 12 degrees. The coal-seam is about 20 feet thick, of which only the top 10 feet is extracted, and is worked on the pillar-and-stall method, pillars being left about 50 feet square; stalls are driven 12 feet wide.

Unfortunately in the early stages of mining here very little attention was paid to any system, with the result that slack coal and machine minings were left indiscriminately, resulting in mine fires which have been a constant source of trouble ever since. This last few years the mining has been done by the panel system, only two openings leading into the panel, so that when the coal inside was extracted the panel could be sealed off. Under this system no trouble has been experienced with fire in the newer working, but in the older, owing to the slight cover, it has been found almost impossible to extinguish the fires.

The haulage is by small air-hoists which feed the Main slope, an outside steam-boist hauling to the tippie. The ventilation is by a small fan of the Guibal type, driven by a steam-engine, and at the time of my last inspection was producing 25,200 cubic feet of air a minute for the use of thirty men. The speed of the fan was 130 revolutions a minute and the water-gauge showed 0.5 inch.

I found no trace of explosive gas and on the West side the air-current was very slack. All the places and roadways were very well timbered and a plentiful supply of timber was provided for the use of the workmen.

The coal is all mined with machines of the post-puncher type, air-driven, and is blasted down with permitted explosives, electric detonators being used under the supervision of certificated shotlighters. All the machine minings are loaded out of the mine and a sprinkling system is in use to keep the dust down.

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 a car holding about 1.5 tons, and is hauled up the Main slope in trips of six cars by a 50-horse-power steam-boist to the tippie. A Robison self-acting rotary dump unloads them on to a picking and shaking screen, which sizes the coal into three grades for the market. The tippie machinery is driven by a 50-horse-power vertical steam-engine, while the loading-conveyor is driven by a separate engine.

The power plant consists of three boilers—two 75-horse-power return-tubular and one 50-horse-power Gray boiler. Two Canadian Rand air-compressors furnish power for the mining-machines, pumps, and inside hoists, 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, in addition to the lamp-room, provides surface accommodation. During the past year the wash-house was burned down and a new one is in course of erection.

Electric lamps of the Wico type and Wolf safety-lamps are used, and are cleaned and repaired at the lamp-room before being issued, and are again re-examined before entering the mine.

Copies of the "Coal-mines Regulation Act," special rules, "timbering order," 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, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	20,494			
" export to United States	10,518			
" " other countries				
Total sales		31,012		
Lost in washing	1,564			
Used under colliery boilers, etc.	6,161			
Total for colliery use		7,725		
		38,737		
Stocks on hand first of year	149			
" last of year	85			
Difference taken from stock during year		64		
Output of colliery for year		38,673		

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	5.50	5	
Whites—Miners	14	5.00 - 9.00			14	
Miners' helpers	10	4.45 - 5.00			10	
Labourers	20	4.00 - 5.00	7	4.00	27	
Mechanics and skilled labour			7	4.40 - 4.65	7	
Boys			4	2.00 - 2.75	4	
Japanese						
Chinese						
Indians						
Totals	44		23		67	

Name of seams or pits—As last year.

Description of seams, tunnels, levels, shafts, etc., and number of same—Practically as last year.

Description and length of tramway, plant, etc.—Practically as last 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; Thos. Bysouth, Fireboss.

This colliery is situated in the Similkameen Mining Division, about five miles from the town of Coalmont, on the North fork of Granite creek. After having been stopped for about two years work was resumed this spring, a raise having been put through to the surface to facilitate ventilation; the level in the No. 2 tunnel was pushed ahead and several pillars blocked out. Only a few men have been employed and the work is more of a prospecting nature to determine the quality and quantity of coal.

The ventilation, which is produced by a 36-inch Comstock blower, driven by an 8- x 10-inch steam-engine, driven at a speed of 600 revolutions a minute, was very good and showed 8,000 cubic feet a minute for the use of five men. The general conditions were very good and the mine well timbered.

In the No. 6 tunnel very little work has been done so far, and this consists mostly of rock-work. The coal which has been mined during the year had to be hauled by auto-trucks to the Kettle Valley Railway at Coalmont, a distance of almost five miles.

A small 25-horse-power boiler supplies steam for the fan, and a cook and bunk house is maintained at the mine, the principal workshops and offices being at Coalmont.

Open lights are used, but the inspection is made with a Wolf safety-lamp, and, so far, no gas has been reported. 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, 1918:—

SALES AND OUTPUT FOR THE YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	2,990	.....	.....	.....
" export to United States.....	1,454	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	4,444	.....	.....
Used in making coke .....	.....	.....	.....	.....
Used under colliery boilers, etc.	300	.....	.....	.....
Total for colliery use .....	.....	300	.....	.....
Stocks on hand first of year .....	.....	.....	.....	.....
" last of year	1,000	.....	.....	.....
Difference added to stock during year.....	.....	1,000	.....	.....
Output of colliery for year .....	.....	5,744	.....	.....

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	\$	2	\$	4	
Whites—Miners	8	4.55-7.00			8	
Miners' helpers	2	4.50			2	
Labourers	2	4.00	2	4.00	4	
Mechanics and skilled labour			2	5.00	2	
Boys						
Japanese						
Chinese						
Indians						
Totals	14		6		20	

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 1 tunnel: Work closed till further development of No. 2 tunnel; 800 feet of tram-line, all in rock. No. 2 tunnel driven along the strike of upper seam, N. 29° 50' W.; 2,700 feet of tram-line. Seam about 60 feet thick. Part of seam being worked averages 9 feet in thickness. Possible output at present 200 tons a day of eight hours. Transport from mine to railway-cars difficult.

Description and length of tramway, plant, etc.—No. 1 tunnel, 800 feet tram-line; No. 2 tunnel, 2,700 feet tram-line. Two 50-horse-power boilers; one 22.5-horse-power boiler; one compressor, 150 lb. pressure; three steam-engines; two small fans, etc.

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 Crowsnest Pass Inspection District during the year 1918.

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.

With the exception of a five-weeks' stoppage, affecting Coal Creek and Michel mines, caused by a dispute regarding the working of a single shift in the mines instead of a double shift, work has been fairly steady during the year, although in the latter part an epidemic of sickness very materially affected the attendance at the mines, and consequently a reduction in the output of coal.

The dispute *re* the single shift was settled by the Director of Coal-mines appointed by the Dominion Government directing the workmen to resume the production of coal, and the Minister of Mines of the British Columbia Government to appoint a Commission consisting of one party appointed by the workmen, one by the owners, and one by the Minister of Mines, which was to inquire into the conditions complained of by the men, and to report, when the order directing the men to resume work would be subject to revision; so far the Commission has not been appointed, owing, I believe, to the workmen having refused to nominate a representative.

The gross output of this district for the year amounts to 732,864 long tons, and shows an increase of about 180,000 tons over the previous year.

ACCIDENTS.

During the year fifteen accidents have been reported, five of which were fatal and ten serious. Of the fatal accidents, two occurred at Coal Creek, in No. 1 South mine, and three at Michel, two of which occurred in No. 8 mine and one in No. 3.

The causes were: In Coal Creek, falls of coal, in one case off the rib or side, the other a cave of roof coal and rock; in Michel, two were due to haulage, the first owing to the compressed-air locomotive jumping off the track, the other owing to lack of space between the side of the road and a piece of machinery which was being moved; and the third accident through the workmen allowing a stringer to fall while placing it in position, striking the fireboss in charge of the work with fatal results.

In the serious or non-fatal class we have five accidents due to haulage, four to falls of roof rock or coal, and one to falling down a chute. All of these accidents have been investigated, and leaves no doubt that the majority are in the avoidable class. Stricter observance of the "Systematic Timbering" orders as laid down in the special rules, and these applied to repair-work, should be impressed on workmen and officials alike, as we frequently find, when visiting the mines, a tendency to neglect both the spragging of the undermined coal and to exceed the maximum distance the timbers should be apart.

While the list of fatalities is very much smaller than last year, we cannot overlook the fact that we have had more accidents with fatal results. In 1917 two accidents contributed thirty-five fatalities; one, the explosion in No. 3 mine, Coal Creek, being responsible for thirty-four of these, showing that the small accidents have contributed more deaths, and indicating that stricter discipline is required to prevent these. As I mentioned in my report last year, the recovery-work in No. 3 East mine, Michel, where the explosion took place on August 8th, 1916, was still proceeding, and on February 26th, 1918, the body of Bratticeman Marmol was recovered in No. 13 room, No. 6 East level, and thus settles the difference as to where he was at the time of the explosion.

My report to you following the recovery of this body gives my reasons for believing that this explosion originated in No. 17 room, No. 6 East level, and the cause an ignition of gas at a defective lamp, the coal-dust on the roadways and sides propagating it throughout the mine.

In No. 3, Coal Creek, where the explosion occurred on April 5th, 1917, the work of recovery was steadily pursued and the remaining six bodies recovered. The first of these was F. Puillandre on February 26th, and the following day his working partner, A. Redoulez, both of whom worked in the Main level. The two bodies were found not far apart on the Main level, about 800 feet outby from their place, as if on their way out of the mine when the explosion occurred.

On June 13th, 1918, the bodies of William Brown and Joe Bravin were found in their working-place in the counter-level, also those of Hector and August Leonard in the crosscut between the Main and counter levels. A Wolf safety-lamp with a punctured hole in the glass cylinder found in the last place provides the principal clue as to the cause of this disaster.

The principal roadways in this mine have now been repaired and work resumed; large developments are in course of being carried out to provide for increased ventilation.

As outlined last year, methods of treating the coal-dust, the principal source of propagating an explosion after ignition, have been continued and in nearly every case brought to completion. The conditions in this respect are very much improved; not only are the roadways treated with water, flue-dust, and ashes, but the roof, sides, and the working-faces are treated thoroughly with water every twenty-four hours, and in some cases more frequently. In some of the mines sprays are arranged to keep the mine-air thoroughly saturated, thus tending to prevent dust rising from the loaded cars in transit.

I should like to see a more extended use of sprays, so arranged to treat the loaded cars before they start on their outward journey. No effort, I feel, should be spared in these mines to keep every part of the intake, haulage, or other roads thoroughly damp, as well as the working-faces, for without doubt the greatest amount of damage in any explosion is caused by coal-dust.

The general condition as to ventilation in the mine has been fairly good during the year, and with the projected installation of a new fan should be even better in 1919. Samples of mine-air were taken regularly during the year, in the most gassy mines nearly every month, and sent to the Department of Mines, Ottawa, for analysis, and have been of very great assistance to us in maintaining our adopted standard of ventilation. Two hundred and eighty-eight samples were taken in Coal Creek, 104 in Michel, and nine in Corbin. Of these, thirty-three were lost,

due either to accident in laboratory or in transit, or about 8 per cent. of the total. In addition to the samples taken in the regular air-current, which in the case of the splits were taken convenient to the last working-place, or of the main return at the junction of the splits, a great number were taken to determine the outflow of methane from the working-faces over certain periods while working or idle, and also from gas-feeders and mine fires. In this work of sampling we are very much indebted to the mine officials for their willing assistance; without this it would have been impossible to have obtained the results.

In the No. 3 mine, Coal Creek, two series were taken during the working-hours, samples being taken every half-hour for six hours. The first series, taken on June 1st, 1918, commencing at 9.30 a.m., showed 0.79 per cent. of methane, rising steady to 1.3 per cent. about half-past 1 and falling to 1.23 at 3.30 p.m., the quantity of air travelling in this split (No. 6 incline) being 31,800 cubic feet a minute.

The second series, taken on June 6th in the same district and with practically the same quantity of air, commencing at the same time, showed pretty nearly similar results, commencing with 0.75 per cent. methane, rising to 1.29 at 2 p.m., and falling to 1.26 at 2.30 p.m.; unfortunately the last results were lost, but sufficient information was derived to show that the production of methane increases and decreases directly as the work of breaking down coal increases and decreases. The decrease showing from 2 p.m. onwards indicates that the miner is devoting more time to either loading or timbering than to actual breaking-down of coal.

In No. 1 East mine, Coal Creek, a series of tests were made also; the first on April 20th, made in the South split, consisted of seven samples, one being taken every hour, commencing at 9 a.m., and showed 2.1 per cent. methane and rising steady to 2.37 at 3.15 p.m., with a quantity of 35,000 cubic feet a minute.

A second series, taken on April 26th in the same district of this mine, with the same quantity of air, consisted of twelve samples, one being taken every two hours, commencing at 9 a.m., and showed 2.02 per cent. methane, rising to 2.29 at 1 p.m. and falling to 2.08 at 7 a.m. the following morning, when the tests finished. This covers the twenty-four hours during which the mine worked actively, producing coal from 7 a.m. to 3 p.m.; then a period of rest to 7 p.m., resuming active mining at 7 p.m., continuing to 3 a.m.; then a further period of rest till 7 a.m.

A similar test made in No. 1 South mine, Coal Creek, on April 26th, consisted of testing the air-current every hour for six hours, commencing at 9 a.m., and showed 1.81 per cent. methane, rising to 2.12 at 2.30 p.m. and falling to 1.74 at 3.30 p.m., in an air-current of 35,000 cubic feet a minute, or practically the same conditions as found in No. 3 mine.

In the South split, No. 1 East mine, Coal Creek, sample while working showed 2.34 per cent. methane (last sample taken before stoppage); after being idle forty-five hours showed 1.82 per cent.; idle 115 hours, 1.64 per cent.; nine days, 1.52; twenty-eight days idle, 1.5 per cent., with an air quantity of 31,500 cubic feet a minute.

A similar series of tests made in No. 1 South mine, Coal Creek, showed while working 2.44 per cent. methane (last sample taken before stoppage of work), decreased to 1.43 per cent. after fifteen days idle, and three days after resuming work analysis only showed 1.41 per cent. Since the resumption of work after the idle time it has been very hard to get a fair test made of the outflow under the single-shift conditions owing to irregularity of the work caused by the epidemic of sickness. One thing I have noticed is that in no case so far has it reached the height shown under the double-shift conditions.

Twice during the year has ethane been reported as found in the analysis, both cases being in the High Line split of No. 2 mine, Coal Creek, sample No. 308 showing 0.13 per cent. and sample No. 396 a trace. This seems strange when we consider that this split has very seldom shown more than 0.7 per cent. methane, while in some cases of blow-out we have recorded 84 per cent. of methane and no trace of ethane.

In the Michel mines tests made during the time the mines were idle showed results much similar to Coal Creek, except in one case, where owing to the speed of the fan being decreased the methane curve shows a tendency upwards. Owing to this we were unable to make so many tests in Michel mines, and the reason more tests were made in one mine than another is due to the tendency of these to give off greater amounts of methane.

The conditions of the airways have been improved to some extent during the year, but a great deal of work still remains to make them all satisfactory, also to cope with the previously

mentioned projected installation of new fans, or, better still, duplicate airways to reduce the high velocities.

Another point I should like to bring up is the provision of separate travelling-roads for the workmen, and where high velocities of air are maintained these are almost indispensable in districts where the temperature during winter falls below zero.

No severe "bumps" have been felt during the year, although several small disturbances have been reported, in some cases resulting in caves at the working-face liberating large quantities of methane, causing the workmen to leave the mine. In this respect the report of George Rice on the "bumps" has been at the disposal of the mine officials for almost a year, but so far no steps have been taken to adopt either the suggestions by him *re* timbering or the alternative one put forward by the Coal Company. Regarding these small disturbances or "bumps," as they are called locally, a great many of these could be easily avoided, provided heavier timber was used and more care taken to secure it.

Several blow-outs of gas have been reported, the largest of which took place in January in No. 26 room, off No. 10 East entry, No. 1 East, Coal Creek, about midnight, displacing 45 tons of coal and leaving a cavity ahead of the working-face about 16 feet deep, 8 feet high, and 9 feet wide. Fortunately, as in the blow-out reported last year, sufficient warning was given to allow the workmen to escape.

In dealing with these blow-outs or "bumps," the greatest danger now that electric lamps are in use is the likelihood of the workmen getting overcome by gas and asphyxiated, and I should like to suggest that investigation be made along the lines of either solving the problems or providing mine-safety apparatus for each individual workman employed in suspected areas.

MINE FIRES.

Trouble with mine fires has been experienced during the year at Corbin and Coal Creek. In the first place, the fire reported last year spread to a lower level, but was successfully sealed off in October. The spread of this fire would seem to indicate that in large coal-seams it is almost impossible to seal fires off successfully with stoppings, and if the fire cannot be loaded or drowned out some method of filling in the areas left vacant by the extraction of coal with sand, clay, or non-cumbustible matter should be adopted.

In No. 1 South mine, Coal Creek, an outbreak of fire was reported in No. 8 room, off No. 4 incline, early in November. Fortunately a good supply of water was convenient to keep it from spreading and work was commenced to load it out, which was successfully accomplished about December 17th.

In investigating mine fires, which seem to be on the increase, the principal cause is lack of sufficient ventilation; old districts are abandoned and not properly sealed off, sluggish currents of air travelling through them, decaying timbers, crushing of pillars, causing decrepitation of the coal, furnish the most favourable conditions for spontaneous combustion.

Practically all the lamps in use by the workmen are the Edison electric mine safety-lamp, the exception being the officials, who use the Wolf safety-lamp in addition to the Burrell gas-detector for inspection purposes.

Searches of the workmen for matches and other articles contrary to Rule 9, section 91, of the "Coal-mines Regulation Act" have been made regularly during the year at all the mines, and in only one case was such found, when the party was prosecuted. Inspection on behalf of the workmen was made nearly every month and copies of the report sent to your office, but no report of the existence or apprehended existence of dangerous conditions was made to this office.

Blasting was carried out to a very limited extent at Coal Creek; in two places in No. B, but to a greater extent at Michel and Corbin. This is carried out as required by the "Mines Act," and so far we have had no cause to complain of the conditions under which this was carried out.

The explosives used amounted to 6,525 lb. Monobel, 18,792 lb. Permittite, 203 lb. Samsonite, and 2,597 lb. Giant; the last two being used for outside purposes or at the open-cut at Corbin.

In Coal Creek 1,956 lb. Permittite was used in 2,050 shots, allowing 0.95 lb. a shot; all the shots being fired with battery and no miss-fires reported.

In Michel 7,511 lb. Permittite was used in 6,406 shots, allowing 1.1 lb. a shot; 3,200 of these were fired with battery, the remainder by fuse; 4,406 lb. Monobel was used in 4,000 shots, allowing 1.1 lb. a shot, and 203 lb. of Samsonite for 306 shots, allowing 0.66 lb. a shot. No miss-fires were reported from Michel.

At Corbin 2,119 lb. Monobel was used and 2,597 lb. Giant for 2,228 shots by electric detonator and 446 by fuse.

The amount of mine-rescue apparatus maintained at the mines is similar to last year and is all of the Draeger type, either 2-hour or ½-hour capacity. The lack of interest in maintaining efficiency in the use of this still continues, and, although a mine-rescue training-station is maintained here at Fernie, not a single workman took a course during the year, nor did any of the present holders of certificates renew their training. This lack of interest is to a great extent due to the expense incurred, especially by the workmen from Michel and Corbin, and also to the fact that, although called upon in the event of an emergency, there is very little and generally inadequate compensation for the work.

In this respect I should like to point out that it would be of great value if a minimum amount of apparatus was set out in the Act; also a minimum amount of training and the amount of work necessary to maintain efficiency; also provision for requiring the turning-out of mine-rescue brigades to test the efficiency, in the same manner as fire brigades are required to do, then we would have some idea of what to expect in the event of a disaster.

The work of first aid to the injured has been very well maintained at all the mines; a demonstration of this was given in Fernie on Labour Day, when four teams turned out from Fernie, Coal Creek, and Michel in competition. In addition to this, a junior team in this work carried off first place at an open competition in Lethbridge, Alberta, on Dominion Day against all-comers, reflecting great credit on the team and their instructors.

In conclusion, I wish to thank the mine officials for their assistance in carrying out my duties during the year, and trust for a continuation of the same during the coming year, so that we may work together for greater safety in what is admittedly dangerous work.

Attached is a list of the accidents reported, prosecutions, and a brief description of the collieries.

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 Caufield, 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 sides 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 1918.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	46,462	.....	147,775	.....
" export to United States	275,140	.....	17,404	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	321,602	.....	165,179
Used in making coke	236,307	.....	.....	.....
Used under colliery boilers, etc.	50,909	.....	.....	.....
Total for colliery use .....	.....	287,216	.....	.....
Stocks on hand first of year	64	608,818	.....	1,474
" last of year	121	.....	.....	375
Difference { * added to } stock during year .....	.....	*57	.....	+1,099
Output of collieries for year .....	.....	608,875	.....	164,080

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	41	.....	14	.....	55	.....
Whites—Miners	357	.....	.....	.....	357	.....
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	96	.....	228	.....	324	.....
Mechanics and skilled labour	250	.....	131	.....	381	.....
Boys	10	.....	16	.....	26	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	754	.....	389	.....	1,143	.....

COAL CREEK COLLIERY.

Bernard Caufield, Manager; R. J. Brown, 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, Nos. 2 and 3.

All the No. 1 mines are working on the No. 1 seam of coal, which varies from 30 to 40 feet thick; Nos. 2, 3, and 9 operate on the No. 2 seam, which varies from 5.5 to 8 feet thick; and No. B North is about 5 feet thick, height for the roads being obtained by lifting about 5 feet of inferior grade of bottom coal.

The method of work in all the mines is pillar and stall, or some modification of the same, the size of the pillars and stall varying according to the seam, and generally the rule is to drive the entries in pairs, leaving as large a pillar as possible between each pair of entries.

All the work consists of blocking out pillars, and so far during the year no pillars have been extracted in Coal Creek. The direction of dip is generally east and varies from 8 to 12 degrees.

The haulage inside the mine is generally by horses gathering the cars for compressed-air hoists, which bring them either to the main rope, endless rope, or compressed-air locomotives, which deliver them to the tippie. In the case of No. 1 North, No. 1 South, and No. B North, all of which are situated higher than the tippie, gravity-tramways lower the cars to the level of the tippie, and from the foot of these either steam or compressed-air locomotives deliver them to the tippie. The tippie, which is of steel construction, is 840 feet long and extends right across the valley, tracks running east and west along the mountain on both sides of the creek, and is very well equipped to handle a large output of coal.

Two separate and independent circular dumps, each driven by electric motors, delivers the coal to the feed-belt supplying the sizing-screen, which allows the slack to pass through into hoppers, from which it is drawn to load the slack-cars to supply the coke-ovens at Fernie, the screened coal being delivered on to a picking-table, where the foreign matter is picked out before going into the cars. From the picking-table the coal is delivered either into open cars or box cars, two Smith hydraulic loaders providing an easy means of loading the box cars.

The main power plant is situated on the north side of the creek and consists of fourteen boilers having a total capacity of 1,600 horse-power, while an auxiliary plant on the south side provides 600 horse-power. Three air-compressors having a total capacity of over 6,000 cubic feet capacity provide power for the pumps and hoists inside the mine, while a Canadian Rand high-pressure compressor with a capacity of 1,346 cubic feet a minute provides power for the compressed-air locomotives at a pressure of 1,100 lb. to the square inch.

The electric power which is used for No. 1 North, No. 1 South, and No. B North fans, motors, lighting, and to drive all the tippie machinery is provided by two separate Robb-Armstrong engines, each of which drives two 400-ampere, 250-volt generators, and one Crocker-Wheeler 280-ampere, 220-volt generator.

A very well-equipped lamp-room is provided where the lamps used in the mines are cleaned and repaired. The Wolf safety-lamp has been replaced to a great extent by the new Edison electric mine-lamp, 675 of which are in use, while fifty of the Wolf type are in use for testing purposes. Wash and change room is provided for 950 workmen, steel lockers being used, each workman providing his own soap and towel.

The horses from the various mines are brought out at the end of the shift, and three large stables provide accommodation for 140, thus ensuring better conditions and supervision than would be found underground. Adequate machine, blacksmith, carpenter, and locomotive repair-shops are maintained at the mines, in addition to those at Fernie, besides large and commodious warehouses and offices.

A large number of houses are provided at Coal Creek for the convenience of the workmen, 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 Caufield, Overman; Harry Dunlop, James Duncan, Thomas Reid, and James Maltman, Firebosses.

This mine is opened by a crosscut tunnel which reaches the coal at a distance of 215 feet from the entrance, and previous to the bump of November, 1916, was very extensively developed. Since that time only that portion reached by No. 10 East slope has been producing coal, and repair-work has been carried out in the disturbed area.

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, running at 148 revolutions, with a 3.5-inch water-gauge.

The mine is ventilated by two separate splits, called North and South, and at the time of the last inspection the first was producing 33,300 cubic feet of air for the use of thirty-five men and three horses, giving 757 cubic feet of air a minute for each unit. The South split showed

32,900 cubic feet of air a minute for the use of twenty-five men and three horses, or 970 cubic feet a unit.

High percentages of methane have been found during the year, especially in the South split, but, with the exception of early in the year, these have been kept below the adopted standard—namely, $2\frac{1}{2}$ per cent. of methane in the air-current.

During the inspections throughout the year explosive gas has been found eight times, generally in cavities above the timbers, where, due to the soft nature of the coal producing caving, it was very hard to deal with it. The roadways are very well timbered and the "Systematic Timbering" order is very well carried out at the working-faces by the miners.

NO. 1. SOUTH MINE.

Frank Landers, Overman; William Stockwell, John Strachan, William Hynds, James Taylor, and William Morgan, Firebosses.

Situated about half a mile west of the tippie, this mine works the western portion of the No. 1 seam on the south side of the creek. Ventilation is produced by an 8- x 4-foot Keith fan driven by an electric motor, producing 40,000 cubic feet of air a minute, running at a speed of 254 revolutions a minute, with a 2.8-inch water-gauge.

There is no splitting of the air in this mine, and at the last inspection 39,000 cubic feet of air was circulating for the use of sixty-five men and twelve horses, providing 387 cubic feet of air a minute for each unit.

During the year explosive gas was found on seven occasions, generally in cavities above the timbers, under conditions similar to those in No. 1 East mine. The mine generally is fairly well timbered, and the "Systematic Timbering" order is carried out fairly well by the workmen.

A new approach is being made to this mine, with the idea of installing a larger fan to provide for future development. As previously mentioned, trouble was experienced due to an ignition of fire, curtailing the output of coal for about a month; fortunately this was overcome and the conditions are now normal.

NO. 1. NORTH MINE.

Joe Worthington, Overman; Edward Routledge, Thomas Tully, and Matthew Turnbull, Firebosses.

This mine is working on the western portion of the No. 1 seam on the north side of the creek, the conditions being very similar to those in the other mines working this seam, except, being higher up and near the outcrop, very little trouble has been experienced with high percentages of methane.

Ventilation is produced by a 7- x 4-foot Keith fan, driven from a 30-horse-power motor, and at the time of the last inspection was producing 28,000 cubic feet of air a minute for the use of sixty men and eight horses, providing about 333 cubic feet of air a minute for each unit in the mine.

Explosive gas was found only once during the year, and the percentage of methane in the air-current runs well below 1 per cent. The roadways and working-places are all very well timbered, and generally the conditions throughout the mine are very good.

B NORTH MINE.

William Commons, Overman; James White, Herbert Parsons, and Evan Jones, Firebosses.

Situated a short distance to the east of the tippie, this is the only mine working on the B seam.

Ventilation is produced by a 10 x 3-foot Brazil fan, driven by a 30-horse-power motor, producing 40,000 cubic feet of air a minute, running at a speed of 150 revolutions a minute, with a water-gauge of 1 inch.

The mine is ventilated by two separate splits, the Slope and the Incline, and at the last inspection the first showed 17,600 cubic feet of air a minute for the use of forty-five men and four horses, allowing 309 cubic feet a minute for each unit in the mine.

The incline split measured showed 12,000 cubic feet a minute for the use of twenty men and two horses, or 465 cubic feet of air a minute for each unit in the mine.

During the year explosive gas has been found five times, generally due to blowers or feeders from the roof. The roadways were all very well timbered, also the working-faces, but consider-

able trouble has been experienced in getting the workmen to sprag the undermined coal as required by the special rule, with the result that several had to be prosecuted.

No. 2 MINE.

Carmichael McNay, Overman; James Bushell, Walter Clarkstone, and John Mawson, Firebosses.

Situated on the south side of the tippie and almost directly in line with the tippie, this is one of the oldest mines in the valley and has now been developed for a distance of 7,500 feet.

Ventilation is produced by a 16- x 8-foot Wilson fan, driven direct by a 125-horse-power steam-engine, capable of producing 150,000 cubic feet of air a minute at a speed of 132 revolutions a minute, with a 3.5-inch water-gauge.

The mine is ventilated by two splits, called the Rock Tunnel and High Line, and at the last inspection the Rock Tunnel was carrying 10,800 cubic feet a minute for the use of thirty-eight men and five horses, allowing about 204 cubic feet of air a minute for each unit.

The High Line split showed 6,000 cubic feet a minute for the use of five men and one horse, allowing 750 cubic feet of air a minute for each unit in the mine.

Explosive gas has been found three time during the year in this mine, and on two occasions ethane has been recorded by the analysis in the High Line split in small quantities. Conditions on the roadways are fairly good, except in the return air, where it has been very hard to keep it open.

In this case, like very many more, airways are neglected until the amount of repair-work gets so great that it almost seems impossible to overtake it, with the result that the percentage of air produced at the fan which reaches the working-faces is very low. Timbering at the working-faces is very good and plenty is provided convenient for the workmen.

No. 3. MINE.

John Biggs, Overman; W. A. Brown, R. S. Phillips, and Edward Caulfield, Firebosses.

This mine is working the dip portion of the No. 2 seam and is connected to it. Ventilation is produced by a fan similar to No. 2 mine, measuring 60,000 cubic feet of air a minute, running at a speed of 148 revolutions a minute, with a 3.5-inch water-gauge. The mine since about April has been ventilated by two separate splits, No. 6 incline and the South Level.

At the last inspection the No. 6 incline split showed 27,600 cubic feet of air a minute for the use of twenty-eight men and four horses, allowing 690 cubic feet of air a minute for each unit.

The South Level split showed 22,100 cubic feet a minute for the use of twenty men and four horses, allowing nearly 700 cubic feet of air a minute for each unit.

Only once during the year has explosive gas been found, and the percentage of methane in the regular air-current has been kept well within the adopted standard of ventilation. As already mentioned, the Main level, counter, and Nos. 5 and 6 inclines were repaired up to the faces and restarted, and all the roadways are very well timbered, and the timbering order covering the working-faces is very well complied with.

No. 9 MINE.

Robert Fowler, Fireboss.

Working on the same seam as Nos. 2 and 3, but on the north side of the valley, this mine was formerly worked long-wall, but had been abandoned for some years. The present work consists of repairing the Main level and the airway.

Ventilation is produced by a 16- x 7-foot fan of the Guibal type, capable of creating about 100,000 cubic feet of air a minute. Owing to there being no active mining the fan is running slow, and at the last inspection was producing 12,000 cubic feet of air a minute for the use of six men and one horse.

Explosive gas was found once during the year; general conditions in respect to timber are very good.

The following are the official returns from the Coal Creek Collieries for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	31,932		82,548	
" export to United States	214,859		4,254	
" other countries.....				
Total sales.....		246,791		86,802
Used in making coke	123,326			
" under colliery boilers, etc.....	32,289			
Total for colliery use.....		155,615		
Stocks on hand first of year.....	64		1,206	
" last of year.....	121		134	
Difference added to stock during year.....		57		1,072
Output of collieries for year		402,463		85,730

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC. (INCLUDING FERNIE 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	27		8		35	
Whites—Miners.....	231				231	
Miners' helpers						
Labourers	62		128		190	
Mechanics and skilled labour	165		73		238	
Boys	8		9		17	
Japanese—Miners.....						
" Labourers						
Chinese—Miners						
" Labourers						
Indians						
Totals	493		218		711	

The following shows the number of days Coal Creek Colliery worked each month during 1918:—

January	24	August	24½
February	21½	September (21 days on strike)	2
March	20½	October (7 days on strike)	19
April	21½	November	26
May	23	December	24
June	21		
July	21	Total	248

Name of seams or pits—No. 1 North, No. 1 South, and No. 1 East, same seam; No. B; Nos. 2 and 3, same seam; No. 9 not operated in 1918.

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 Crowsnest 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.

Both the No. 3 mines are working the upper No. 3 seam, averaging about 10 feet thick, while No. 8 seam is about 12 feet thick; both seams dip at an angle of about 15 degrees to the south.

Both seams are worked pillar and stall; in No. 8 during the year part of the work has been extracting pillars, but in the other mines development-work has been followed. A continuation of the crosscut tunnel which intersects Nos. 3, 4, and 5 seams curtailed the haulage in the No. 3 seam, allowing of more active development. The haulage is by horse gathering the cars from the faces to the landings, from where they are hauled up the slopes by compressed-air hoists and taken to the tippie by compressed-air locomotives.

On the No. 8 side, this mine is situated about 500 feet above the tippie; the cars are dumped into a bunker, from which a skip is loaded, taking the coal down to another bunker at the tippie level, and here the cars are loaded and taken to the tippie by an endless rope.

The tippie is built of structural steel and is 664 feet long and 14 feet wide; all the coal from the South side is weighed at the foot of the incline leading to the tippie; here there is a Green car-haul consisting of a double endless-chain arrangement, which travels on car-wheels with axles which act 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-wheel and pushes the car up the incline to the dump. The dump, which is simply a continuation of the track, increases gradually from 20 to 60 degrees angle, and when the door of the car is opened the coal discharges on to the dump or screen; the cross-bar, continuing to travel around a large sprocket-wheel, pushes the car on to a swing-lift transfer, while the bar following the sprocket-wheel carries the rear end of the car with it over the top of the sprocket on to the upper or overhead track, by which the car returns down the incline, the cross-bar now acting as a retarder.

On the North or No. 8 side the cars are dumped by an automatic dump, after which a transfer arrangement allows them to return underneath the loaded track to the endless rope, which handles them to and from the coal-bin at the foot of the incline.

The tippie is fully equipped with picking-tables and screens, a conveyor-belt taking the slack to the bins, from which it is drawn as required for the coke-ovens. All the machinery around the tippie is driven by electric motors, and Smith gravity box-car loaders allow of the handling of screened coal with the minimum of breakages.

Two low-pressure compressors provide power for the hoists and pumps inside the mine and No. 8 ventilating-fan outside, one of these being of the Walker and the other a Rand make; the two combined provide about 8,000 cubic feet of free air a minute.

A high-pressure Rand compressor with a capacity of 1,450 cubic feet a minute compressed to 1,200 lb. provides the power for the compressed-air locomotives. Two generators of 250 kw. each supplies the tippie motors and other machinery, in addition to providing for the lights around the tippie and town of Michel, where the majority of the workmen reside. The steam plant consists of eleven boilers with a combined capacity of 1,600 horse-power; this with the power plant is all housed in brick fire-proof buildings.

A very well-equipped lamp-room is maintained where the lamps are cleaned and repaired. As I mentioned last year, the Edison electric mine-lamp has replaced to a great extent the Wolf safety-lamp for the workmen, 320 of these now being in use, while fifteen Wolf safety-lamps are used for inspection purposes. Besides the Wolf safety-lamp, the Burrell gas-detector is in use in all the mines for determining lower percentages of gas than can be detected by the ordinary safety-lamp.

Large and commodious stables are provided for the horses, all of which are brought out of the mine at the end of the day's work. In addition to the above, large machine, blacksmith, carpenter, and car-repair shops are maintained, besides warehouses and offices.

The following is a brief description of the mines and the general conditions therein:—

No. 3 MINE.

Matthew Littler, Overman; Walter Almond, Andrew Frew, and Thomas James, Firebosses.

As previously mentioned, the continuation of the tunnel cutting Nos. 3, 4, and 5 seams, cuts off the slopes driven in the lower No. 3 seam, through which the coal from the Upper seam was hauled and effected a direct connection, resulted in the reopening of the mine early in the year.

The upper No. 3 seam is about 12 feet thick, and owing to the hard nature of the coal is mined by machines of the post type. After being mined it is blasted down with permitted explosive, under the direction of competent officials.

Ventilation is produced by a fan of the Guibal type, 6 feet wide and 12 feet in diameter, driven by a 125-horse-power steam-engine, and creates about 43,000 cubic feet of air a minute, running at a speed of 128 revolutions a minute, with a 1.7-inch water-gauge. At the time of the last inspection this was for the use of thirty-four men and four horses, allowing about 934 cubic feet a minute for each unit in the mine.

The mine generally is very well ventilated and the percentage of methane in the general air-current is less than 1 per cent. The roadways are all fairly well timbered and the timbering of the working-places is very good.

No. 3 EAST MINE.

Thomas Cunliffe, Overman; Ben Ball, Edward Hayes, and Alfred Ball, Firebosses.

This mine is situated about 3,000 feet east of the tippie. The coal is found outcropping on the side of the creek, and the Main tunnel is driven north, first practically flat for 400 feet, then dipping at an angle of about 14 degrees.

Ventilation is produced by a fan of the Wilson type, driven by a 125-horse-power steam-engine, and produces about 72,450 cubic feet of air a minute, running at a speed of 120 revolutions a minute, with a 2.2-inch water-gauge. This is divided into three splits—No. 6 East, East of slope, and West of slope.

At the last inspection the No. 6 East split was giving 24,000 cubic feet of air a minute for the use of thirty men and five horses, allowing an average of 533 cubic feet of air a minute for each unit in the mine.

East of slope split showed 11,000 cubic feet a minute for the use of twelve men and two horses, giving 611 cubic feet a unit. West of slope split showed 29,700 cubic feet of air a minute for the use of thirty-four men and five horses, allowing 606 cubic feet of air a minute for each unit in the split.

At no time during the year have we found explosive gas in this mine, and the percentage of methane in the air-current has always been well below the adopted standard. The roadways are all very good and the timbering at the faces is well maintained; generally the conditions have been very good.

No. 8 MINE.

Thomas Baybutt, Overman; John Marsh, James Mercer, Alex. Almond, and John Newman, Firebosses.

Situated on the north side of the valley at an elevation of 535 feet above the tippie, this mine is on the same seam as Old No. 8, which was sealed off due to fire in 1911.

Ventilation is produced by a 4- x 8-foot Murphy fan, operated by belt from a 40-horse-power compressed-air-driven engine, and produces about 48,000 cubic feet of air a minute, running at a speed of 200 revolutions a minute, with a 0.75-inch water-gauge.

This ventilation is divided into two splits—No. 1 incline and No. 6 incline splits—and at the time of the last inspection the first was passing 14,000 cubic feet of air a minute for the use of thirty-five men and five horses, allowing 280 cubic feet of air a minute for each unit. The No. 6 incline split was passing 20,160 cubic feet of air a minute for the use of thirteen men and three horses, allowing 916 cubic feet of air a minute for each unit.

During the year very small quantities of explosive gas have been found three times, and the percentage of methane in the general air of the mine has been very low. The roadways and places are very well timbered and generally the conditions are very good.

As previously mentioned, the coal from this mine is hauled to the top of the incline by compressed-air locomotives, weighed and dumped into a coal-pocket, and is afterwards lowered to the tippie level by skip operated as a self-acting incline.

The following are the official returns from the Michel Colliery for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	14,530		65,227	
" export to United States	60,281		13,150	
" " other countries				
Total sales		74,811		78,377
Used in making coke	112,981			
" under colliery boilers, etc.	18,620			
Total for colliery use		131,601		
Stocks on hand first of year			268	
" last of year			241	
Difference taken from stock during year				27
Output of colliery for year.		206,412		78,350

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	14		6		20	
Whites—Miners	126				126	
Miners' helpers						
Labourers	34		100		134	
Mechanics and skilled labour	85		58		143	
Boys	2		7		9	
Japanese						
Chinese						
Indians						
Totals	261		171		432	

The following shows the number of days Michel Colliery worked each month during 1918:—

January	26	August	27
February	23	September (21 days on strike)	2
March	24½	October (6 days on strike)	20
April	25	November	26
May	25	December	24
June	25		
July	25	Total	272½

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 Crowsnest branch of the Canadian Pacific Railway, and is connected to this by the branch line called the British Columbia Eastern Railway.

During the year Nos. 3, 4, 2, and 5 mines have been operating. No attempt was made to reopen No. 1, which was sealed off owing to a gob-fire some years ago. Most of the coal produced came from Nos. 3 and 4 mines, but owing to the trouble experienced in keeping the road open to the No. 3, or, as it is generally termed, the "Big Showing," during the winter, a large surplus of coal was brought down early in the fall and stacked at Corbin, while active work there was abandoned for the winter.

No. 4 MINE.

James Blair, Overman; Geo. Elmes, Geo. Luck, and Ed. Ainsworth, Firebosses.

This seam, which was the second to be opened at Corbin, is situated about 150 feet west of the No. 1 seam and runs from 50 to 250 feet thick. An outside incline practically goes up on the outcrop of the coal-seam, and openings are made every hundred feet to each side of this. During the year the 400-, 500-, and 600-foot levels were operated, but owing to continued trouble with fire the 600-foot had to be abandoned.

In the other levels the work has been the extraction of pillars on the caving system. In this method blocks are first formed until the point is reached where it is decided to retreat; chutes are then built and the timber withdrawn; this allows the pillar to cave, and owing to the friable nature of the coal it generally continues to run or cave until practically all the coal tributary to it is out, and in most cases the rock fills up the vacancy caused by the extraction of coal. To facilitate the work small raises are maintained convenient to the cave, from which levels are driven to prevent the chute blocking. Nearly all the coal produced in this mine during the year has come from this work, amounting to about 40,000 tons. Several of these chutes are maintained, so that, in the event of one blocking, the coal can be drawn from the others.

The coal-seam being practically vertical, the haulage is horses pulling the loaded cars from the bottom of the chutes to the outside, where they are lowered down to the tippie by a steam-hoist, which hauls up the empty cars.

Ventilation is produced by a 4 x 12-foot fan of the Gulbal type, driven direct from a steam-engine, and was producing at the time of the last inspection 25,000 cubic feet of air a minute for the use of twenty-three men and three horses, running at a speed of 100 revolutions a minute, with a water-gauge of 0.5 inch.

During the year the conditions have been fairly good; practically no gas has been found and the places are all well timbered. A plentiful supply of timber is provided for the use of the workmen convenient to the face and the mine is fairly free from coal-dust.

NO. 3 MINE, OR "BIG SHOWING."

Situated about two miles from Corbin and about 800 feet higher, this, as the name indicates, is an open quarry, the method of work being to strip off the surface soil and coal-blossom, then load the coal direct into the railroad-cars with steam-shovels. Four separate benches permit of the stripping and loading to proceed simultaneously, the railroad car being on an outside track and the steam-shovel between this and the coal. As the coal is extracted the steam-shovel and the railroad-track are moved up as required.

Where the coal is strong, long holes are drilled and blasted to permit the shovel to operate. Stumping-powder is generally used for this purpose, and all the drilling and blasting is under the charge of a certificated person as required by the "Coal-mines Regulation Act." A standard-gauge railway eight miles long switchbacks up to the mine and permits of a fairly good if rapid grade. As I have already mentioned, considerable trouble has been experienced in keeping this road open during the year.

The present pocket of coal being operated is 280 feet thick and is estimated to contain over 1,000,000 tons of coal, to obtain which it is necessary to remove 0.5 ton of cover for every ton of coal recovered.

It is needless to remark that there are no gas, ventilation, or coal-dust problems here and the work is very well supervised. In the Nos. 2 and 5 seams connections have been made to the surface for ventilation and the levels driven in about 300 feet, the work being more of a prospecting nature than anything else so far.

The coal from No. 4 mine is hauled to the tippie by horse, that from the No. 3 mine by locomotive, and if required to be screened it is put over a Marcus screen to be cleaned and sorted as required; if not, it is dumped into the storage-bin, or if from No. 3 mine it is shipped direct.

The power plant consists of four boilers with a combined capacity of 300 horse-power, a 4-stage compressor for supplying the compressed-air locomotives when they are in use, and a 120-kw. alternator which provides lights for the mines and also the village of Corbin, where the workmen reside.

Blacksmith, machine, and car-repair shops are maintained in addition to commodious warehouses and offices. A well-equipped lamp-room is situated at the tippie, where the lamps are cleaned and repaired. Wolf safety-lamps are in use in addition to the Edison electric mine-lamp.

The following are the official returns for the Corbin Coal and Coke Company for the year ending December 31st, 1918:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
(Tons of 2,240 lb.)				
Sold for consumption in Canada	31,180			
" export to United States	67,078			
" " other countries				
Total sales		98,258		
Used in making coke				
Used under colliery boilers, etc.	7,731			
Total for colliery use		7,731		
Stocks on hand first of year				
" last of year	18,000			
Difference added to stock during year		18,000		
Output of colliery for year		123,989		

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	.....	13	.....	17	.....
Whites—Miners.....	34	.....	.....	.....	34	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	22	.....	71	.....	93	.....
Mechanics and skilled labour.....	.....	.....	40	.....	40	.....
Boys.....	.....	.....	.....	.....	.....	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	60	.....	124	.....	184	.....

During 1918 tipples was built at No. 5 mine to load output in railroad-cars on Leg No. 1 of High Line. New timber-yard and about 500 feet of track were constructed between barn and joiner's shop to facilitate the handling of the mine timbers. Bridge was built over incline and landing made at 300 level to open up basin of coal through right wall, and which level will act as counter to "A" tunnel of No. 4 mine. Fire in No. 4 mine, 600 Left, is still burning, but is sealed off in such a way as to confine it to a very small area. Retreating system of working was commenced in No. 4 mine in May, and about 75 per cent. of the output from this mine has been from this source. No. 3 mine: During the year considerable overburden was removed, and also considerable work done on the industrial railway by widening out cuts and filling-in of bridges. Work at this point was suspended in December for the winter. During the year an ambulance class and examination was held, as a result of which nine certificates were issued.

Names of seams or pits—Coal mountain, operated by No. 3 mine or "Big Showing" by open-work; Nos. 2, 4, and 5 mines being underground workings, and Nos. 2 and 5 being still in prospect stage.

Description of seams, tunnels, levels, shafts, etc., and number of same—Same as per previous reports.

Description and length of tramway, plant, etc.—Same as per previous reports.

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For the year.....	1909.				1910.				1911.				1912.				1913.				1914.				1915.				1916.				1917.				1918.				Total for 10 years.			
Output of coal..... tons	2,400,600				3,130,235				2,193,062				3,025,709				2,570,760				1,810,967				1,972,580				2,485,580				2,398,715				2,578,724				24,575,932			
Number of persons employed.....	6,418				7,758				6,873				7,130				6,671				5,732				4,991				5,060				5,170				5,427				61,230			
Nature of Injury and Cause of Accident.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.	Fatal.	Serious.	Slight.	Total.								
Gas explosions.....	32	7	39	...	6	6	...	10	10	7	2	3	12	...	13	13	...	1	2	3	23	2	8	33	12	...	12	33	...	38	...	1	1	112	5	50	167							
Falls of coal.....	7	7	4	18	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	35	62	43	140
Falls of rock.....	6	13	9	28	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	49	92	86	227
Mine cars and horses.....	6	17	24	47	11	49	23	83	5	7	18	30	5	10	10	25	4	28	9	41	5	18	2	25	3	27	2	26	5	15	7	27	1	11	5	17	4	14	5	23	49	190	105	344
Powder, etc., explosion.....	1	1	3	5	1	1	3	5	...	1	2	3	2	1	...	3	...	2	...	2	2	3	...	5	1	1	1	1	1	1	2	2	6	9	13	28
Hoisting, ropes, etc.....	3	3	...	2	4	6	...	1	1	2	3	7	6	16	1	2	...	3	2	1	1	4	1	4	4	9	...	5	4	9	1	5	6	11	16	...	2	18	24	27	30	81
Mine timber.....	...	2	3	5	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	6	21	23	50		
Underground, miscellaneous.....	2	2	2	6	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	31	17	36	84	
On surface, miscellaneous.....	3	5	4	12	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	1	1	13	32	30	75		
	57	47	59	163	28	95	66	189	16	23	32	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	23	30	19	77	325	455	416	1,190

ACCIDENTS IN BRITISH COLUMBIA COLLIERIES DURING 1918.

Cause of Accident and Nature of Injury.	NAME OF COLLIERY.																	Total for 1918.												
	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.	F.C. Co.	P.C. & L. Co.	C.C. Co.	C.N.P. C. Co.	C.N.P. C. Co.	C.C. & C. Co.														
	Cum-berland.	Extens-ion.	S. Wel-llington.	Nanai-mo.	S. Wel-llington.	E. Wel-llington.	Cassidy.	Nanoose.	Telkwa.	Middles-boro.	Merritt.	Prince-ton.	Coal-mont.	Coal Creek.	Michel.	Corbin.														
	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Fatal.	Serious.	Slight.	Total.								
Gas—Explosion of																						1								
Fatal																														
Serious																														
Slight																														
Falls of Coal																						7								
Fatal	1		1								1									3										
Serious		1				2															3									
Slight																														
Falls of Rock or Roof																						17								
Fatal	1										1										4									
Serious		4		1			2					1				2														
Slight											1						1													
Mine Cars and Horses																						23								
Fatal							2													4										
Serious							7									3														
Slight		2															1													
Shots and Powder																						2								
Fatal																														
Serious																														
Slight																														
Ropes, Hoisting or Haulage																						18								
Fatal						10															16									
Serious																														
Slight		1		1																										
Post or Timber																						6								
Fatal																														
Serious																														
Slight			1																											
Miscellaneous—Underground																						3								
Fatal																														
Serious																														
Slight						2														1										
Miscellaneous—Surface																														
Fatal																														
Serious																														
Slight																														
Totals	2	7	4	1	1	2													2	5	1	3	2		1		28	30	19	77
Number of men employed.	1,332	492	147	1,818	206	9	115	78	5	168	73	67	20	711	432	184											5,427			

ANALYSES OF ACCIDENTS DURING YEAR 1918.

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.....	3.76	6.02	0.07	10.55	146,573	91,483	732,864	52,347
Coast.....	5.60	5.86	4.39	15.36	80,254	83,902	102,547	29,299
Total for Province.....	5.15	5.62	3.50	14.19	92,097	85,957	135,722	33,489

PER CAPITA PRODUCTION OF COLLIERIES.

District.	Gross Tons of Coal mined in 1918.	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.....	732,864	1,327	552	814	900
Coast.....	1,846,880	4,100	450	3,944	649
Total for Province.....	2,578,724	5,427	475	3,658	704

ACCIDENTS IN MINES DURING 1918.

COAL-MINES.

District.	Fatal.	Serious.	Slight.	Total.
East Kootenay.....	5	8	1	14
Nicola.....	2	2	2	6
Coast.....	21	20	16	57
Totals.....	28	30	19	77

METAL-MINES.

West Kootenay-Similkameen.....	7	5	4	16
Coast.....	5	6	8	19
Totals.....	12	11	12	35
Grand totals of all accidents.....	40	41	31	112

DETAILED STATEMENT OF ACCIDENTS IN B.C. COLLIERIES DURING 1918.

COAST COLLIERIES.

REPORTED BY HENRY DEVLIN AND JOHN NEWTON, INSPECTORS.

No.	Colliery.	Date.	Name.	Occupation.	Details.
1	Wellington-Ex- tension (C.C.)	Jan. 16	John Vanetti.....	Miner	Simple fracture of right tibia, caused by fall of rock.
2	Grant. (N.C.C.)	Jan. 16	Joseph Casorzo....	Winch-boy....	Broken arm, caused by being jammed between two cars.
3	Comox..... (C.C.)	Mar. 9	Leung Hee.....	Loader	Fractured left arm, caused by fall of coal.
4	Wellington-Ex- tension (C.C.)	" 15	John Tapella.....	Miner	Friction burn about face and hands, caused by blown-out shot.
5	Reserve..... (C.W.F.C.)	" 20	Karl Oercharick...	Pusher.....	Fractured forearm, caused by being caught between two cars.
6	No. 1..... (C.W.F.C.)	" 28	A. J. Hayes.....	Motorman....	Fractured ribs and internal injury, caused by being jammed between rib and motor.
7	Reserve..... (C.W.F.C.)	April 3	Thos. Johnson....	Miner	Bruised shoulder and small projection of scapula broken off, caused by being struck by stringer.
8	Nanaimo..... (C.W.F.C.)	" 5	Hugh Gilmore....	Driver.....	Dislocated hip-joint, caused by being squeezed between car and side.
9	Harewood..... (C.W.F.C.)	" 8	Samuel Dean.....	Rope-rider....	Fractured leg, caused by being squeezed between two cars.
10	Morden..... (P.C.C.M.L.)	" 9	Mike Bennock....	Miner	Struck by coal, causing compound fracture of right tibia.
11	No. 1 shaft..... (C.W.F.C.)	" 13	John Towers.....	Machine-miner	Fourth finger of right hand amputated, caused by being caught between cam-plate and bracket.
12	Comox..... (C.C.)	" 19	Mah Wing.....	Miner	Rock fell and caused bruised and lacerated left shoulder and lacerated right forearm.
13	Comox..... (C.C.)	May 1	Ronald Delaney...	Driver-boss....	Going up trip was caught against timber, causing broken collar-bone and badly bruised ribs.
14	Reserve..... (C.W.F.C.)	" 10	Joseph Dawson....	Labourer.....	Bruised head and shoulders, fractured ribs, caused by runaway trip.
15	Comox..... (C.C.)	" 18	Joseph Salmon....	Machine-miner	Fall of rock caused compound fracture of right leg above ankle.
16	No. 1..... (C.W.F.C.)	" 18	Costin Leyonard...	Driver.....	Foot caught between bumper of car and floor while riding loaded-car, fracturing big toe of left foot.
17	Wellington-Ex- tension (C.C.)	June 4	George Wilson....	Miner	Dislocated right ankle, caused by displacement of post which let car run down hill.
18	Wellington-Ex- tension (C.C.)	" 7	Louis Charlier....	Miner	Fatally injured by fall of overhanging coal and dirt.
19	Harewood..... (C.W.F.C.)	" 10	Thos. Aitken.....	Miner	Broken arm, caused by fall of rock.
20	Reserve..... (C.W.F.C.)	" 22	Verner W. Tisu...	Driver.....	Death through crushed head and body by falling in front of trip; cause unknown.
21	Comox..... (C.C.)	July 3	Y. Oda.....	Miner	Fall of coal caused compound fracture of right leg below knee.
22	Granby No. 1.... (G.C.M.S. & P.C.)	" 16	Mike Agabha....	Mucker.....	Muscular bruises of thigh and arm, left side, caused by mine-car being derailed.
23	Comox..... (C.C.)	" 18	Alexander McLeod.	Miner	Compound fracture of skull, lacerated scalp, fracture of right cheek-bone, nose, and right leg; rock fell.
24	Comox..... (C.C.)	" 27	Leung Chee.....	Miner's helper.	Fall of cap-rock caused dislocated hip and cuts on head.
25	No. 1..... (C.W.F.C.)	Aug. 8	William D. Scott..	Miner	Fall of rock fractured tibia-bone in left leg.

ACCIDENTS IN COAST COLLIERIES—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
26	Morden..... (P.C.C.M.L.)	Aug. 9	Tony Commentucci.	Miner.....	Simple fracture of the right tibia and fibula, caused by fall of coal.
27	Comox..... (C.C.)	Aug. 30	Chin Chong.....	Miner.....	Making wedge with axe, struck left hand with blade, cutting it severely.
28	No. 1, Protection (C.W.F.C.)	Sept. 10	M. Eussa.....	Loader.....	Killed by rope breaking when seventh cage of men was descending.
29	Ditto.....	" 10	Lionel Barlow.....	Miner.....	Ditto.
30	".....	" 10	Angelo Sedola.....	Miner.....	"
31	".....	" 10	Caleb Price.....	Miner.....	"
32	".....	" 10	Jos. Sturma.....	Loader.....	"
33	".....	" 10	Robert Kelly.....	Timberman.....	"
34	".....	" 10	James Bond.....	Loader.....	"
35	".....	" 10	Jos. Turner.....	Loader.....	"
36	".....	" 10	Augusto Eussa.....	Loader.....	"
37	".....	" 10	David Eddy.....	Miner.....	"
38	".....	" 10	Rathom Maisuradse	Brusher.....	"
39	".....	" 10	Wm. Blinkhorne.....	Loader.....	"
40	".....	" 10	John Rollo.....	Miner.....	"
41	".....	" 10	T. Bonaz.....	Brusher.....	"
42	".....	" 10	John Kernahan.....	Miner.....	"
43	".....	" 10	Robert McArthur.....	Miner.....	"
44	Comox..... (C.C.)	" 18	Hop Yuen.....	Driver.....	Left leg crushed by being caught by hook on tail-chain when turning mule around.
45	Wakesiah..... (C.W.F.C.)	" 30	Harry Fletcher.....	Sinker.....	Loose rock fell on left foot and fractured little toe.
46	Comox..... (C.C.)	Oct. 21	Ronald Delaney.....	Driver-boss.....	Rock fell from roof, striking him and causing bruised back and limbs.
47	Comox..... (C.C.)	" 22	Peter Bobba.....	Brusher.....	Rock fell and crushed his skull, proving fatal.
48	No. 1..... (C.W.F.C.)	" 25	A. B. Watson.....	Rope-rider.....	Right thigh-bone broken, caused by piece of coal falling off car and causing it to jump track.
49	Granby No. 1..... (G.C.M.S.P.C.)	" 28	John Powell.....	Miner.....	Slight burns on face, neck, and back of hands, caused by using naked light on his head.
50	Comox..... (C.C.)	Nov. 1	Cho Wood Young.....	Miner's helper.....	Fracture of right leg, caused by rock falling and knocking out timber, which fell on his leg.
51	Harewood..... (C.W.F.C.)	Nov. 22	Steven Melzer.....	Miner.....	Coal fell and fractured left arm.
52	Comox..... (C.C.)	Nov. 27	Jung Dong.....	Driver.....	Mule kicked him on lower jaw, fracturing it.
53	Reserve..... (C.W.F.C.)	Dec. 7	David Byers.....	Driver.....	Fractured leg caused by derailed car.
54	No. 1..... (C.W.F.C.)	" 11	Alex. McCracken.....	Rope-rider.....	Struck by runaway car, which caused crushed pelvis; fatal.
55	Harewood..... (C.W.F.C.)	" 14	Ed. Milburn.....	Motor-siding [attendant]	Caught by shoulder between cars, breaking right collar-bone.
56	No. 1 Mine..... (C.W.F.C.)	" 27	Andrew Malcolm.....	Driver.....	Crushed foot, necessitating amputation of the toe, caused by car running over foot.
57	Telkwa..... (T.C.)	" 13	M. F. Hennessy.....	Miner.....	Bruised in the face and upper part of body by returning too soon on shot.

NICOLA COLLIERIES.

REPORTED BY ROBERT STRACHAN, SENIOR INSPECTOR, AND JOHN NEWTON, INSPECTOR.

58	Coal Hill..... (F.C.C.)	Feb. 13	Joseph McPhee.....	Timberman.....	One rib broken and one fractured by falling and knocking post, which struck him.
59	Middlesboro..... (M.C.L.)	Mar. 16	Matthew McKibben.....	Fireboss.....	Struck by piece of lagging, fracturing his right collar-bone.
60	Coal Hill..... (F.C.C.)	April 16	Henry Kinnear.....	Miner.....	Fatally injured by fall of roof.

ACCIDENTS IN NICOLA COLLIERIES—*Concluded.*

No.	Colliery.	Date.	Name.	Occupation.	Details.
61	Middlesboro..... (M.C.L.)	June 13	Thomas Colquhoun.	Miner	Broken rib on left side, caused by stepping on loose timber, which rolled, causing him to fall.
62	Coal Hill..... (F.C.C.)	Aug. 28	Steve Radick.....	Miner	Fall of coal, which struck him on the head, killing him instantly.
63	Middlesboro..... (M.C.L.)	Nov. 14	Archibald Grieve..	Rope-rider....	Small toe of right foot broken by derailment of loaded car.

CROWSNEST PASS DISTRICT.

REPORTED BY ROBERT STRACHAN AND WILLIAM LANCASTER, INSPECTORS.

64	Michel	Jan. 21	A. Pittas.....	Driver.....	Link attached to loose end of rope struck his leg, causing compound fracture of left leg.
65	Coal Creek..... (C.N.P.C.C.)	Jan. 24	Giovanni Qualtieri.	Miner	Slipped on loose coal and boom fell on his leg, fracturing fibula.
66	Coal Creek	Feb. 1	Wm. Zingiera.....	Driver.....	Back wheels of car slipped off track and struck him, fracturing two ribs on right side.
67	Michel	Feb. 10	G. Hyshka.....	Miner	Fractured fibula, caused by fall of rock.
68	Michel	Feb. 14	M. Danyluk	Motorman	Broken leg and internal injuries, caused by apparently being struck by bumper of motor.
69	Coal Creek..... (C.N.P.C.C.)	Mar. 4	Johan Mayok	Miner on company work	Fractured shoulder-blade, caused by fall of loose rock.
70	Coal Creek..... (C.N.P.C.C.)	Mar. 16	A. Kaleta	Miner	Piece of rock fell off side, causing fatal injuries.
71	Michel	April 24	Wm. Dunn	Fireboss	Fractured ribs on both sides and internal injuries, caused by being struck by timber.
72	Coal Creek..... (C.N.P.C.C.)	April 29	Andro Knatko	Driver.....	Struck by boom, which fractured his skull.
73	Coal Creek..... (C.N.P.C.C.)	July 8	James Wills	Tracklayer's helper	Roof fell on him, fatally injuring him.
74	Michel	July 13	Frank Breniskesky.	Machineman's helper	Neck and lower jaw broken, caused by being caught between drum and post, fatally injuring him.
75	Corbin	Aug. 5	George Luk.....	Fireboss	Overcome by methane, fell down chute; head cut and bruised to vault of cranium.
76	Coal Creek	Dec. 5	Matthew Zelinckas.	Miner	Piece of rib coal struck him on side of leg, causing fracture of middle of right thigh.
77	Coal Creek..... (C.N.P.C.C.)	Dec. 16	Harold Jones	Driver.....	Horse backed loaded car, which threw him, and horse stepped on right leg, breaking it.

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.	Occupation.	Mine.	Offence charged.	Judgment.
Jan. 9	M. Keperwitch	Miner	Corbin....	Breach of Special Rule 115....	Fined \$10 and costs.
" 9	M. Kosin	Miner	Corbin.....	Breach of Special Rule 115....	Fined \$10 and costs. Adjourned to Jan. 25th.
" 10	A. Murphy....	Miner	Nanaimo No. 1	Violating Co's. Special Rule 126	Fined \$10 and costs. Certificate cancelled for one month
" 10	Jacob Stobbert	Fireboss	Nanaimo No. 1	Violating Co's. Special Rule 126	Fined \$10 and costs. Certificate cancelled for two months
" 19	Geo. Biguoff...	Pusher.....	Reserve	Having matches in his possession	Fined \$10 and costs.
" 19	Paul Ebaner...	Pusher.....	"	Having matches in his possession	Fined \$10 and costs.
" 19	Pete Bernhond	Miner	"	Having matches in his possession	Fined \$10 and costs.
" 19	Jos. Dickson ..	Faceman....	"	Tamping shot-hole with inflammable substance	Case dismissed.
" 22	R. Romagnoli..	Miner	B. North, Coal	Breach of Special Rule 114....	Fined \$10 and costs.
Feb. 22	Lee Yien.....	Labourer....	No. 6, Comox..	Smoking and having matches in possession	Sent to gaol for three months with hard labour.
Mar. 8	Geo. Mackie...	Miner	Reserve	Having matches in his possession	Fined \$10 and costs.
" 28	J. Schmeltzer..	"	B. North, Coal	Breach of Special Rule 114....	Fined \$10 and costs.
" 28	Jan. Staron....	"	B. North, Coal	Breach of Special Rule 114....	Fined \$10 and costs.
" 28	M. Albo	"	B. North, Coal	Having lucifer matches in his possession	Fined \$5 and costs.
April 4	John Tapella..	"	No. 1, Well.	Violation of General Rule 12, Sec. 91, C.M.R.A.	Sentenced to fifteen days in gaol.
April 4	D. J. Gordon ..	Fireboss	No. 1 Well.	Violation of special Rule 44....	Fined \$10 and costs.
Aug. 28	B. Volpatti....	Miner	No. 8, Michel..	Breach of Special Rules 57 and 115	Ordered to pay costs, \$3.25.
" 28	J. Volpatti....	"	"	Ditto	Ditto.
" 28	S. Quarrin	"	"	"	"
" 28	A. Depaully....	"	"	"	"
" 28	S. Veneir	"	"	Breach of Special Rule 12....	Fined \$10 and costs.
" 28	J. K. Ashman..	Mine fore- [man]	Telkwa.....	Breach of General Rule 12....	Fined \$10 and costs.

METALLIFEROUS MINES SHIPPING IN 1918.

CASSIAR.

ATLIN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Engineer	Windy arm.	Reginald Brook	Atlin	Gold, silver.
Maid of Erin	Rainy Hollow	Richard Kennedy	Seattle	Silver, copper.

SKEENA.

SKEENA MINING DIVISION.

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.

NASS RIVER MINING DIVISION.

Golkiesh	Anyox	H. W. Heidman	Anyox	Gold, silver.
Hidden Creek	Anyox	Granby Cons. M. S. & P. Co.	Anyox	Gold, silver, copper.
La Rose	Alice arm	Miles Donald	Alice Arm	Gold, silver.

PORTLAND CANAL MINING DIVISION.

Bush	Salmon river	R. K. Neill, Manager	Stewart	Gold, silver.
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QUEEN CHARLOTTE MINING DIVISION.

Dank of Commerce.	Jedway	A. J. Wilds	Jedway	Copper.
Ikeda	Ikeda bay	A. Ikeda	Ikeda	Gold, silver, copper.

OMINECA MINING DIVISION.

Copper Queen	Telkwa	Fred Griffin	Telkwa	Gold, silver, copper.
Hazelton View	Rocher Déboulé mount.	New Hazelton Gold-Cobalt Mines,	Vancouver	Gold.
Rocher Déboulé	Rocher Déboulé mount.	Rocher Déboulé Copper Co.	Tramville	Gold, silver, copper.
Silver Standard	Hazelton	Silver Standard	New Hazelton	Gold, silver, lead, zinc.

EAST KOOTENAY.

FORT STEELE MINING DIVISION.

Burton	Elko	Daly-Burton Copper Syndicate ..	Kimberley	Copper.
North Star	Kimberley	O. C. Thompson	Kimberley	Silver, lead.
St. Eugene	Moyie	St. Eugene Leasing Co.	Moyie	"
Sullivan	Kimberley	Consolidated M. & S. Co.	Kimberley	"
		Consolidated M. & S. Co.	Kimberley	"

WINDERMERE AND GOLDEN MINING DIVISIONS.

Isaac	Isaac creek	H. E. Forster	Wilmer	Silver, lead.
Mabel R.	Boulder creek	Frank Anderson	Wilmer	"
Paradise	Toby creek	R. Randolph Bruce	Invermere	"
Silver Belt	Windermere	Duncan Brander	Kimberley	"
Star (Hot Punch)	Toby creek	J. E. Stoddart	Windermere	Gold, silver, lead.
Couverapee	(Golden) Field	Wm. Adkins	Field	Silver, lead.

WEST KOOTENAY.
AINSWORTH MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Bell & Sunset.	Jackson basin	Jackson Basin Zinc Co.	Kaslo	Silver, lead.
Bluebell	Riondel	The New Canadian Metal Co., Ltd.	Riondel	Silver, lead.
Cork-Province	Zwicky	Cork-Province Mines, Ltd.	Kaslo	Silver, lead, zinc.
Florence	Ainsworth	Florence Silver Mining Co., Ltd.	Spokane	Silver, lead.
Gallagher	Ainsworth	McVicar & Smith	Ainsworth	"
Gibson	Kaslo	Gibson Mining Co., Ltd.	Kaslo	"
Highland	Ainsworth	Consolidated M. & S. Co.	Trail	"
Jessie Bluebird	Woodbury creek	Eric Johnson	Kaslo	"
Lavina	Argenta	G. A. Lafferty	Rossland	"
Lincoln	Adamant	Columbia Mining Co.	New Denver	"
Little Phil.	Ainsworth	J. W. Smith	Ainsworth	"
Maestro	Ainsworth	H. Giegerich	Kaslo	"
Monhawk	Adamant	Ray J. Hughes	Kaslo	"
Montezuma	Kaslo creek	H. Giegerich	Kaslo	Zinc.
No. 1	Ainsworth	Consolidated M. & S. Co.	Trail	Silver.
Skyline	Ainsworth	H. Giegerich	Ainsworth	Silver.
Spokane Trinket.	Ainsworth	James McDougall	Ainsworth	Silver, lead.
Tam O'Shanter	Riondel	C. F. Sherwin	Riondel	Silver.
Tariff	Ainsworth	J. W. Smith	Ainsworth	Silver, lead.
Utica	Paddy peak	Utica Mines, Ltd.	Kaslo	Silver, lead.
Whitewater	Retallack	J. L. Retallack & Co.	Kaslo	Gold, silver, lead, zinc.

SLOCAN MINING DIVISION.

Best	Sandon	W. A. Cameron	New Denver	Silver, lead.
Bosun	Sandon	J. P. MacFadden	Sandon	Silver, lead, zinc.
Echo	Silverton	Echo Silver Lead Mining Co.	Silverton	Silver, lead.
Freddie Lee	Sandon	M. M. McCune	Nelson	Gold, silver, lead.
Galena	Silverton	Galena Mining & Milling Co.	Silverton	Silver, lead.
Gem	Carpenter creek	Frank Edwards	Sandon	Silver, lead.
Hewitt	Silverton	Clarence Cunningham	Sandon	Silver, lead, zinc.
Idaho-Alamo	Sandon	Clarence Cunningham	Sandon	Silver, lead.
Lily B	Slocan City	W. A. Buchanan	Nelson	Silver, lead.
Lucky Thought	Silverton	Consolidated M. & S. Co.	Trail	Silver.
Lucky Jim	Zincton	A. W. Allen	Victoria	Silver, zinc.
Number One	Sandon	J. M. Harris	Sandon	Silver, lead.
Payne	Sandon	Andrew Anderson (lessee)	Sandon	Silver, lead.
Payne	Sandon	J. A. Black (lessee)	Sandon	Silver, lead.
Queen Bess	Sandon	Clarence Cunningham	Sandon	Silver, lead.
Rambler-Cariboo	Rambler	W. A. Cameron	Three Forks	Silver, lead, zinc.
Reco	Sandon	J. M. Harris	Sandon	Silver, lead.
Ruth	Sandon	James Anderson	Kaslo	Silver, zinc.
Silversmith	Sandon	Silversmith Mines, Ltd.	Sandon	Silver, lead.
Slocan Sovereign	Sandon	Clarence Cunningham	Sandon	Silver, lead.
Standard	Silverton	Standard Silver Lead Mining Co.	Silverton	Silver, lead.
Surprise	Sandon			
Van-Roi	Silverton	Clarence Cunningham	Sandon	Silver, lead, zinc.
Victoria	Payne mountain	John Worgan	Sandon	Gold, silver, lead.
Wonderful	Sandon	Clarence Cunningham	Sandon	Silver, lead.

SLOCAN CITY MINING DIVISION.

Anna	Springer creek	Kurt E. Zimmerman	Slocan	Silver, copper.
Arlington	Slocan	H. D. Curtis	Slocan	Silver, lead.
Black Prince	Lemon creek	J. T. Tipping	Slocan	Silver.
Eastmont	Slocan	H. D. Lea	Slocan	Silver, lead.
Evening Star	Slocan	Jas. O'Shea, Box 1080	Nelson	Gold, silver.
L. T.	Springer creek	D. B. O'Neill	Slocan	Silver, lead.
Meteor	Lemon creek	G. H. Aylard	Victoria	Gold, silver.
Ottawa	Slocan	Consolidated M. & S. Co.	Trail	Silver.
Republic	Springer creek	G. E. Laird	Nelson	Gold, silver.
Silver Cliff	Ten-mile creek	P. Swan	Slocan	Silver, lead.

NELSON MINING DIVISION.

Aspen	Salmo	Mrs. H. M. Billings	Salmo	Gold, silver.
Emerald	Salmo	Iron Mountain, Ltd.	Salmo	Silver, lead.
Eureka	Eagle creek	Eureka Copper Mines, Ltd.	Nelson	Gold, silver, copper.
Molly Gibson	Kokanee	Consolidated M. & S. Co.	Trail	Silver, lead.
Ore Hill	Salmo	C. H. Cassill	Ovando, Mont.	Gold, silver, lead.
Orinoco	Bensley	Michael Egan	Nelson	Gold, silver, copper.
Queen	Sheep creek	Queen Gold Mining Co.	Sheep creek	Gold, silver.
Relief	Erie	A. D. Westby	Erie	Gold, silver, copper.
Spokane	Bayonne mountain	R. M. & K. E. Laib	Salmo	Gold, silver, lead.
Yankee Girl	Ymir	Hobson Silver Lead Co., Ltd.	Ymir	Gold, silver, lead.

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	Rosslund	Consolidated M. & S. Co.	Rosslund	Gold, silver, copper.
Inland Empire	Paulson	Inland Mining Co.	Paulson	" "
Le Roi No. 2	Rosslund	Le Roi No. 2, Ltd.	Rosslund	" "
Mountain Chief	Renata	Owen Wheeler	Rock creek	" "
Velvet	Rosslund	Granby Cons. M. S. & P. Co.	Phoenix	" "
War Eagle	Rosslund	Consolidated M. & S. Co.	Rosslund	" "
White Bear	Rosslund	Consolidated M. & S. Co.	Rosslund	" "

TROUT LAKE AND LARDEAU MINING DIVISIONS.

Ethel	Trout lake	Silver Crown Mining Co., Ltd.	Trout Lake	Silver, lead.
Ferguson	Ferguson	Ferguson Mines, Ltd.	Kaslo	Gold, silver, lead.
Fidelity	Horsefly creek	F. C. Elliott	Victoria	Gold, silver, lead.
Monte Christo	Silverton	L. Hillman	Silverton	Gold, silver, lead.
Triune	Ferguson	Triune Gold & Silver M. & M. Co.	Ferguson	Gold, silver, lead, zinc.
True Fissure	Ferguson	True Fissure M. & M. Co.	Ferguson	Gold, silver, lead.
Winnipeg	Boyd creek	Arthur Evans	Beaton	Silver, lead.

BOUNDARY.

GRAND FORKS MINING DIVISION.

B.C.	Eholt	Canada Copper Corporation,	Allenby	Silver, copper.
Emma	Grand Forks	Consolidated M. & S. Co.	Trail	Gold, silver, copper.
Lightning Peak	Kettle river	W. A. Calder	Edgewood	Gold, silver, lead.
Mastodon	Castle mountain	Stewart Calvert Co.	Orville, Wn.	Chrome.
Rock Candy	Grand Forks	Consolidated M. & S. Co.	Trail	Fluorspar.
Stemwinder	Phoenix	New Dominion Copper Co., Ltd.	Allenby	Gold, silver, copper.
Union	Franklin camp	Lewis Johnson	Grand Forks	Gold, silver.

GREENWOOD MINING DIVISION.

Aftermath	Greenwood	W. R. Richard	Greenwood	Gold, silver, copper.
Bell	Wallace mountain	Oliver & McIntosh	Beaverdell	Silver, lead.
Big Copper	Greenwood	James Poggi	Greenwood	Silver, copper.
Black Diamond	Beaverdell	P. J. Kennedy	Beaverdell	Silver.
Bounty Fraction	Beaverdell	P. E. Crane	Greenwood	Silver, lead.
Cariboo-McKinney	Camp McKinney	F. G. Scace	Toronto	Gold, silver.
Enterprise	Greenwood	C. Scott MacRae	Deadwood	Silver, copper.
Freemont	"	J. H. Duhamel	Greenwood	Gold, silver.
Motherlode	"	Canada Copper Corporation, Ltd.	Allenby	Gold, silver, copper.
Phoenix	"	Granby Cons. M. S. & P. Co.	Phoenix	Gold, silver, copper.
Providence	"	A. J. Morrison	Greenwood	Gold, silver.
Rambler	Beaverdell	W. Rambo	Beaverdell	Silver, lead.
Sally	Kettle river	James Drum	Beaverdell	Silver, lead.
Sappho	Midway	Edward Mellrud	Greenwood	Silver, copper.
Standard Frac.	Beaverdell	J. L. Nordman	Beaverdell	Silver, lead.
Sudbury	Deadwood	Jas. D. Graham	Deadwood	Gold, silver, copper.
Sunnyside	Kettle river	E. Williamson	Rock creek	Gold, silver, lead.
Sunset	Greenwood	New Dominion Copper Co., Ltd.	Allenby	Gold, silver, copper.
Surprise No. 3	Skylark camp	J. E. Thompson, M.L.A.	Phoenix	Copper.
Waterloo	Kettle river	G. Bong & C. Hamerstadt	Edgewood	Gold, silver, lead.

OSOYOOS MINING DIVISION.

Dolphin	Keremeos	C. W. Jordan	Keremeos	Silver, copper.
Golconda	Keremeos	D. McEachren	Keremeos	Silver, copper.
Horn Silver	Similkameen	Lessees, Horn Silver Mine	Similkameen	Gold, silver, copper.
Nickel Plate	Hedley	Hedley Gold Mining Co.	Hedley	Gold, arsenic.
Thirsk	Thirsk	Sandberg Bros.	Penticton	Gold, silver, lead.
Torpedo	Penticton	Duncan J. McIntyre	Penticton	Gold, silver.

SIMILKAMEEN, NICOLA, AND VERNON MINING DIVISIONS.

Copper Mountain	Allenby	Canada Copper Corporation, Ltd.	Allenby	Gold, silver, copper.
Big Sioux	Aspen Grove	R. R. Hedley	Nicola	Silver, copper.
Hunter	Nicola	George H. Allen	Victoria	Gold, silver, copper.

YALE, ASHCROFT, AND KAMLOOPS MINING DIVISIONS.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Emancipation	Hope	Emancipation Mining Co., Ltd.	Hope	Gold, silver.
Chataway	Ashcroft	Frederick Keffer	Spokane	Silver, copper.
Iron Mask	Kamloops	Kamloops Copper Co., Ltd.	Kamloops	Gold, silver, copper.
Maxine No. 2	Kamloops	C. B. Frederick	Tranquille	Silver, copper.

LILLOOET MINING DIVISION.

Lorne	Cadwallader creek	Lorne Amalgamated Mines, Ltd.	Lorne	Gold, silver.
Pioneer	Cadwallader creek	Pioneer Gold Mines, Ltd.	Lillooet	Gold, silver.
Ida May	Cadwallader creek			

SOUTH COAST.

VANCOUVER MINING DIVISION.

Britannia	Britannia beach	Britannia Mining & Smelting Co.	Britannia Beach	Gold, silver, copper.
Summit	Mons.	J. H. Thompson	Vancouver	Iron.

NANAIMO MINING DIVISION.

Ingersoll	Quadra island	Valdes Island Copper Co., Ltd.	Victoria	Silver, copper.
Loyal	Blubber bay	James Raper	Vananda	Gold, silver, copper.
Marble Bay	Vananda	Tacoma Steel Co.	Vananda	Gold, silver, copper.

VICTORIA MINING DIVISION.

Blue Grouse	Cowichan lake	G. H. Kilburn	Cowichan lake	Silver, copper.
Margaret	Sooke	East Sooke Mines, Ltd.	East Sooke	Gold, silver, copper.
Willow Grouse	Sooke	Manager	East Sooke	Silver, copper.

CLAYOQUOT AND QUATSINO MINING DIVISIONS.

Indian Chief	Sidney inlet	Tidewater Copper Co.	Sidney Inlet	Gold, silver, copper.
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ALBERNI MINING DIVISION.

Monitor	Alberni	J. A. Skene	Port Alberni	Silver, copper.
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LIST OF CROWN-GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1918.

CASSIAR.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
A.B. Fraction.	Omineca.	Joseph S. Kelly and Randolph Haigh.	5451 R. 5	5.12	Mar. 21
Bellevue No. 1.	Skeena.	William Thomas Kergin and George Rudge.	3508	51.65	Feb. 4
Bellevue Fraction.	"	William Thomas Kergin and George Rudge.	3507	42.38	Feb. 4
Bellevue No. 2.	"	William Thomas Kergin and George Rudge.	3506	48.17	Feb. 4
Blenheim.	"	William Thomas Kergin.	3509	47.21	Feb. 4
Brown Bear.	"	Millard F. Warren.	2099 R. 4	32.31	Mar. 25
Camp Bird Fraction.	"	Millard F. Warren.	2100 R. 4	35.06	May 15
Cascade Falls No. 4.	Portland Canal.	Oakley Beaufort Bush.	3590	32.00	May 2
Cascade Falls No. 8.	Portland Canal.	Oakley Beaufort Bush.	3591	42.00	May 2
Centre Fraction.	Omineca.	Debenture Creek Mines, Ltd., N.P.L.	6316 R. 5	1.33	April 3
Contact.	"	James Gilmore and James E. Dean.	3182	50.67	July 15
Copper Hill.	"	Andrew Fairbairn and Horace S. Lavery.	3320	36.82	May 9
Crescent.	"	Joseph Burr Tyrrell.	3385	33.65	Sept. 19
Dalby.	Portland Canal.	Reginald King Neill.	3595	51.65	May 2
Dominion Fraction.	Omineca.	James Gilmore and James E. Dean.	8179	16.20	July 15
Easington.	Portland Canal.	Oakley Beaufort Bush.	3593	47.05	May 2
Gem.	Skeena.	B.C. Salt Works, Ltd.	6499	42.38	Oct. 29
George.	Skeena.	B.C. Salt Works, Ltd.	6497	32.21	Oct. 29
Golden Chief.	Omineca.	Joseph Burr Tyrrell.	3323	40.32	Sept. 19
Golden Potlatch.	"	Joseph Burr Tyrrell.	3834	48.25	Sept. 19
Golden Wonder.	"	Joseph Burr Tyrrell.	3822	34.30	Sept. 19
Granite.	"	James Gilmore and James E. Dean.	3184	34.00	July 15
Homestake.	Stikine.	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter.	2858	42.69	Aug. 30
Little Helen.	Omineca.	Andrew Fairbairn and Horace S. Lavery.	3319	36.97	May 9
Little Maid.	Atlin.	Jules Eggert.	226	38.89	Feb. 4
Little Tomy Fraction.	Skeena.	Millard F. Warren.	2098 R. 4	42.37	Mar. 20
Louise.	Portland Canal.	Robert Musket Stewart.	1555	51.65	Nov. 20
Maple Leaf.	Omineca.	Joseph Burr Tyrrell.	3836	29.59	Sept. 19
Mermaid.	Stikine.	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter.	2860	50.20	Aug. 30
North Star.	Skeena.	Gustaf Pearson.	3634	21.01	Sept. 19
Nugget.	Omineca.	Joseph S. Kelly and Randolph Haigh.	5450 R. 5	51.65	Mar. 19
Observatory.	Skeena.	Millard F. Warren.	2101 R. 4	49.66	Mar. 20
Pat Fraction.	Portland Canal.	Reginald King Neill.	3594	22.82	May 2
Pictou.	Portland Canal.	Oakley Beaufort Bush.	3596	51.61	May 2
Quartzite.	Omineca.	James Gilmore and James E. Dean.	3186	25.84	July 15
Queena.	Omineca.	Michael J. Kolb.	6286 R. 5	50.14	May 9
Reno.	Omineca.	James Gilmore and James E. Dean.	3183	30.10	July 15
Red Bluff.	Stikine.	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter.	2857	51.65	Aug. 30
Red Bird.	Stikine.	Fred. E. Bronson, Peter C. McCormack, George H. Whitney, Bruno Grief, and Cassius M. Coulter.	2859	42.60	Aug. 30
Right Rim.	Omineca.	Debenture Creek Mines, Ltd.	6314 R. 5	50.70	April 3
Rupert.	Portland Canal.	Oakley Beaufort Bush.	3597	49.72	May 2
Rupert.	Skeena.	B.C. Salt Works, Ltd.	6498	24.88	Oct. 29
Seranton.	"	B.C. Salt Works, Ltd.	6500	39.66	Oct. 29
Sea Gull.	"	Millard F. Warren.	2097 R. 4	49.90	Mar. 20
Sea Lion Fraction.	"	Millard F. Warren.	2104 R. 4	48.04	May 15
Shamrock.	Omineca.	Byron R. Jones.	3712	45.42	Aug. 9
Sheet Anchor Fraction.	Skeena.	Millard F. Warren.	2105 R. 4	44.88	Mar. 20
Simpson.	Portland Canal.	Oakley Beaufort Bush.	3592	31.00	May 2
Skeena.	Omineca.	Andrew Fairbairn and Horace S. Lavery.	3321	34.88	May 9
Skyline.	Skeena.	Millard F. Warren.	2108 R. 4	49.90	Mar. 20
Snow Fraction.	Skeena.	William Thomas Kergin and George Rudge.	3653	9.18	Feb. 4
Stark Fraction.	Nass River.	William Thomas Kergin, George Rudge, and William Rose Lord.	2944	12.19	Nov. 20
Summit.	Omineca.	James Gilmore and James E. Dean.	3180	51.65	Sept. 19
Sunlight Fraction.	Skeena.	Millard F. Warren.	2103 R. 4	25.92	Mar. 20
Sunshine.	Omineca.	James Gilmore and James E. Dean.	3181	48.70	July 15
Surprise.	"	Byron R. Jones.	3711	40.44	Aug. 8
Valley View.	"	James Gilmore and James E. Dean.	3185	38.00	July 15
Wonderful.	"	Byron R. Jones.	3710	40.01	Aug. 9
Zeolitic No. 1.	"	Joseph S. Kelly and Randolph Haigh.	5447 R. 5	51.65	Mar. 21
Zeolitic No. 2.	"	Joseph S. Kelly and Randolph Haigh.	5448 R. 5	51.61	Mar. 21
Zeolitic No. 4.	"	Joseph S. Kelly and Randolph Haigh.	5448 R. 5	45.70	Mar. 21
Zeolitic No. 5.	"	Joseph S. Kelly and Randolph Haigh.	5449 R. 5	41.90	Mar. 21

EAST KOOTENAY.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Alvarado.....	Fort Steele.....	The Consolidated M. & S. Co. of Canada.....	12516 G. 1	50.90	Mar. 18
Angus Fraction.....	"	Consolidated M. & S. Co.....	12518 G. 1	34.19	May 17
April Fraction.....	"	Consolidated M. & S. Co.....	12621 G. 1	37.07	Mar. 18
Carbajal Fraction.....	"	Consolidated M. & S. Co.....	12515 G. 1	45.08	Mar. 18
Charlotte Fraction.....	"	Consolidated M. & S. Co.....	12514 G. 1	45.64	Mar. 18
Empire.....	"	Consolidated M. & S. Co.....	12517 G. 1	81.81	May 17
Empire.....	Golden.....	John Murdock McLeod.....	506 G. 1	51.65	June 12
Ernestine Fraction.....	Fort Steele.....	Consolidated M. & S. Co.....	12522 G. 1	43.14	Mar. 18
Josephine.....	Fort Steele.....	Consolidated M. & S. Co.....	12624 G. 1	46.05	April 4
Jumbo.....	Windermere.....	Bessie Shaw.....	293	20.66	Aug. 22
Kathleen Fraction.....	Fort Steele.....	Consolidated M. & S. Co.....	12520 G. 1	27.76	May 17
Mohican.....	Fort Steele.....	Consolidated M. & S. Co.....	3051 G. 1	43.16	May 9
Monitor.....	Golden.....	Arthur Emerson Rand.....	651 G. 1	20.66	June 13
Pauline.....	Fort Steele.....	Consolidated M. & S. Co.....	12525 G. 1	51.65	April 4
Tipperary.....	Fort Steele.....	Consolidated M. & S. Co.....	12523 G. 1	51.65	Mar. 18
Ward.....	Fort Steele.....	Consolidated M. & S. Co.....	12519 G. 1	51.65	May 17

WEST KOOTENAY.

American Eagle.....	Slocan.....	William Edwin Graham.....	5499 G. 1	34.14	June 5
Baltimore Fraction.....	Slocan.....	Murdock McLean.....	3522 G. 1	50.53	Mar. 16
Beatrice Fraction.....	Nelson.....	George Mortimer Davidson.....	4741 G. 1	22.61	Nov. 26
Bell No. 2.....	Slocan.....	William Edward Graham.....	5500 G. 1	49.08	June 5
Cabin Fraction.....	Slocan.....	Consolidated M. & S. Co.....	12598 G. 1	50.32	
Carolina.....	Nelson.....	Harris Ginsberg.....	12531 G. 1	51.65	May 15
Chapleau.....	Slocan.....	Emily Ada Harris.....	4963 G. 1	26.12	Aug. 28
Chapleau Con. Fraction.....	Slocan.....	Emily Ada Harris.....	4966 G. 1	0.81	Aug. 28
Connie Fraction No. 2.....	Ainsworth.....	Walter Magoon.....	5818 G. 1	50.70	Nov. 21
Drum Lumon.....	"	Richard H. Graves.....	7870 G. 1	49.20	Mar. 18
Ellen.....	"	Henry Giegerich.....	980 G. 1	14.20	June 12
Fletcher.....	"	Albert Henry Watkins.....	5608 G. 1	22.19	Nov. 21
Freemont.....	Nelson.....	John Dingwall McDouald.....	2928 E. 1	34.53	Oct. 16
Gold Bug No. 2.....	Trail Creek.....	Guy Alexander Lafferty.....	1154	17.30	Sept. 24
Gold Leaf Fraction.....	Nelson.....	James A. Gilker, Administrator of the estate of Jons Person Swedberg, deceased.....	12458 G. 1	18.20	June 8
Gold Leaf No. 2.....	Nelson.....	James A. Gilker, Administrator of the estate of Jons Person Swedberg, deceased.....	12457 G. 1	46.01	June 8
Gray Rock.....	Nelson.....	Harris Ginsberg.....	12534 G. 1	49.08	May 15
Havana.....	Ainsworth.....	Albert Henry Watkins.....	5610 G. 1	35.84	Nov. 21
Helena.....	Slocan.....	Carl Westin.....	4238 G. 1	33.40	Oct. 10
Helen No. 2.....	Trail Creek.....	Lana A. Blondin.....	1151 G. 1	43.21	July 30
Humboldt.....	Nelson.....	Lorne Argyle Campbell.....	3929 G. 1	51.07	Oct. 16
Imperial.....	Nelson.....	David E. Grobe.....	3025 G. 1	37.43	Oct. 22
Isabella No. 2.....	Trail Creek.....	Ernest Morrison.....	1355 G. 1	44.21	July 10
Last Fraction.....	Ainsworth.....	Consolidated M. & S. Co.....	12408 G. 1	14.85	June 5
London.....	Slocan.....	Henry Giegerich.....	1416 G. 1	47.29	June 12
Lost Lode.....	Ainsworth.....	Consolidated M. & S. Co.....	12404 G. 1	51.65	Feb. 5
Monte Christo Fraction.....	Trail Creek.....	Consolidated M. & S. Co.....	12172 G. 1	3.09	April 15
Morning.....	Ainsworth.....	Helen Johnston.....	6818 G. 1	33.11	Mar. 15
Old Abe.....	Nelson.....	Harris Ginsberg.....	12533 G. 1	41.86	May 15
Old Mike.....	Nelson.....	Harris Ginsberg.....	12532 G. 1	49.20	May 15
Onix.....	Nelson.....	Lorne Argyle Campbell.....	3926 G. 1	23.36	Oct. 16
Orizaba.....	Trail Creek.....	Lana A. Blondin.....	1153 G. 1	42.10	July 25
Peerless.....	Slocan.....	John Baillargeon.....	1512 G. 1	41.78	June 12
Phoenix.....	Trail Creek.....	Guy Alexander Lafferty.....	1152	20.79	Sept. 24
Reciprocity.....	Ainsworth.....	James Wilson Smith and James Russell Hardie.....	12407 G. 1	44.04	Nov. 27
Republic No. 2.....	Slocan.....	Jesse Thompson Tipping, Administrator of the estate of Lida A. Tipping, deceased.....	5498 G. 1	50.91	June 5
Ruth.....	Ainsworth.....	Consolidated M. & S. Co.....	10696 G. 1	39.00	April 4
Silver Reef.....	Ainsworth.....	Consolidated M. & S. Co.....	12403 G. 1	47.29	Feb. 5
Sleeve-na-non.....	Lardeau.....	William Joseph Butler and Owen Rowland.....	4761 G. 1	29.87	Sept. 6
St. Peter Fraction.....	Trail Creek.....	Consolidated M. & S. Co.....	11475 G. 1	11.09	April 15
Thompson Fraction.....	Ainsworth.....	Consolidated M. & S. Co.....	12405 G. 1	47.23	Feb. 5
Victoria Fraction.....	Nelson.....	Consolidated M. & S. Co.....	12273 G. 1	38.43	April 4
Washington.....	Ainsworth.....	James Wilson Smith and James Russell Hardie.....	12406 G. 1	38.39	Nov. 27

BOUNDARY.

Ada B.....	Clinton.....	Frank Calvert.....	4792 G. 1	51.65	Nov. 20
Apex.....	Ashcroft.....	George H. Chataway, George Ward, and Mark L. McAbbe.....	3645 G. 1	51.47	Oct. 4
August.....	Similkameen.....	Canada Copper Corporation.....	366 S.	21.90	June 18
Beta.....	Kamloops.....	Glen Iron Mining Co., N.P.L.....	1414 G. 1	51.65	Oct. 21
Blackbird.....	Similkameen.....	Canada Copper Corporation.....	2272 S.	33.12	Nov. 26
Britannia Fraction.....	Kamloops.....	Angela Beckman.....	2554 G. 1	19.16	Jan. 18
Brandon.....	Grand Forks.....	James McNulty, James Marshall, and Thomas Roderick.....	2382 G. 1	45.72	Sept. 18
Chicago.....	Similkameen.....	Canada Copper Corporation.....	2264 S. 1	19.57	June 21
Clifford.....	Clinton.....	Frank Calvert.....	4791 G. 1	51.65	Nov. 20
Copper King.....	Kamloops.....	Angela Beckman.....	1457 G. 1	51.65	Feb. 7
Diamond.....	Similkameen.....	James F. Cunningham, John Mulligan.....	1326	51.65	June 24
Duke.....	Ashcroft.....	Jane Sanson, Administratrix, estate Geo. Sanson, deceased.....	3641 G. 1	32.11	Oct. 6
Granite Mountain.....	Similkameen.....	Canada Copper Corporation.....	2050 S.	23.80	Nov. 26
Grey Rock.....	Similkameen.....	Canada Copper Corporation.....	2051 S.	45.50	Nov. 26
Hercules.....	Similkameen.....	Albert T. Bryant & Charles W. Staples.....	1511 S.	38.49	June 1

BOUNDARY—Concluded.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Idaho	Similkameen...	Canada Copper Corporation	2049 S.	30.24	Nov. 26
I.O.U.	Ashcroft	George H. Chataway, George Ward, and Mark L. McAbee	3643 G. 1	51.65	Oct. 4
I.X.L.	Ashcroft	Jane Sanson	3646 G. 1	36.42	Oct. 4
Jessie	Similkameen	Canada Copper Corporation	2269 S.	48.74	June 21
Major Fraction	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	3642 G. 1	26.24	Oct. 5
Mooney	Similkameen	Canada Copper Corporation	2268 S.	35.20	June 18
Montana	Similkameen	Canada Copper Corporation	2048 S.	28.60	Nov. 28
Norah	Kamloops	Glen Iron Mining Company	1413 G. 1	51.65	Oct. 21
O.K.	Ashcroft	George H. Chataway, George Ward, and Mark L. McAbee	3644 G. 1	49.13	Oct. 4
Oregon	Similkameen	Canada Copper Corporation	2265 S.	33.29	Nov. 26
Princess Carolina Frac.	Similkameen	Canada Copper Corporation	2284 S.	36.78	Dec. 10
Princess Helen No. 1	Similkameen	Canada Copper Corporation	2271 S.	46.14	June 25
Shamrock	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	1245A. G. 1	51.61	Oct. 5
Slamet	Greenwood	Ellen Hallett	2663	38.12	Aug. 28
Signorina	Kamloops	Angele Beckman	2555 G. 1	47.18	Jan. 16
Star	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	1246A. G. 1	51.65	Oct. 5
Tamarac	Ashcroft	Jane Sanson, Administratrix, estate Geo. Sanson, deceased	1244A. G. 1	37.90	Oct. 5
Tam O'Shanter	Greenwood	Allan John Morrison	2405	39.77	Aug. 8

VANCOUVER ISLAND AND COAST.

Ajax	Vancouver	Britannia M. & S. Co.	4842 G. 1	51.65	Dec. 20
Alert	"	"	4776 G. 1	50.50	July 19
Arctic	"	"	4633	49.47	Dec. 12
Atlantic	"	"	4640 G. 1	51.65	Dec. 20
Barney	"	"	4798 G. 1	51.65	July 19
Bean Fraction	Quatsino	Coast Copper Company	1472	9.02	Nov. 27
Behr Fraction	Vancouver	Britannia M. & S. Co.	4791 G. 1	47.88	July 19
Belchor No. 1	Nanaimo	The Hematite Mining Co.	1063 R. 2	51.65	Oct. 2
" 2	"	"	1064 R. 2	49.78	" 2
" 3	"	"	1065 R. 2	35.58	" 2
" 4	"	"	1066 R. 2	48.95	" 2
" 5	"	"	1067 R. 2	43.26	" 2
" 6	"	"	1068 R. 2	23.06	" 2
" 7	"	"	1069 R. 2	51.06	" 2
" 8	"	"	1070 R. 2	38.81	" 2
Beta Fraction	Vancouver	Britannia M. & S. Co.	3947 G. 1	12.67	Mar. 13
Betty	Vancouver	Britannia M. & S. Co.	4857 G. 1	51.52	July 19
Billy Frac.	Vancouver	Britannia M. & S. Co.	3720 G. 1	6.11	Mar. 13
Black Jack Frac.	Quatsino	Edward F. Walsh	1498	25.82	Mar. 22
Bluebell	Nanaimo	The Hematite Mining Co.	1084 R. 2	35.74	Oct. 2
Boulder Canyon No. 1	Quatsino	John Jacob Badraun	1546	40.73	Dec. 6
Briton	Nanaimo	The Hematite Mining Co.	1082 R. 2	51.65	Oct. 2
Broad Fraction	Vancouver	Britannia M. & S. Co.	4636 G. 1	44.77	Dec. 13
Bulliondale No. 1	"	Robert Mungall	4649	46.26	Nov. 6
" 2	"	"	4650	35.27	" 6
" 3	"	"	4651	27.35	" 6
" 5	"	"	4653	34.35	" 6
Bute Fraction	"	Britannia M. & S. Co.	4632 G. 1	42.32	Dec. 12
Chal Fraction	"	"	4797 G. 1	43.81	July 19
Chas	"	"	4801 G. 1	51.65	July 19
Candor Fraction	"	"	4386 G. 1	50.74	Feb. 19
Copper Dyke	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd.	704 R. 2	51.58	April 23
Copper Dyke Extension	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd.	703 R. 2	51.65	April 23
Copper Prince	Vancouver	James Williams	2083 G. 1	51.65	June 5
Copper Queen	Vancouver	David Singleton	2082 G. 1	39.06	June 5
Curzon Fraction	Vancouver	Britannia M. & S. Co.	4878 G. 1	13.93	Sept. 13
Dada Fraction	Quatsino	Coast Copper Co.	1491	10.55	Nov. 18
Defiance	Vancouver	Britannia M. & S. Co.	4578 G. 1	51.65	Dec. 12
Delta	Vancouver	Britannia M. & S. Co.	3714 G. 1	43.80	Feb. 15
Derby Fraction	Vancouver	Britannia M. & S. Co.	4982 G. 1	9.44	Sept. 13
Dorothy M. Fraction	Quatsino	Coast Copper Co.	1479	7.17	Nov. 27
Drew Frac.	Vancouver	Britannia M. & S. Co.	4625 G. 1	33.22	Sept. 13
Drum	Vancouver	Britannia M. & S. Co.	4635 G. 1	51.65	Dec. 12
Dutch Fraction	Quatsino	Coast Copper Co.	1407	6.49	Nov. 12
Eden	Vancouver	Britannia M. & S. Co.	4624 G. 1	51.54	Mar. 19
Elith Fraction No. 1	Quatsino	Coast Copper Co.	1490	14.51	Nov. 21
Elsa	Quatsino	Coast Copper Co.	1476	40.15	Nov. 27
Enid	Nanaimo	William Robert Taylor	280 R. 1	46.25	June 13
Ernie Fraction No. 1	Quatsino	Coast Copper Co.	1497	1.76	Dec. 11
Eve Fraction	Vancouver	Britannia M. & S. Co.	4793 G. 1	43.13	July 19
Faith	Vancouver	Britannia M. & S. Co.	4689 G. 1	51.65	Dec. 12
Fin Fraction	Vancouver	Britannia M. & S. Co.	4632 G. 1	48.68	Mar. 19
Finish Fraction	Quatsino	Coast Copper Co.	1463	8.92	Nov. 13
First Chance No. 1	Quatsino	Coast Copper Co.	1466	51.65	Nov. 12
Gill	Vancouver	Britannia M. & S. Co.	4619 G. 1	51.65	Mar. 19
Golby-Fen-Ding Fraction	Quatsino	Coast Copper Co.	1489	14.28	Nov. 18
Grant	Vancouver	Britannia M. & S. Co.	4799 G. 1	45.33	July 19
Happy Jack	Quatsino	Coast Copper Co.	1495	51.00	Nov. 18
Harp Fraction	Vancouver	Britannia M. & S. Co.	4641 G. 1	49.37	Mar. 19
Heather	Nanaimo	The Hematite Mining Co.	1083 R. 2	37.38	Oct. 2
Hecia Fraction	Vancouver	Britannia M. & S. Co.	4639 G. 1	40.85	Dec. 13
Heron H.	Quatsino	Coast Copper Co.	1482	40.15	Nov. 15
Howe	Vancouver	Britannia M. & S. Co.	4629 G. 1	51.65	Dec. 12
Idaho	Quatsino	Anna Adams	1487	51.65	Mar. 22

VANCOUVER ISLAND AND COAST.—Concluded.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Idaho Fraction	Quatsino	Nick Badraun.	1481	31.96	Mar. 22
Indian Fraction	Vancouver	Britannia M. & S. Co.	4631 G. 1	39.69	Dec. 12
Iron Crown No. 7	Nanaimo	The Hematite Mining Co.	1071 R. 2	51.64	Oct. 2
Iron Prince Fraction	Victoria	Harrie Gerald Ross.	214	14.83	Aug. 20
Isaac T.	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd.	701 R. 2	41.57	April 23
Ivory Fraction	Vancouver	Britannia M. & S. Co.	4634 G. 1	38.89	Mar. 19
Jennie B.	Nanaimo	Thomas Neil Phillips.	278 R. 1	42.53	June 18
Jersey	Vancouver	Britannia M. & S. Co.	4645	51.65	Dec. 20
Jinx Fraction	Quatsino	Coast Copper Co.	1477	18.16	Nov. 27
Julie	Nanaimo	Thomas Neil Phillips.	233 R. 1	38.84	June 13
Juno Fraction	Vancouver	Britannia M. & S. Co.	4159 G. 1	50.78	Feb. 19
Ken Fraction	Vancouver	Britannia M. & S. Co.	4900 G. 1	49.56	July 18
King Fisher Fraction	Quatsino	Adolf A. Gyes.	1582	19.68	Aug. 29
Lady of the Lake	Vancouver	Robt. Mungall.	4654 G. 1	38.78	Nov. 9
Last Chance No. 1	Quatsino	Coast Copper Co.	1465	51.65	Nov. 12
Leora Fraction	Vancouver	Britannia M. & S. Co.	4643 G. 1	45.92	Dec. 20
Machete Fraction	Quatsino	Coast Copper Co.	1501	20.77	Nov. 19
Maude H. Fraction	Quatsino	Coast Copper Co.	1504	1.62	Nov. 19
Max	Vancouver	Britannia M. & S. Co.	4792 G. 1	46.74	July 19
Merry Widow No. 1	Quatsino	Adolf A. Gyes.	1529	51.48	Aug. 29
Milner Fraction	Vancouver	Britannia M. & S. Co.	4081 G. 1	46.07	Sept. 18
Monarch	Nanaimo	The Hematite Mining Co.	1076 R. 2	43.57	Oct. 2
Naas Fraction	Vancouver	Britannia M. & S. Co.	4627 G. 1	49.23	July 19
Nancianna Fraction	Quatsino	Coast Copper Co.	1435	10.03	Nov. 15
Nancy Lee	Quatsino	Coast Copper Co.	1469	51.65	Nov. 27
Nellie S.	Quatsino	Coast Copper Co.	1470	51.65	Nov. 27
No. 24 Fraction	Vancouver	Britannia M. & S. Co.	3996 G. 1	27.64	Mar. 19
Ogden	Vancouver	Britannia M. & S. Co.	4773 G. 1	50.51	July 19
Old Sport No. 4	Quatsino	Harry George Adams.	1493	51.65	Mar. 23
" 1	"	Maynard T. McClure.	1480	51.65	" 23
" 2	"	Edward F. Walsh.	1486	50.96	" 23
" 6	"	William M. Halliday.	1499	51.65	" 25
" 11	"	Coast Copper Co.	1500	48.89	" 25
" 9	"	Coast Copper Co.	1494	49.78	" 25
Orpha Fraction	"	Coast Copper Co.	1496	4.15	Nov. 19
Pacific	Vancouver	Britannia M. & S. Co.	4638 G. 1	51.65	Dec. 13
Patricia Fraction	Vancouver	Britannia M. & S. Co.	4577 G. 1	50.66	Dec. 12
Perch Fraction	Vancouver	Britannia M. & S. Co.	4869 G. 1	50.44	Feb. 19
Percy F. Curtiss	Quatsino	Joseph Hunter and Andrew Tait Monteith.	529	44.94	Aug. 21
Prince Fraction	Vancouver	Britannia M. & S. Co.	3949 G. 1	46.38	Mar. 13
Read Fraction	"	"	4626 G. 1	51.62	Mar. 19
Royalist	"	"	2201 G. 1	51.65	Mar. 19
Sage	"	"	4630 G. 1	51.65	Dec. 12
Satellite	"	"	2202 G. 1	51.65	Mar. 7
Shamrock No. 2	Quatsino	Nils S. Nilson.	1484	51.65	Mar. 25
Shamrock No. 3	Quatsino	Frederick William Kenmuir.	1478	51.65	Mar. 21
Shark	Vancouver	Britannia M. & S. Co.	4378 G. 1	48.92	Feb. 19
Shirley Fraction	Vancouver	Britannia M. & S. Co.	4795	50.80	Dec. 20
Singer	Vancouver	Britannia M. & S. Co.	4637 G. 1	51.65	Dec. 13
Sockeye	Quatsino	Joseph Hunter and Andrew Tait Monteith.	528	49.53	Aug. 21
Some Fraction	Quatsino	Coast Copper Co.	1488	29.46	Nov. 18
Sourdough Fraction	Quatsino	Coast Copper Co.	1473	21.56	Nov. 27
Spokane	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd.	702 R. 2	39.40	April 23
Stella	Nanaimo	William Robert Taylor.	281 R. 1	25.60	June 13
Success	Vancouver	Britannia M. & S. Co.	4628 G. 1	51.65	Dec. 12
Sunloch No. 3	Victoria	Sunloch Mines, Ltd., G. E. Winkler, C. W. Frank, D. W. Hanbury.	794	85.89	Aug. 6
Sunloch No. 4	"	Ditto.	795	38.22	Aug. 6
Sunloch No. 5	"	"	796	30.91	Aug. 6
Sunloch No. 1	"	"	792	51.59	Sept. 19
Sunloch No. 2	"	"	798	50.97	" 19
Sunloch No. 6	"	"	797	32.54	" 19
Surf Fraction	Vancouver	Britannia M. & S. Co.	4623 G. 1	48.16	" 13
Tatlico	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd.	699 R. 2	51.35	April 23
Tintic Fraction	Vancouver	Britannia M. & S. Co.	4647 G. 1	14.02	Dec. 20
Toba	Vancouver	Britannia M. & S. Co.	4620 G. 1	51.65	Mar. 18
Turkey Fraction	Vancouver	Britannia M. & S. Co.	4390 G. 1	44.22	Feb. 19
Tyee	Nanaimo	The Tatlayoko Lake Gold Mines, Ltd.	700 R. 2	51.65	April 23
Union Fraction	Vancouver	Britannia M. & S. Co.	4774 G. 1	51.04	July 19
Van	"	"	4796 G. 1	51.65	July 19
Wally Fraction	"	"	4855 G. 1	57.81	July 19
Wasp Fraction	"	"	4782 G. 1	46.67	Sept. 13
Weary Willie Fraction	Quatsino	Coast Copper Co.	1483	16.60	Nov. 15
Yeo Fraction	Vancouver	Britannia M. & S. Co.	4621 G. 1	51.48	Mar. 19

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, *Chief Inspector of Mines.*D. E. WHITTAKER, *Provincial Analyst and Assistant Assayer.*HENRY DEVLIN, *District Inspector, Nanaimo.*J. D. GALLOWAY, *Resident Engineer, Hazelton.*JOHN NEWTON, *District Inspector, Nanaimo.*W. M. BREWER, *Resident Engineer, Nanaimo.*ROBERT STRACHAN, *District Inspector, Fernie.*GEO. A. CLOTHIER, *Resident Engineer, Prince Rupert.*WM. LANCASTER, *District Inspector, Fernie.*P. B. FREELAND, *Resident Engineer, Grand Forks.*JAMES MCGREGOR, *District Inspector, Nelson.*A. G. LANGLEY, *Resident Engineer, Revelstoke.*THOS. J. SHENTON, *District Inspector, Prince Rupert.*R. W. THOMSON, *Resident Engineer, Kamloops.*H. H. JOHNSTONE, *Temporary Inspector, Nelson.*

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	"	"	C. A. Tervo.
Liard Mining Division ..	Telegraph Creek ..	"	"	
Sub-office	Porter			Chas. H. Smith.
"	McDame Creek			Mike Larsen.
"	Fort St. John			F. W. Beaton.
Skeena Mining Division ..	Prince Rupert....	J. H. McMullin...	J. H. McMullin	
Sub-office	Alice Arm			Telka Carney.
"	Kitimat			Geo. L. Anderson.
"	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 ..	P. S. Jack	
		(at Prince Rupert)		
Bella Coola Mining Div...	Prince Rupert....	J. H. McMullin...	J. H. McMullin ..	Brynild Brynildsen.
Sub-office	Bella Coola			
"	Bella Bella			John A. Pauline.
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. Beaton.
"	Copper City			P. R. Skinner.

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	Terrace			T. J. Kirkpatrick.
"	New Hazelton			L. B. Warner.
"	Fort Fraser			J. S. Alexander.
"	Junction Finlay & Parsnip rivers.			
"	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. Beaton . . .	
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. Herne.
"	McBride	"		Thos. Van Dyk.
Quesnel Mining Division. .	150-Mile House	C. W. Grain	R. M. McGusty . .	
Sub-office	Quesnel	(at Barkerville)		E. C. Lunn.
"	Quesnel Forks.			Grant Grinder.
"	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	
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	
Osyoos 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			Ronald Hewat.
"	Moyie			W. H. Laird.
"				
Ainsworth Mining Div. . .	Kaslo	R. J. Stenson . . .	A. McQueen	Wm. J. Green.
Sub-office	Howser			W. Simpson.
"	Trout Lake			Oscar Jacobson.

GOLD COMMISSIONERS AND MINING RECORDERS—*Concluded.*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Ainsworth M.D.— <i>Con.</i>				
Sub-office	Crawford Bay.....			Thos. W. Lytle.
"	Poplar			Arthur G. Johnston.
Slocan Mining Division...	New Denver	R. J. Stenson	Angus McInnes ..	
Sub-office	Sandon	(at Kaslo)		W. J. Parham.
Slocan City Mining Div...	Slocan	R. J. Stenson	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			G. A. Kennington.
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)	Francis I. Fraser ..	
Trail Creek Mining Div...	Rossland	H. R. Townsend...	M. S. Morrell.....	
Nanaimo Mining Division	Nanaimo	S. McB. Smith....	S. McB. Smith....	
Sub-office	Ladysmith			John Stewart.
"	Alert Bay			Ernest H. Robinson
"	Vananda			Leonard Raper.
"	Quathiaski Cove			S. Marshall.
"	Granite Bay			Henry Twidle.
"	Campbell River.....			T. W. Hanson.
Alberni Mining Division..	Alberni	A. G. Freeze	A. G. Freeze	
Clayoquot Mining Division	Clayoquot	" (at Alberni)	W. T. Dawley	
Quatsino Mining Division	Quatsino	"	Ed. Evensen	
Victoria Mining Division..	Victoria	Herbert Stanton...	Herbert Stanton...	
New Westminster Min. D.	New Westminster.	F. C. Campbell....	I. Wintemute.....	
Sub-office	Harrison Lake			L. A. Agassiz.
"	Chilliwack			J. Pelly.
Vancouver Mining Div...	Vancouver	John Mahony	A. P. Grant.....	

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