ANNUAL REPORT

OF THE

MINISTER OF MINES

FOR THE

YEAR ENDING 31ST DECEMBER

1920

BEING AN ACCOUNT OF

MINING OPERATIONS FOR GOLD, COAL, ETC.

IN THE

PROVINCE OF BRITISH COLUMBIA

THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1921.

To His Honour WALTER CAMERON NICHOL,

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 1920 is herewith respectfully submitted.

WILLIAM SLOAN,

Minister of Mines.

Minister of Mines' Office,

March 16th, 1921.

Atlin Mountain as seen from Atlin across the Lake.

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, 1920.

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

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

I have the honour to be,

Sir,

Your obedient servant,

WILLIAM FLEET ROBERTSON,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,

March 16th, 1921.

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 1920.

Gold, placer	$ 75,944,203
Gold, lode	102,753,823
Silver	53,668,284
Copper	161,513,864
Lead	46,637,221
Zinc	19,896,466
Coal and coke	212,573,492
Building-stone, bricks, etc.	32,168,217
Miscellaneous minerals, etc.	1,037,408
Total	$706,192,978

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1920 (INCLUSIVE).

1852 to 1892 (inclusive)	$ 81,090,069
1893	3,588,413
1894	4,225,717
1895	5,643,042
1896	7,507,956
1897	10,455,268
1898	10,906,861
1899	12,393,131
1900	16,344,751
1901	20,086,780
1902	17,486,550
1903	17,495,954
1904	18,977,359
1905	22,461,325
1906	24,980,546
1907	25,882,560
1908	23,851,277
1909	24,443,025
1910	26,377,066
1911	23,499,072
1912	32,440,800
1913	30,296,398
1914	26,388,825
1915	29,447,508
1916	42,290,462
1917	37,010,392
1918	41,782,474
1919	33,296,313
1920	35,543,084
Total	$706,192,978

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1918, 1919, and 1920. 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 1918, 1919, AND 1920.

	Customary Measure.	1918.		1919.		1920.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold placer	Ounces.	16,000	$ 320,000	14,325	$ 286,500	11,080	$ 221,600
" lode	"	164,674	3,403,812	152,426	3,150,645	120,048	2,481,392
Silver	"	3,498,172	3,215,870	3,403,119	3,592,673	3,377,849	3,235,980
Copper	Pounds	61,483,754	15,143,449	42,459,339	7,939,896	44,887,676	7,832,899
Lead	"	43,899,661	2,928,107	29,475,968	1,526,855	39,331,218	2,816,115
Zinc	"	41,772,916	2,899,040	56,737,651	3,540,429	47,208,268	3,077,979
Coal	Tons, 2,240 lb.	2,302,245	11,511,225	2,267,541	11,337,705	2,595,125	12,975,625
Coke	" "	188,967	1,322,769	91,138	637,966	67,792	474,544
Miscellaneous products			1,038,202		1,283,644		2,426,950
			$41,782,474		$33,296,313		$35,543,084

TABLE IV.

OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

NAMES.	DIVISIONS.			DISTRICTS.		
	1918.	1919.	1920.	1918.	1919.	1920.
CARIBOO DISTRICT				$ 383,996	$ 196,801	$ 222,335
Cariboo and Quesnel Mining Division	$ 83,500	$ 73,500	$ 66,000			
Omineca Mining Division	300,496	123,301	156,335			
CASSIAR DISTRICT				9,178,441	6,402,082	7,293,008
EAST KOOTENAY DISTRICT				7,259,897	6,612,954	9,428,989
WEST KOOTENAY DISTRICT				6,113,279	4,669,090	3,049,731
Ainsworth Division	663,388	405,478	558,339			
Slocan and Slocan City "	3,675,762	2,900,087	1,390,563			
Nelson and Arrow Lake "	396,697	76,719	100,565			
Trail Creek "	1,357,571	1,275,538	982,020			
Revelstoke, Trout Lake, Lardeau	19,861	11,268	18,244			
BOUNDARY-YALE DISTRICT				4,961,452	2,527,514	2,011,803
Osoyoos, Grand Forks, and Greenwood Divisions	3,897,826	1,637,827	1,109,527			
Similkameen, Nicola, Vernon	909,869	759,637	842,287			
Yale, Ashcroft, Kamloops	153,757	130,050	59,989			
LILLOOET DISTRICT				57,746	62,684	15,980
COAST DISTRICT (Nanaimo, Alberni, Clayoquot, Quatsino, Victoria, Vancouver)				13,827,663	12,825,188	13,521,238
				$41,782,474	$33,296,313	$35,543,084

TABLE V.

MISCELLANEOUS PRODUCTS AND TOTALS OF PRODUCTION, 1920.

District and Division.	Cement.	Lime and Limestone.	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 Metalliferous Minerals.	Totals for Divisions.	Totals for Districts.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$	$
CARIBOO															222,335
Cariboo and Quesnel													66,000	66,000	
Omineca												7,000	149,335	156,335	
CASSIAR															7,293,008
Atlin, Stikine, Liard													138,600	138,600	
Skeena, Nass River, Portland Canal, Queen Charlotte		48,000			150,000				198,000		198,000		6,956,408	7,154,408	
EAST KOOTENAY															9,428,989
Fort Steele										21,500	21,500	4,203,244	5,074,204	9,298,948	
Windermere, Golden													130,041	130,041	
WEST KOOTENAY															3,049,731
Ainsworth													558,339	558,339	
Slocan and Slocan City													1,390,563	1,390,563	
Nelson, Arrow Lake						1,900			1,900		1,900		98,665	100,565	
Trail Creek													982,020	982,020	
Revelstoke, Trout Lake, Lardeau						3,500			3,500		3,500		14,744	18,244	
BOUNDARY-YALE															2,011,803
Grand Forks, Greenwood, Osoyoos		15,636							15,636	193,702	209,338		900,189	1,109,527	
Similkameen, Nicola, Vernon, Yale, Ashcroft, Kamloops								5,296	5,296	400	5,696	748,655	87,936	842,287	
								140	140	8,000	8,140		51,849	59,989	
LILLOOET-CLINTON															15,980
Lillooet and Clinton										10,000	10,000		5,980	15,980	
COAST-SOUTHERN															13,521,238
Vancouver Island (Nanaimo, Quatsino, Clayoquot, Alberni, Victoria)	822,484	274,515				44,516	9,823	92,101	1,243,439	15,488	1,258,927	8,491,270	22,839	9,773,036	
Mainland (Vancouver, New Westminster)				981	117,787	74,871	237,500	277,410	708,549	1,400	709,949		3,038,253	3,748,202	
Totals	822,484	338,151		981	267,787	124,787	247,323	374,947	2,176,460	250,490	2,426,950	13,450,169	19,665,965	35,543,084	35,543,084

TABLE VI.—PLACER GOLD.

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

YIELD OF PLACER GOLD TO DATE.

1858	$ 705,000	1874	$1,844,618	1890	$ 490,435	1906	$ 948,400
1859	1,615,070	1875	2,474,094	1891	429,811	1907	828,000
1860	2,228,543	1876	1,786,648	1892	399,526	1908	647,000
1861	2,666,118	1877	1,608,182	1893	356,131	1909	477,000
1862	2,656,903	1878	1,275,204	1894	405,516	1910	540,000
1863	3,913,563	1879	1,290,058	1895	481,683	1911	426,000
1864	3,735,850	1880	1,013,827	1896	544,026	1912	555,500
1865	3,491,205	1881	1,046,737	1897	513,520	1913	510,000
1866	2,662,106	1882	954,085	1898	643,346	1914	565,000
1867	2,480,868	1883	794,252	1899	1,344,900	1915	770,000
1868	3,372,972	1884	736,165	1900	1,278,724	1916	580,500
1869	1,774,978	1885	713,738	1901	970,100	1917	496,000
1870	1,336,956	1886	903,651	1902	1,073,140	1918	320,000
1871	1,799,440	1887	693,709	1903	1,060,420	1919	286,500
1872	1,610,972	1888	616,731	1904	1,115,300	1920	221,600
1873	1,305,749	1889	588,923	1905	969,300		
						Total	$75,944,203

TABLE VII.—PRODUCTION OF LODE MINES.

YEAR.	GOLD.		SILVER.		COPPER.		LEAD.		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	.....	.....	53,192	47,873	.....	.....	165,100	6,498	.....	.....	54,371
1890	.....	.....	70,427	73,948	.....	.....	*Nil.*	*Nil.*	.....	.....	73,948
1891	.....	.....	4,500	4,000	.....	.....	*Nil.*	*Nil.*	.....	.....	4,000
1892	.....	.....	77,160	66,935	.....	.....	808,420	33,064	.....	.....	99,999
1893	1,170	23,404	227,000	195,000	.....	.....	2,135,623	78,996	.....	.....	297,400
1894	6,252	125,014	746,379	470,219	324,680	16,234	5,662,523	169,875	.....	.....	781,342
1895	39,264	785,271	1,496,522	977,229	952,840	47,642	16,475,464	532,255	.....	.....	2,342,397
1896	62,259	1,244,180	3,135,343	2,100,689	3,818,556	190,926	24,199,977	721,384	.....	.....	4,257,179
1897	106,141	2,122,820	5,472,971	3,272,836	5,325,180	266,258	38,841,135	1,390,517	.....	.....	7,052,431
1898	110,061	2,201,217	4,292,401	2,375,841	7,271,678	874,781	31,698,559	1,077,581	.....	.....	6,529,420
1899	138,315	2,857,573	2,939,413	1,663,708	7,722,591	1,351,453	21,862,436	878,870	.....	.....	6,751,604
1900	167,152	3,453,381	3,958,175	2,309,200	9,997,080	1,615,289	63,358,621	2,691,887	.....	.....	10,069,757
1901	210,384	4,348,603	5,151,333	2,884,745	27,603,746	4,446,963	51,582,906	2,002,733	.....	.....	13,683,044
1902	236,491	4,888,269	3,917,917	1,941,328	29,636,057	3,446,673	22,536,381	824,832	.....	.....	11,101,102
1903	232,831	4,812,616	2,996,204	1,521,472	34,359,921	4,547,536	18,089,283	689,744	.....	.....	11,571,367
1904	222,042	4,589,608	3,222,481	1,719,516	36,710,128	4,578,037	36,646,244	1,421,874	.....	.....	12,309,035
1905	238,660	4,933,102	3,439,417	1,971,818	37,692,251	5,876,222	56,580,703	2,399,022	.....	.....	15,180,164
1906	224,027	4,630,639	2,990,262	1,897,320	42,990,488	8,288,505	52,408,217	2,667,578	.....	.....	17,484,102
1907	196,179	4,055,020	2,745,448	1,703,825	40,832,720	8,166,544	47,738,703	2,291,458	.....	.....	16,216,847
1908	255,582	5,282,880	2,631,389	1,321,483	47,274,614	6,240,249	43,195,733	1,632,799	.....	.....	14,477,411
1909	238,224	4,924,090	2,532,742	1,239,270	45,597,245	5,918,522	44,396,346	1,709,259	8,500,000	400,000	14,191,141
1910	267,701	5,533,380	2,450,241	1,245,016	38,243,934	4,871,512	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911	228,617	4,725,513	1,892,364	958,293	36,927,656	4,571,644	26,872,397	1,069,521	2,634,544	129,092	11,454,063
1912	257,496	5,322,442	3,132,108	1,810,045	51,456,537	8,408,513	44,871,454	1,805,627	5,858,280	316,139	17,662,766
1913	272,264	5,627,490	3,465,856	1,968,606	46,460,365	7,094,489	55,864,677	2,175,232	6,758,768	324,421	17,190,838
1914	247,170	5,109,004	3,602,180	1,876,736	45,009,699	6,121,319	50,625,048	1,771,877	7,886,467	346,125	15,225,061
1915	250,021	5,167,934	3,366,506	1,588,991	56,918,405	9,835,500	46,503,590	1,939,200	12,982,440	1,460,524	19,992,149
1916	221,932	4,587,334	3,301,923	2,059,739	65,379,364	17,784,494	48,727,516	3,007,462	37,168,980	4,043,985	31,483,014
1917	114,523	2,367,190	2,929,216	2,265,749	59,007,565	16,038,256	37,307,485	2,951,020	41,848,513	3,166,259	26,788,474
1918	164,674	3,403,812	3,498,172	3,215,870	61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,590,278
1919	152,426	3,150,645	3,403,119	3,592,673	42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429	19,750,498
1920	120,048	2,481,392	3,377,849	3,235,980	44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979	19,444,365
To'l	4,981,888	102,753,823	86,617,680	53,668,284	925,344,009	161,513,864	1,036,893,814	46,637,221	273,021,019	19,896,466	384,469,658

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

COAL.

Year.	Tons (2,240 lb.).	Value.
1836-1881	1,873,907	$ 6,003,245
1882	282,139	846,417
1883	213,299	639,897
1884	394,070	1,182,210
1885	265,596	796,788
1886	326,636	979,908
1887	413,360	1,240,080
1888	489,301	1,467,903
1889	579,830	1,739,490
1890	678,140	2,034,420
1891	1,029,097	3,087,291
1892	826,335	2,479,005
1893	978,294	2,934,882
1894	1,012,953	3,038,859
1895	939,654	2,818,962
1896	896,222	2,688,666
1897	882,854	2,648,562
1898	1,135,865	3,407,595
1899	1,306,324	3,918,972
1900	1,439,595	4,318,785
1901	1,460,331	4,380,993
1902	1,397,394	4,192,182
1903	1,168,194	3,504,582
1904	1,253,628	3,760,884
1905	1,384,312	4,152,936
1906	1,517,303	4,551,909
1907	1,800,067	6,300,235
1908	1,677,849	5,872,472
1909	2,006,476	7,022,666
1910	2,800,046	9,800,161
1911	2,193,062	7,675,717
1912	2,628,804	9,200,814
1913	2,137,483	7,481,190
1914	1,810,967	6,338,385
1915	1,611,129	5,638,952
1916	2,084,093	7,294,325
1917	2,149,975	7,524,913
1918	2,302,245	11,511,225
1919	2,267,541	11,337,705
1920	2,595,125	12,975,625
Total	54,209,495	$188,789,808

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
1919	91,138	637,966
1920	67,792	474,544
Total	4,123,267	$23,783,684

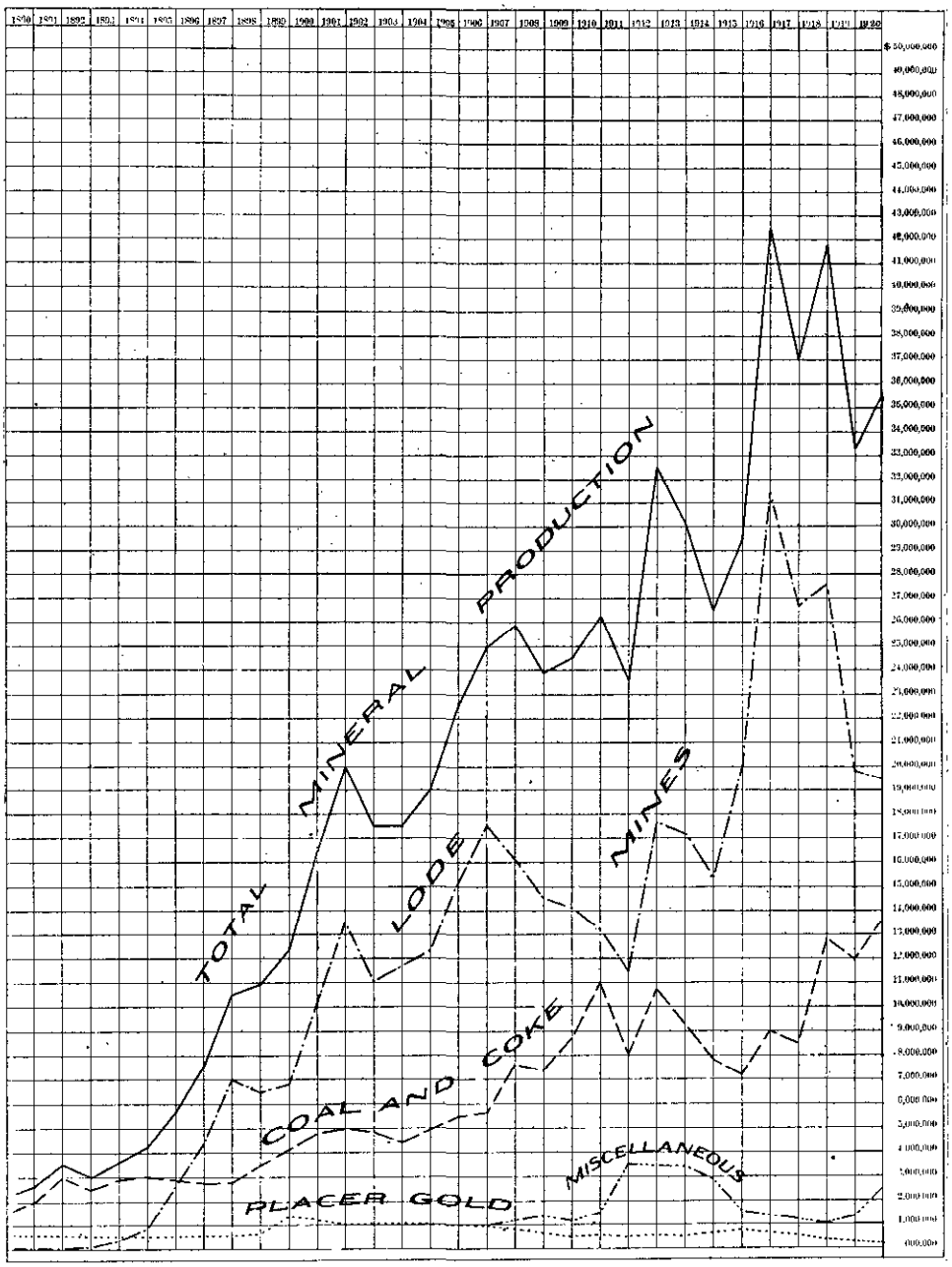
TABLE IX.—PRODUCTION IN DETAIL OF THE

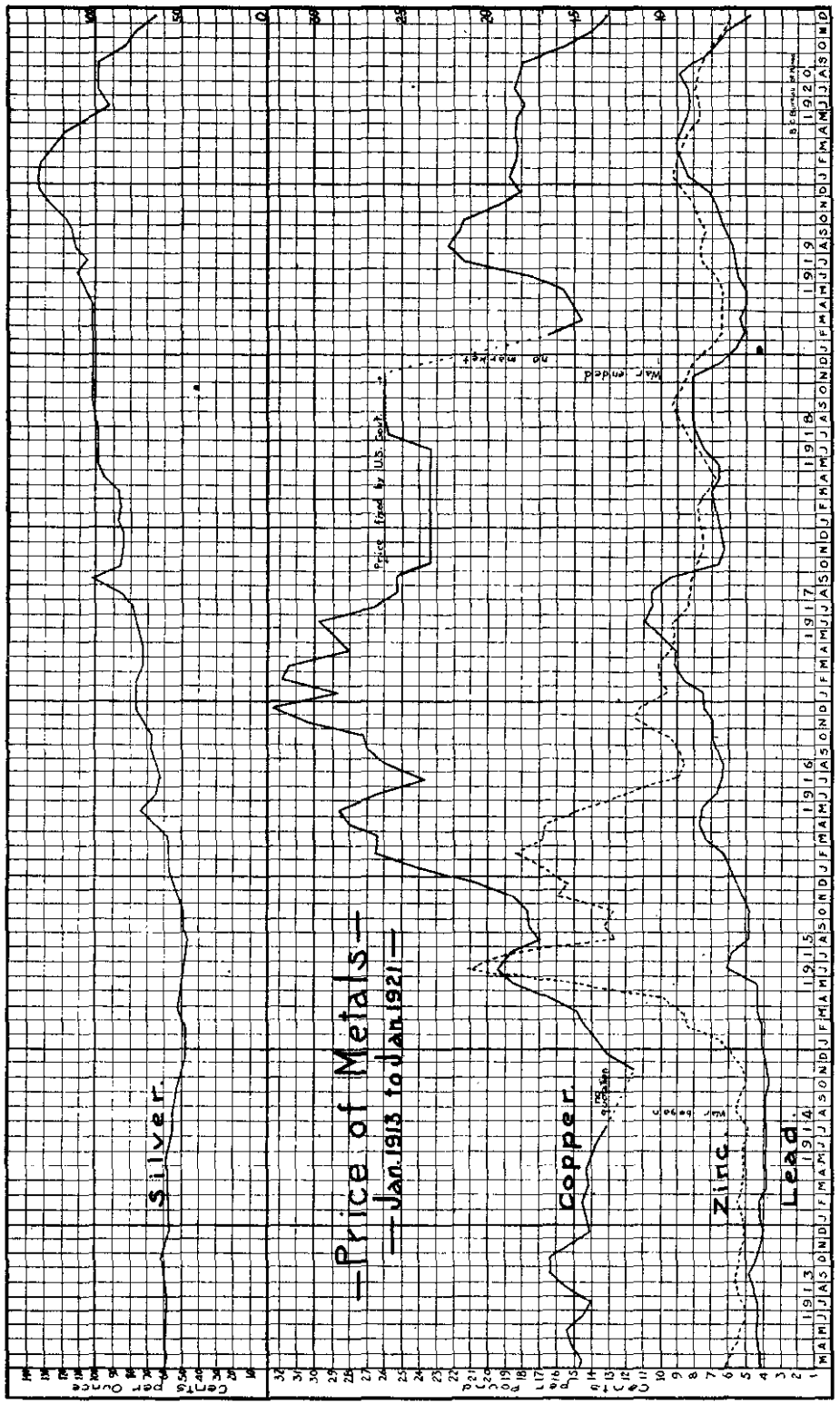
DISTRICT.	YEAR	TONS.	GOLD.—PLACER.		GOLD—LODE.		SILVER.	
			Ounces	Value.	Ounces.	Value.	Ounces.	Value.
				$		$		$
Cariboo								
Cariboo and Quesnel Divisions	1917		7,500	150,000				
	1918		4,000	80,000				
	1919		3,500	70,000				
	1920		3,360	66,000				
Omineca Division	1917	4,159	600	12,000	931	19,244	82,311	63,668
	1918	6,956	400	8,000	985	20,360	84,125	77,336
	1919	4,051	400	8,000	147	3,038	72,573	76,615
	1920	4,000	150	3,000	218	4,506	103,020	98,693
Cassiar								
Atlin, Stikine, and Liard Divisions	1917	33	15,600	312,000	1,000	20,670		
	1918	73	11,025	220,500	446	9,219	1,115	1,025
	1919		8,850	177,000				
	1920		6,930	138,600				
Skeena, Nass, Portland Canal, and Queen Charlotte Divisions	1917	821,819			9,805	202,669	343,805	265,983
	1918	956,231			48,016	992,491	416,616	382,995
	1919	760,057	850	17,000	60,076	1,241,771	920,413	971,680
	1920	944,208	150	3,000	54,531	1,127,156	1,317,832	1,262,483
East Kootenay								
Fort Steele Division	1917	114,391	100	2,000			180,168	139,380
	1918	137,950	50	1,000			261,497	240,394
	1919	145,039	50	1,000			205,500	216,946
	1920	267,381	175	3,500			362,143	346,933
Windermere-Golden	1917	2,354					79,685	61,636
	1918	3,620					91,784	84,377
	1919	2,697			2	41	68,634	72,457
	1920	1,977					53,510	51,263
West Kootenay								
Ainsworth Division	1917	82,481			1	20	224,461	173,621
	1918	44,937			18	372	228,699	210,243
	1919	30,157			26	537	167,453	176,780
	1920	18,213			32	661	266,963	255,751
Slocan and Slocan City	1917	149,895			18	372	1,547,576	1,197,060
	1918	142,700			67	1,385	1,873,236	1,722,066
	1919	139,824			95	1,964	1,556,714	1,643,423
	1920	59,768			73	1,509	733,515	707,497
Nelson and Arrow Lake Divisions	1917	10,738	50	1,000	2,521	52,109	46,229	35,758
	1918	15,348	50	1,000	7,155	147,894	136,738	125,703
	1919	5,694	25	500	297	6,130	44,280	46,747
	1920	6,189	25	500	1,924	39,769	7,085	6,768
Trail Creek Division	1917	100,171			33,290	688,104	47,112	36,441
	1918	112,349			43,745	904,209	47,203	43,394
	1919	88,266			50,229	1,038,233	27,788	29,336
	1920	67,714			36,425	752,905	36,411	34,882
Revelstoke, Trout Lake, and Lardeau	1917	534	50	1,000	62	1,282	37,733	29,187
	1918	255	50	1,000	35	723	11,761	10,812
	1919	47	50	1,000	8	165	2,994	3,161
	1920	91	50	1,000	7	145	7,979	7,644
Boundary-Yale								
Grand Forks, Greenwood, and Osoyoos Divisions.	1917	779,345	50	1,000	58,544	1,210,104	220,213	170,335
	1918	692,504	50	1,000	55,353	1,144,147	227,113	208,785
	1919	252,106	50	1,000	32,874	679,506	222,680	235,083
	1920	84,125	25	500	20,366	420,965	385,681	369,482
Similkameen, Nicola, and Vernon Divisions	1917	1,384	400	8,000	111	2,294	3,470	2,684
	1918	73	250	5,000	1	21	131	120
	1919	154	50	1,000	25	517	6,823	7,208
	1920	18,996	25	500	83	1,716	4,876	4,671
Yale, Ashcroft, and Kamloops Divisions	1917	8,254	100	2,000	1,355	28,008	3,525	2,727
	1918	30,826	50	1,000	815	16,846	1,317	1,211
	1919	29,871	100	2,000	627	12,960	2,096	2,213
	1920	1,025	50	1,000	238	4,919	437	419
Lillooet								
Lillooet and Clinton Divisions	1917	4,700	300	6,000	3,092	63,912	276	213
	1918	3,858	50	1,000	2,473	51,117	412	379
	1919	4,720	375	7,500	2,506	51,799	365	385
	1920	200	175	3,500	120	2,480		
Southern Coast								
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria Divisions)	1917	19,221	50	1,000	2,813	58,145	25,727	19,900
	1918	13,269	25	500	2,515	51,985	23,040	21,181
	1919	7,657	25	500	1,164	24,060	9,936	10,490
	1920	6,183	25	500	19	393	2,745	2,630
Mainland (Vancouver and New Westminster Divisions)	1917	662,100			980	20,257	86,925	67,236
	1918	731,900			3,050	63,043	93,385	85,849
	1919	642,635			4,350	89,915	94,870	100,154
	1920	668,117			6,012	124,268	90,672	86,864
TOTALS	1917	2,761,579	24,800	496,000	114,523	2,367,190	2,929,216	2,265,749
	1918	2,892,849	16,000	320,000	164,674	3,403,812	3,498,172	3,215,870
	1919	2,112,975	14,325	286,500	152,426	3,150,645	3,403,119	3,592,673
	1920	2,178,187	11,080	221,600	120,048	2,481,392	3,377,849	3,235,980

METALLIFEROUS MINES, ETC., FOR 1917, 1918, 1919, AND 1920.

COPPER.		LEAD.		ZINC.		TOTALS FOR DIVISIONS.				TOTALS FOR DISTRICTS.
Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	1917.	1918.	1919.	1920.	1920.
	$		$		$	$	$	$	$	$
										215,335
						150,000				
							80,000			
								70,000		
									66,000	
852,373	231,675	271,885	21,509	364,097	27,548	375,641				
643,843	158,578	123,568	8,242	313,112	21,730		294,246			
16,205	3,030	180,455	9,347	224,539	14,011			114,041		
		189,488	13,567	453,512	29,569				149,335	
										7,095,008
						332,670				
11,160	2,749						233,493			
								177,000		
									138,600	
27,978,015	7,604,424					8,073,026				
30,190,606	7,435,946						8,811,432			
20,411,421	3,816,936							6,047,387		
26,153,406	4,563,769								6,956,408	
										5,204,245
9,679	2,631	13,996,640	1,107,134	20,715,090	1,567,304	2,818,429				
1,768	435	18,695,565	1,246,994	26,704,806	1,953,313		3,342,136			
		10,729,483	555,787	46,460,703	2,899,148			3,672,881		
		26,926,319	1,927,924	42,881,092	2,795,847				5,074,204	
12,040	3,436	1,774,649	140,375	18,000	1,362	206,809				
		2,659,210	177,369				261,746			
		1,659,279	85,951					158,449		
1,953	341	1,095,436	78,437						130,041	
										3,044,331
		6,395,350	505,872	918,601	69,501	749,014				
		6,106,262	407,288	640,991	44,485		662,388			
		4,336,602	224,636	36,785	2,295			404,248		
		4,072,807	291,613	158,193	10,314				558,339	
		11,808,019	934,014	18,789,573	1,421,619	3,553,056				
242	60	14,575,379	972,178	14,107,682	979,073		3,674,762			
		12,156,845	629,725	10,015,624	624,075			2,900,087		
		6,135,581	439,308	3,715,471	242,249				1,390,563	
50,946	13,847	2,605,666	206,108	982,309	74,322	383,144				
28,933	7,126	1,611,166	107,465				389,188			
21,964	4,107	292,010	15,126					72,619		
755	132	719,219	51,496						98,665	
1,730,088	470,238					1,194,783				
1,654,356	407,468						1,355,071			
1,112,133	207,969							1,275,588		
1,113,085	194,233								982,020	
		395,321	31,270	33,279	2,518	65,257				
		80,773	5,387	6,325	439		18,361			
		44,035	2,281					6,607		
		83,165	5,955						14,744	
										1,039,974
10,329,765	2,807,630	36,548	2,891			4,191,960				
9,940,125	2,448,253	47,738	3,184				3,895,369			
3,273,655	612,173	43,200	2,238					1,530,000		
582,350	101,622	106,433	7,620						900,189	
87,326	23,735	10,697	846			37,559				
11,928	2,938						8,079			
5,180	969	4,594	238					9,927		
453,347	80,854	2,720	195						87,936	
700,199	190,314	12,690	1,004	27,564	2,085	226,138				
525,780	129,500						148,557			
556,681	104,099	29,465	1,526					122,798		
260,808	45,511								51,849	
										5,980
						70,125				
							52,496			
								59,684		
									5,980	
										3,031,092
1,461,704	397,291					476,336				
926,886	228,292						301,958			
432,252	80,831							115,881		
110,696	19,316								22,839	
15,794,830	4,293,035					4,380,528				
17,548,127	4,322,104						4,470,996			
16,629,848	3,109,782							3,299,851		
16,201,266	2,827,121								3,038,253	
59,007,565	16,038,256	37,307,465	2,951,020	47,848,513	3,166,259	27,284,474				
61,483,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040		27,910,278			
42,459,339	7,939,896	29,475,968	1,526,855	56,737,651	3,540,429			20,036,998		
44,887,676	7,832,899	39,331,218	2,816,115	47,208,268	3,077,979				19,665,965	19,665,965

TABLE X.—SHOWING MINERAL PRODUCTION OF BRITISH COLUMBIA.




—Price of Metals—
—Jan. 1913 to Jan. 1921—
Silver
Copper
Zinc
Lead
Cents per Ounce
Cents per Pound
Price fixed by U.S. Govt.
War ended
1913
1914
1915
1916
1917
1918
1919
1920

PROGRESS OF MINING.

The gross value of the mineral production of the Province for the year 1920 was $35,543,084, an increase over that of the preceding year of $2,246,771, or equivalent to an increase of about 7 per cent.

It is extremely gratifying that British Columbia's mining industry has been so well maintained, notwithstanding the fluctuating metal market, and despite generally unsettled conditions, that it is possible to report an increase in 1920 over the value of the production of 1919.

It is to be remembered, too, that other mineral-producing sections of America have of late been announcing reductions in mineral-output, a fact which emphasizes the very satisfactory showing of this Province.

The gold production of the Province for the year 1920 amounted in value to $2,702,992, a decrease from the preceding year of $734,153. This might have been expected, as the mining of gold, with its fixed value, has in these times of high cost of labour and supplies for some years past offered little encouragement, and even less at the beginning of this year, on the eve of what promised to be a period of unstable prices. With what is now an assured promise of lower costs of supplies and living, it would seem that gold-mining would again become profitable, and we may confidently look for an increased gold production in the near future.

With the other metals during the past couple of years it has been a battle of prices, of wild fluctuations in the market values of the metals, causing an uncertain market demand for ores, for smelters could not buy ores in the face of an impending drop in the market values of the contained metals and the subsequent loss.

To indicate how fluctuating the market has been, a chart has been prepared to accompany this Report, which shows the monthly fluctuations of metal-market prices from 1913 to date.

It is quite apparent, from the chart, that there has been a great drop from war-days in all metal prices, but, for all this, it is to be noted that the market prices even at the end of the year are not lower than the normal pre-war prices, at which profitable mining was carried on.

By the end of the year productive copper-mining all over the American continent had been greatly curtailed, with many mines closed down entirely. This state of stagnation in the copper-mining industry will prevail until the prices of the elements entering into and making up the costs of mining and treatment of ores are reduced, or when the market prices of the metals are raised, and with some assurance of continuance at such higher level.

As to the first of these alternatives, there seems to be a tendency to a material reduction in price of the essential factors making up the mining costs, which will eventually so reduce the cost of mining as to permit of operations being again profitably carried on.

As to the second alternative, a rise in metal prices, until these meet the cost of production, this is bound to come eventually when the world's markets again approach normal conditions, and when that will be depends upon how soon the world—particularly Europe, where our great market lies—settles down to pre-war industry and is able to buy our products.

These conditions apply particularly to the larger and lower-grade mines, necessarily working on narrower margins per ton, rather than to the high-grade ores produced in smaller quantities and with wider margins between costs of production and selling-prices.

It will be noted that during the year 1920 the prices of all the metals were held up to a fair and uniform price during the first nine months of the year, and then, about the end of August, all metal prices simultaneously dropped about 40 per cent. to the present prices, which are unreasonably low and below the cost of production.

This sudden collapse of prices was not due to any condition of mining or of the metal market, but was the reflex action of industrial conditions the world over, entirely apart from the mining industry.

It is reassuring to find, in the face of all these untoward conditions, that nevertheless the metalliferous mines of the Province, as a whole, still made a production valued at $19,665,965, as compared with a production in 1919 of $20,036,998—a nominal decrease of only $371,033, equivalent to less than 2 per cent.

The fluctuations of the market, already referred to, have caused some strange anomalies, as shown in the accompanying table of production; for instance, the quantity of copper

produced in 1920 is greater than was produced in 1919, but the average yearly price of the metal was so much lower in 1920 that the value of the product of the metal is less than in 1919.

The production of zinc under the existing conditions was unexpectedly large and is entirely due to the increased operations of the Consolidated Mining and Smelting Company at the company's *Sullivan* mine in East Kootenay.

During the last half of the year, in other places there has been little or no market for zinc ore, and a very small volume of sales of the metal; several of the larger zinc mines and refineries in the United States closed down early in the fall.

The collieries of the Province have more than held their own this year, having made a net coal production of 2,595,125 tons, valued at $12,975,625, and 67,792 tons of coke, valued at $474,544. The total value of the colliery products for the year was $13,450,169.

The net coal production for 1920 exceeds that of the previous year by 327,584 tons, and, as a matter of fact, it has only twice been equalled in quantity—i.e., in the years 1910 and 1912, when it was but slightly greater.

The old adage that "It's an ill wind that blows nobody good" is illustrated by the falling-off of the California oil-supply, thus causing a greatly increased demand for coal, particularly from the Coast collieries.

There was no coke made by the Coast collieries this past year; the Crowsnest Pass Colliery produced 67,792 tons, an increase over its last year's output.

The following table shows the number of mines which shipped ore during the year 1920, 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 1920.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1920.	Men employed in these Mines.		
				Below.	Above.	Total.
CARIBOO DISTRICT:						
Omineca	4,000	1	1	12	20	32
CASSIAR DISTRICT:						
Atlin, Stikine	...	..	...	...	...	...
Queen Charlotte, Portland Canal, Skeena, and Nass River	944,208	10	7	447	358	805
EAST KOOTENAY DISTRICT:						
Fort Steele	267,381	3	3	209	129	338
Windermere-Golden	1,977	6	3	35	15	50
WEST KOOTENAY DISTRICT:						
Ainsworth	18,213	20	11	100	55	155
Slocan and Slocan City	59,768	32	12	252	142	394
Nelson and Arrow Lake	6,189	6	4	49	40	89
Trail Creek	67,714	5	4	156	79	235
Revelstoke, Lardeau, and Trout Lake	91	3	..	10	5	15
BOUNDARY-YALE DISTRICT:						
Greenwood, Grand Forks, and Osoyoos	84,125	24	8	187	155	342
Similkameen, Nicola, and Vernon	18,996	2	1	101	107	208
Yale, Ashcroft, and Kamloops	1,025	3	1	18	17	35
LILLOOET DISTRICT	200	1	1	...	...	...
SOUTHERN COAST DISTRICT, V.I.	6,183	3	2	17	46	63
SOUTHERN COAST, MAINLAND	698,117	2	2	328	262	590
Total	2,178,187	121	60	1,921	1,430	3,351

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	15	19	34	37	35	72
East Kootenay	5	10	15	10	15	25
Ainsworth	6	21	27	9	5	14
Slocan	14	30	44	28	12	40
Nelson	5	21	26	7	13	20
Trail Creek	1	7	8	..	1	1
Revelstoke-Lardeau	8	8	16	12	10	22
Boundary-Yale	9	41	50	9	37	46
Lillooet	3	5	8	4	3	7
Southern Coast	6	17	23	37	44	81
Total	72	179	251	153	175	328

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 1920, aggregating $706,192,978. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of $212,573,492; followed next in importance by copper at $161,513,864, and next in order is lode gold at $102,753,823, with placer gold in fourth place at $75,944,203.

TABLE II. shows the value of the total production of the mines of the Province from 1852 to 1892 (inclusive) and for each year from 1893 to 1920 (inclusive), during which period the output increased tenfold, and reached a gross production for the year 1920 of $35,543,084.

The value of the total mineral production of the Province up to the end of 1920 was $706,192,978.

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 $64,900 and a decrease in output of lode gold of $669,253, making a total decrease of $734,153 in the total production of the precious metal.

The amount of silver produced this past year was 3,377,849 oz., having a gross value of $3,235,980, a decrease in the number of ounces produced of 25,270.

The table shows an output of lead amounting to 39,331,218 lb., valued at $2,816,115, an increase in quantity of 9,855,250 lb. and in value of $1,289,260.

The production of copper this year was 44,887,676 lb., valued at $7,832,899, an increase in amount of 2,428,337 lb., or about 5 per cent. The value of the product was less than that of the preceding year by $106,997, due to lower prices.

The other metals are specifically mentioned under the headings which follow this summary.

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

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

The Southern Coast District also derives a fair proportion of its production from "Miscellaneous products," such as building materials, etc., due to the larger cities therein; this year this amounted to $1,968,876, as shown in Table V.

TABLE V. is an endeavour to show in some detail the production of those products, such as building materials, previously summarized under "Miscellaneous products," and which amounts this year to $2,426,950. 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 1920, and shows a total production of $75,944,203. The output for 1920 was $221,600, a decrease, as compared with the previous year, of $64,900.

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 $384,469,658; this figure includes the zinc production of 1909 and all subsequent years.

TABLE VIII. contains the statistics of production of the coal-mines of the Province. The total net amount of coal produced to the end of 1920 was 54,209,495 tons (2,240 lb.), worth $188,789,808. Of this, there was produced in 1920 2,595,125 tons valued at $12,975,625. 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 1920 was 101,649 tons, from which was made 67,792 tons of coke, having a value of $474,544, a decrease in amount from the preceding year of 23,346 tons. The total value of the output of the collieries of the Province in 1920 was $13,450,169.

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 1917, 1918, 1919, and 1920, 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 1920 was 2,178,187 tons, having a gross value of $19,444,365, and, with the placer gold, a total value of $19,665,965.

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

Cassiar and Omineca District	948,208
Southern Coast District	704,300
Boundary-Yale District	104,146
Slocan Mining Division	59,768
East Kootenay District	269,358
Trail Creek Mining Division	67,714
Ainsworth Mining Division	18,213
Nelson Mining Division	6,189
Other Mining Divisions	291
Total	2,178,187

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 thirty years, lode-mining did not begin, practically, until 1894, since when it has risen with remarkable rapidity, though not without interruption, until it reached

its maximum in 1916, the $31,500,000 line. The total mineral production in 1910 reached the $26,000,000 line, in 1912 it reached the $32,000,000 line, in 1916 the $42,000,000 line, while this year it is just a little above the $35,500,000 line.

GOLD.

Placer Gold. The recovery of placer gold for 1920 was $221,600, of which practically all was obtained in the Cariboo and Cassiar Districts, only about one-twentieth of the total coming from the other districts. An approximate apportionment is as follows: From Cariboo District, $69,000; Atlin, Stikine, and Liard Divisions of Cassiar District, $138,000; remaining parts of the Province, $14,600. This production for 1920 shows a decrease from the preceding year of $64,900, or about 23 per cent.

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

Information available regarding the Atlin Division shows that the production was considerably less than in 1919, and that some of the former operating companies were closed down during the year.

Gold from Lode-mining. The value of lode gold produced in 1920 was $2,481,392, as compared with $3,150,645 in 1919, a decrease of $669,253, or about 21 per cent. During the year 1919 the Granby Company closed its mines and smelter in the Boundary-Yale District and therefore only made a clean-up production during the past year. The low-grade copper ore handled carries small gold and silver values, and in former years this gold production amounted to a considerable total. The *Nickel Plate* mine in this district also made a decreased production, the mine being closed down since September, 1920.

The Rossland mines, which prior to 1917 contributed annually about one-half of the output of lode gold, made a decreased production in 1920 as compared to the preceding year; during these two years about one-quarter the normal output was made.

The following table shows the gold production of 1919 and 1920:—

	1919. Oz.	1920. Oz.
Cassiar District	60,076	54,531
Rossland (Trail Creek)	50,229	36,425
Boundary-Yale	33,526	20,687
Coast (Southern)	5,514	6,031
Lillooet	2,506	120
Nelson	297	1,924
All others	278	330
Totals	152,426	120,048

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

The increase in Nelson Division is large and is mainly due to the *Nugget* mine being again operated. Developments in this district at present under way may bring the production up again to that of former years.

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

SILVER.

The quantity of silver produced was 3,377,849 oz., worth $3,235,980, a decrease from the production of 1919 in quantity of 25,270 oz., and a decrease in value of $356,693, or nearly 10 per cent.

The market price of silver gradually but steadily fell during the whole year of 1920; the average price for the month of January was 132.83 cents an ounce, while for the month of December the price was about 65.8 cents an ounce, with a falling market. The average price for the year was 100.9 cents an ounce.

An accompanying diagram illustrates the fluctuations of market prices.

The following table shows the silver production for 1919 and 1920:—

	1919. Oz.	1920. Oz.
Slocan and Slocan City	1,556,714	738,515
Skeena	920,413	1,317,832
Boundary-Yale	231,599	390,994
Fort Steele	205,500	362,143
Ainsworth	167,453	266,963
Coast (Southern)	104,806	93,417
Omineca	72,573	103,020
Windermere-Golden	68,634	53,510
Nelson	44,280	7,065
All others	31,147	44,390
Totals	3,403,119	3,377,849

The above table shows an increase in the silver production from the Omineca, Skeena, Fort Steele, Boundary-Yale, and Ainsworth Districts, with decreases in all the others.

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

The greatest decrease is found in the Slocan District, where mining has been greatly retarded due to labour troubles with the O.B.U., and has nothing to do with the mines proper.

It is a pleasing surprise to find a very considerable increase in the Boundary-Yale District, despite the cutting-off of the production of the Granby and Canada Copper Corporation, which formerly produced 50 per cent. of the silver of the district.

The silver-output of this district this year is chiefly derived from the *Providence*, *Horn Silver*, *Sally*, and *Bell* mines.

COPPER.

The amount of copper produced in 1920 shows, as compared with the previous year, an increase in quantity, but owing to the lower market selling-price, a small decrease in value. The production was 44,887,676 lb., which is 2,428,337 lb. greater than the 1919 output; the value for this year is $7,832,899, which, compared with $7,939,896 made in 1919, shows a decrease of $106,997.

The demoralized condition of the copper market during 1919 was referred to somewhat fully in the report for that year, so that it is not necessary to further discuss it here.

The following table shows the production of copper, according to districts, in 1919 and in 1920:—.

	1919. Lb.	1920. Lb.
Skeena	20,411,421	26,153,406
Coast (Southern)	17,062,100	16,311,962
Boundary-Yale	3,835,516	1,306,515
Trail Creek Division	1,112,133	1,113,085
All others	38,169	2,708
Totals	42,459,339	44,887,676

From the above table it will be seen that there has been a large increase in the Skeena and a small increase in the Trail Creek Division. In the Coast (Southern) District the main producer was the *Britannia*, and this property mined and milled a larger tonnage in 1920 than in any previous year. Considering the adverse market conditions, this increased production of the Britannia mine shows the satisfactory condition of the property.

In June, 1919, the Granby Company was forced to close down the low-grade mines at Phoenix and smelter at Grand Forks, resulting in a great decrease in the copper production of Boundary-Yale District.

The Granby Company made an increased production at the mines and smelter at Anyox, with the result that the copper production was greater than that of last year.

The *Marble Bay* mine at Vananda was not operated during the year.

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

LEAD.

The total amount of lead produced in 1920 was 39,331,218 lb., valued at $2,816,115. This represents, as compared with the previous year, an increase in quantity of 9,855,250 lb. and an increase in value of $1,289,260, or about 84 per cent.

Lead is the only one of the metals the market price of which was greater than in 1919, the average price for the year 1920 being 7.957 cents a pound.

Immediately after the Armistice and during early part of 1919 the price of lead in New York fell to 5 cents, but by the end of the year had gradually risen to 8 cents, and remained at about that price until September, 1920, when, in company with all the other metal prices, it fell rapidly, and at end of the year had reached the pre-war standard of about 4 cents.

The following table shows the production of lead, according to district, for the years 1919 and 1920:—

	1919. Lb.	1920. Lb.
Fort Steele	10,729,483	26,926,319
Slocan	12,156,845	6,135,581
Ainsworth	4,336,602	4,072,807
Windermere-Golden	1,659,279	1,095,486
Nelson	292,010	719,219
All others	301,749	381,806
Totals	29,475,968	39,331,218

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

The Fort Steele District this year made an output over double that of 1919, and this year leads all the other districts. This great increase is due to the great output of the *Sullivan* mine, owned by the Consolidated Mining and Smelting Company, of Trail. The *North Star* mine produced about 1,330,000 lb. lead.

In the Slocan District the heaviest producer in 1920 was the *Silversmith*, followed by the combined Clarence Cunningham mines and the *Standard*.

In the Ainsworth Division the largest producer was the *Florence*, with an output of about 1,500,000 lb., followed by the *Bluebell*, with approximately 1,400,000 lb., and fourteen smaller shippers.

The lead production of Nelson Division comes mainly from the *Emerald* mine, and this mine produced very much more than in the previous year.

The production from Windermere-Golden was chiefly from the *Paradise* mine, with a production of about 911,258 lb., and three small shippers.

ZINC.

The quantity of zinc produced in 1920 amounted to 47,208,268 lb., which, compared with 56,737,651 lb. produced in 1919, shows a decrease of 9,529,383 lb. This production is valued at $3,077,979, which shows a decrease, as compared with the 1919 value, of $462,450, or about 17 per cent.

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

During the latter half of 1920, although the prices of the metal were sustained, there were but small sales and the market for zinc ore disappeared, while many zinc-smelting plants and mines on this continent closed down temporarily at least.

The average price in New York for the year was about 7.9 cents a pound; the market price at end of the year was about 5.8 cents.

The following table shows the production of zinc, according to districts, for the years 1919 and 1920:—

	1919. Lb.	1920. Lb.
Fort Steele	46,460,703	42,881,092
Slocan	10,015,624	3,715,471
Omineca	224,539	453,512
Ainsworth	36,785	158,193
All others	.....	.....
Totals	56,737,651	47,208,268

Some uncertainty was felt as to the production of zinc this year, as labour troubles have been general in the zinc-producing districts and considerable ore has been shipped to the United States.

From the above table it would seem that most of the zinc ore mined in the Province this last year was from the Fort Steele District. The output in this district was made chiefly by the *Sullivan* mine, and was due to a large tonnage being sent to the Consolidated Company's electrolytic zinc-refinery at Trail, where the ore is treated.

In the Slocan District the heaviest shipper was again the *Standard*, with a production of nearly 2,000,000 lb., which, however, is about 2,500,000 lb. less than in 1919. The next largest shipper was the *Idaho* mill, followed by the *Silversmith*.

The figures for Ainsworth show a greatly increased production.

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

OTHER MINERALS.

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

Further investigation of the Taseko limonite-deposits was made during 1920 by a party sent out by the Department of Mines. The deposits were also examined in detail by Dr. J. D. MacKenzie, of the Geological Survey of Canada.

The only shipment of iron ore made this past year was of 220 tons from the *Iron King* at Alta Lake to Vancouver.

Platinum. The well-known fact of the wide occurrence of platinum throughout the Province in connection with our placer-gold deposits gives reasonable hope that such may be found in payable quantities and justifies further investigations. As far as reports received indicate, the only output this year is about $400 worth from the Similkameen District.

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

Chromite. In 1918 about 800 tons of chromite ore, carrying from 30 to 45 per cent. chromic oxide, was shipped from the *Mastodon* claim, Grand Forks Division; and a deposit on Scottie creek, near Clinton, was opened up, but no shipments were made. With the end of the war the market for chromite temporarily collapsed, as large stocks were available, with no purchasers in sight. It is believed that no ore was shipped in 1919 or 1920.

Manganese. Nearly 600 tons of manganese ore, running over 50 per cent. manganese and less than 20 per cent. silica, was shipped from the *Hill 60* property on Cowichan lake before the roads became impassable through winter rains. The company has installed an aerial tramway, which should prevent, in the future, interruption to sustained shipments. During the latter part of the year shipments ceased and development-work only was carried on.

Non-metallic Minerals. About 7,500 tons of fluorspar concentrates was shipped from the *Rock Candy* group, in the Grand Forks Division. This property is owned by the Consolidated Mining and Smelting Company and is equipped to make steady shipments in the future. The growth of this property has been very interesting during the last two or three years. The property is now equipped with an efficient concentrating-mill, in which about 20,000 tons of ore was treated, producing nearly 7,500 tons of concentrates, carrying about 87 per cent. calcium fluoride and 6 per cent. silica, and having a total value of about $175,000. The mineral is shipped to the Trail smelter and is used for making hydrofluoric acid, which is used in the lead-refinery, and to other points in Canada and to the United States.

Shipments of magnesium sulphate (Epsom salt) were made from Spotted lake, Osoyoos Division, but figures have not been obtained. About 1,100 tons of magnesium sulphate was said to have been 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.

A production of arsenic valued at $22,000 was made by the *Nickel Plate* mine in 1920.

Talc.—Some 100 tons of talc was mined and ground in the Victoria Mining Division, for which product there appears to be a large demand.

Iron Pyrites.—At the *Sullivan* mine in East Kootenay some 4,300 tons of iron pyrites was mined and shipped to Trail.

COAL.

The gross production of coal in 1920 was 2,696,774 long tons, of which 101,649 tons was made into coke, leaving the net production at 2,595,125 tons. These figures show an increase, as compared with 1919, of 287,826 tons gross and of 327,584 tons net. The quantity of coke made was 67,792 tons, which is a decrease of 23,346 tons as compared with 1919. For purposes of comparison the following table is shown:—

	1915.	1916.	1917.	1918.	1919.	1920.
Coal, gross.....tons, 2,240 lb..	1,972,580	2,485,580	2,398,715	2,578,724	2,408,948	2,696,774
Less made into coke "	361,451	401,487	248,740	276,479	141,407	101,649
Coal, net..... "	1,611,129	2,084,093	2,149,975	2,302,245	2,267,541	2,595,125
Coke made..... "	245,871	267,725	159,905	188,967	91,138	67,792

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

	1917.	1918.	1919.	1920.
Vancouver Island mines.....tons, 2,240 lb.	1,695,721	1,666,211	1,699,348	1,698,254
Nicola and Similkameen mines..... "	151,243	179,179	149,042	149,731
Crowsnest mines..... "	551,751	732,864	558,806	847,389
Omineca-Telkwa ..... "	....	470	1,752	1,400
Total quantity of coal mined.. "	2,398,715	2,578,724	2,408,948	2,696,774
Less made into coke..... "	248,740	276,479	141,407	101,649
Net quantity of coal produced "	2,149,975	2,302,245	2,267,541	2,595,125

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

	1917.	1918.	1919.	1920.
Vancouver Island collieries.....tons, 2,240 lb.	30,406	24,887	34,071	*Nil*
Nicola and Similkameen collieries... "	*Nil*	*Nil*	*Nil*	*Nil*
Crowsnest District collieries..... "	129,499	164,080	57,067	67,792
Total coke production.. ... "	159,905	188,967	91,138	67,792

As will be seen from the above figures, the net coal production this year is 327,584 tons more than it was in 1919, and greater than it has been since 1912.

The production of coke in 1920 was 67,792 tons (2,240 lb.), which is 23,346 tons less than the preceding year. This gross coke production was made by the Crow's Nest Pass Coal Company in East Kootenay.

The greater part of the gross Provincial coal production is still being mined by three companies—the Crow's Nest Pass Coal Company of East Kootenay, the Canadian Collieries (Dunsmuir), and the Canadian Western Fuel Company of Vancouver island, which mined, collectively, 77 per cent. of the gross output.

Of the other collieries: In the Coast District, on Vancouver island, the Pacific Coast Coal Mines, Limited, produced 94,904 tons; the Nanoose Collieries, Limited, 32,500 tons; and the Granby Company, from a new colliery near Cassidy, produced 201,589 tons. In the Nicola Valley section of the district, the Middlesboro Colliery Company mined 87,602 tons; the Fleming Coal Company 32,122 tons; the Princeton Coal and Land Company 20,717 tons; the Coalmont Colliery 8,983 tons; and the Chu Chua Colliery 307 tons of coal.

A new coalfield has been opened up in the Omineca District, where a small colliery is being developed on the Telkwa river that last year shipped 1,400 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 696,375 tons, the Corbin Coal and Coke Company produced 151,041 tons.

The collieries of the Coast District, including the Nicola-Princeton and Telkwa fields, are to be credited this year with about 69 per cent. of the total coal-output.

The gross output of the collieries of the Province for the past year was, as already stated, 2,696,774 tons; there was also 56,244 tons of coal taken from stock.

Of this gross amount, there was sold for consumption in Canada, 1,384,005 tons; sold for consumption in the United States, 792,293 tons; sold in other countries, 7,647 tons; making the total coal sales for the year 2,183,945 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 101,649 tons, and used under companies' boilers, etc., 261,312 tons; while 206,112 tons was lost in washing and screening.

The coke sales of the Province for the past year amounted to 67,523 tons, and a further 269 tons was added to stocks on hand.

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.	1,178,929	205,076	1,384,005
" export to United States ..... "	312,951	479,342	792,293
" export to other countries ..... "	7,647	.....	7,647
Total coal sales	1,499,527	684,418	2,183,945
COKE.			
Sold for consumption in Canada .....tons, 2,240 lb.	.....	35,805	35,805
" export to United States ..... "	.....	31,718	31,718
" export to other countries ..... "	.....	.....	.....
Total coke sales	.....	67,523	67,523

COLLIERIES OF COAST DISTRICT.

The Collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields, and a small colliery on Telkwa river mined 1,849,385 tons of coal in 1920, in addition to which 58,769 tons was taken from stock, making 1,908,154 tons distributed from these collieries in 1920. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	1,178,929	
Sold as coal in United States	312,951	
Sold as coal in other countries	7,647	
Total sold as coal		1,499,527
Used under companies' boilers, etc.		202,515
Used in making coke		.....
Lost in washing, etc.		206,112
		1,908,154
Minus coal taken from stock		58,769
Gross output		1,849,385

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, an increase of 117,408 tons, equivalent to about 8 per cent.

The coal sold in Canada by the collieries of the Coast District this year shows an increase of 187,452 tons, or about 18 per cent. from the preceding year; the amount exported to the United States was 77,691 tons less than the preceding year, a decrease of about 20 per cent.

There was no coke produced in the Coast District this year.

On Vancouver island five companies produced coal this year—the Canadian Collieries, Limited, the Canadian Western Fuel Company, the Granby Consolidated Mining, Smelting, and Power Company, the Pacific Coast Coal Mines, and the Nanoose Collieries, Limited; the majority of these companies each operate two, or more, collieries. The combined gross output of the Island collieries was 1,698,254 tons.

In the Nicola and Princeton coalfields of the Coast District, the Middlesboro Colliery Company produced 87,602 tons of coal; the Fleming Coal Company 32,122 tons; the Princeton Colliery, 20,717 tons; the Coalmont Collieries, 8,983 tons; and the Chu Chua Collieries, 307 tons.

The total output of this portion of the sub-district was 149,731 tons. The Telkwa Collieries produced 1,400 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 696,375 tons; and the Corbin Coal and Coke Company, which made an output of 151,014 tons; making a gross output for the district for 1920 of 847,389 tons of coal.

Of the coal mined, 2,525 tons was added to stock, making the amount of coal distributed from the collieries 844,864 tons.

Of this gross tonnage, 101,649 tons was used in the manufacture of coke, of which there was produced 67,792 tons (2,240 lb.).

The coke sold this year amounted to 67,523 tons, in addition to which 269 tons was added to stock.

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

	Tons.	Tons.
Sold as coal in Canada	205,076	
Sold as coal in United States	479,342	
Total sold as coal		684,418
Used by the companies in making coke		101,649
Used by the companies under boilers, etc.		58,797
		844,864
Plus coal added to stock		2,525
Gross output		847,389

BUILDING MATERIALS.

The output during 1920 of structural materials, such as cement, lime, building-stone, sand and gravel, brick and other clay products, was considerably greater than in the preceding year, being $2,176,460 as against $1,148,485.

Approximately 90 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.

It is probable that an output amounting to about $1,000,000 represents the steady yearly demand for these materials for use in repairs, renewals, and various small demands, with but little new construction-work, and the increment shown in this year's production would seem to indicate a revival of new construction-work and a partial recovery from war-time depression.

The increase in the cement-output, which is more than 200 per cent. greater than in 1919, is a pretty sure indication of building activity.

On the other hand, there has been practically no production of building-stone, and only a small production of red brick, which would seem to indicate the substitution of concrete for stone and brick.

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

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

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

Red Brick. The sale of red brick during the past year was about 6,100 M.; the price varies from $12 to $17 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. Firebrick is the principal manufactured article produced by this company, but, in addition, considerable quantities of common brick, paving-brick, tiles, drain-pipes, and prepared fireclay are made.

Lime. The manufacture of lime is conducted in a small way at a large number of points in the Province, but only on the Coast has any attempt been made at more extensive operations. In the neighbourhood of Victoria, on Esquimalt harbour, two kilns are in operation, and there is a kiln on Saanich inlet. On Texada Island—in addition to the 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 1920 is valued at $338,151, as compared with $204,538 in 1919; of this about $48,000 worth of limestone was quarried for use as smelter flux by the Granby and Consolidated Companies and $25,224 worth quarried by the paper and pulp mills for their own use.

Portland Cement. There were two large and well-equipped cement plants in the Province, both situated on Saanich inlet. These two concerns have recently been amalgamated under the name of the British Columbia Cement Company, with plant at Tod inlet, which made a production in 1920 of over $800,000. Portland cement is thus the most important item in the production of building materials.

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

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; John Adams as Laboratory Assistant; H. T. Nation, general office assistant; and S. Hodgkinson, clerk.

MINERAL SURVEY DISTRICTS AND RESIDENT ENGINEERS THEREOF.

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:—

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

The North-eastern Mineral Survey District (No. 2) 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.

The Central Mineral Survey District (No. 3) 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.

The Southern Mineral Survey District (No. 4) 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.

The Eastern Mineral Survey District (No. 5) 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.

The Western Mineral Survey District (No. 6) 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 1920 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1920 there were made by the staff in the Government Assay Office, 2,658 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	$ 871 00
Fees for assaying	132 75
Fees for assayers' examinations	285 00
Total cash receipts	$1,288 75
Determinations and examinations made for other Government departments for which no fees were collected—	
Attorney-General's Department	$ 899 00
Agricultural Department	860 00
Board of Health	220 00
Treasury Department	27 00
Other departments	50 00
	$2,056 00
Value of work done outside of Mines Department work	$3,344 75

The value of gold melted during the year 1920 was $3,116 in 15 lots, as against $16,182 in 23 lots in 1919.

Free Determinations.

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

A considerable amount of time was spent by the Assay Office staff testing for potash from deposits on the west coast of Vancouver island.

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 1920 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act Amendment Act, 1899."

Examinations were held in Victoria, in the Government Laboratory, on April 12th, May 17th, and December 13th and the following days. Eleven candidates came up for examination. Seven

obtained the required number of marks and the Board recommended that Certificates be granted to them. Three candidates applied for exemption under section 2, subsection (2), of the Act, and the Board recommended that Certificates be issued to them.

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

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

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

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

Under section 2, subsection (2).

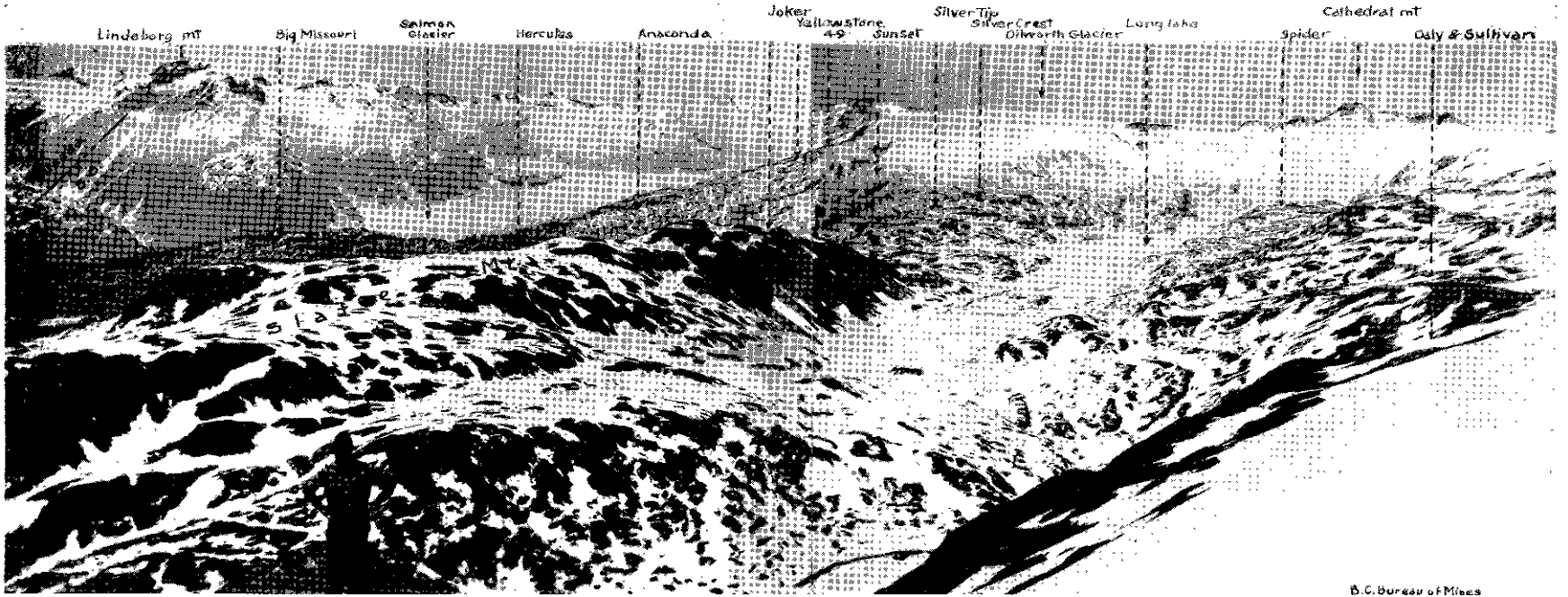
Archer, Allan	
Baylock, Selwyn G.	Trail.
Bissett, D. G.	Trail.
Bolton, George E.	Silverton.
Brennan, Charles Victor	Victoria.
Browne, R. J.	Rossland.
Browne, P. J.	Nelson.
Bryant, Cecil M.	
Burwash, N. A.	
Cavers, Thomas W.	
Clothier, George A.	Prince Rupert.
Cole, Arthur A.	Cobalt, Ont.
Cole, G. E.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

Under section 2, subsection (3).

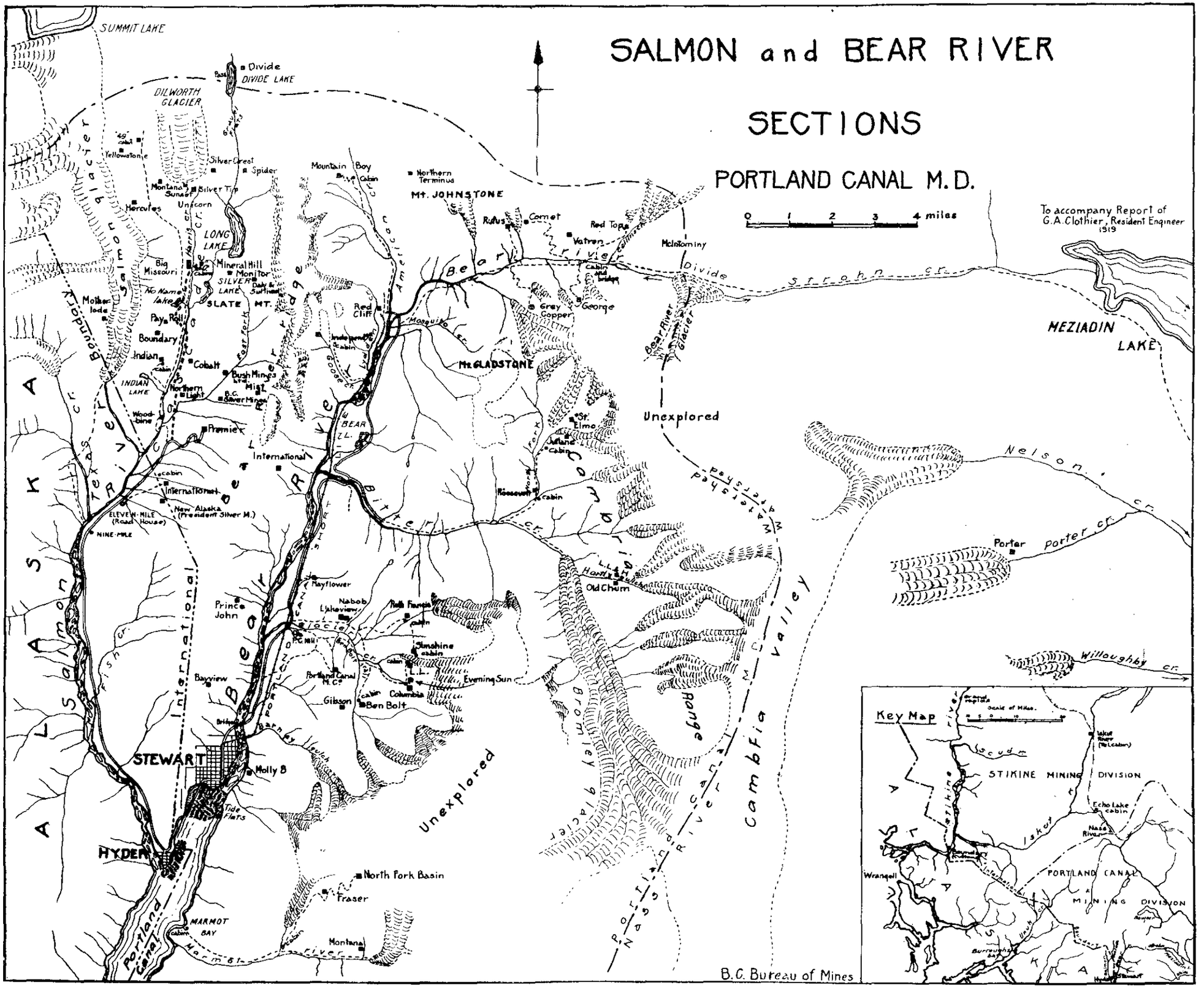
Carmichael, Herbert	Victoria.
Galloway, J. D. (Resident Engineer.)	Victoria.
Harris, Henry	Tasmania.
Hedley, Robt. R.	Vancouver.
Kiddie, Thos.	California.
Marshall, Dr. T. R.	London, England.
McKillop, Alexander	Vancouver.
Pellew-Harvey, Wm.	London, England.
Robertson, Wm. Fleet (Provincial Mineralogist.)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

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

Pinder, B.	
Thompson, James B.	Vancouver.



Headwaters of Salmon River, Portland Canal M.D.


SALMON and BEAR RIVER
SECTIONS
PORTLAND CANAL M.D.
0 1 2 3 4 miles
To accompany Report of
G.A. Clothier, Resident Engineer
1919
SUMMIT LAKE
DILWORTH GLACIER
Divide
DIVIDE LAKE
Silver Crest
Spider
Mountain Boy
Northern Terminus
MT. JOHNSTONE
Rufus
Comet
Red Tops
Vatren
McIntomny
Divide
Strohn cr.
MEZIADIN LAKE
LONG LAKE
Mineral Hill
Monitor
SILVER LAKE
SLATE MT.
Big Missouri
Mother lode
Pay Roll
Boundary
Indian
Cobalt
INDIAN LAKE
Bush Mines Ltd.
Northern Light
B.C. Silver Mines
Woodbine
Premier
Red Cliff
Mosquito cr.
Grey Copper
George
Bear River Glacier
Mt. GLADSTONE
Unexplored
St. Elmo
Julian
Roosevelt
International
New Alaska (President Silver M.)
ELEVEN-MILE (Road House)
NINE-MILE
Nelson cr.
Porter
porter cr.
Old Chum
Hannah
Mayflower
Prince John
Nabob
Lakeview
Ruth Francis
Sunshine
Portland Canal M. Co
Evening Sun
Columbia
Ben Bolt
Gibson
Bayview
Fish cr.
STEWART
Molly B
Tide Flats
HYDER
Unexplored
North Fork Basin
Fraser
MARMOT BAY
Portland Canal
Marmot
Montana River
Willoughby cr.
Key Map
STIKINE MINING DIVISION
PORTLAND CANAL MINING DIVISION
Wrangell
Echo Lake cabin
Iskut
Stikine
Portland Canal
Alaska
B.C. Bureau of Mines

NORTH-WESTERN DISTRICT (No 1).

REPORT OF GEO. A. CLOTHIER, RESIDENT ENGINEER.

INTRODUCTORY.

This district comprises the following eight Mining Divisions of the Province: Bella Coola, Skeena, Queen Charlotte, Nass River, Portland Canal, Stikine, Liard, and Atlin; the first three taking in the coast portion of this district, the remainder lying behind or east of the Alaska strip.

The boundaries of the two Divisions, Nass River and Portland Canal, have been somewhat altered this year, the upper or north half of the former being added to the latter. This change was thought advisable for the convenience of prospectors and others who had occasion to look up any records of claims located in the Meziadin Lake, Upper Nass, and Unuk River areas. Heretofore the records of claims in these areas, though reached by way of Stewart, were kept in Anyox. Claims staked in the Unuk River section can be attested to in Prince Rupert Recording Office and forwarded to Stewart for recording.

The main geologic and geographic features of the district, and the most likely prospecting areas and how to get to them, were outlined in last year's report. Of the three belts or zones into which the district may be divided—viz., the Coast Range granites, the Western Contact Belt, and the Eastern Contact Belt—the last mentioned has had the greatest amount of prospecting and development this year, though the increase in the number of prospectors throughout the district has been very evident. With the exceptions of the two centres of activities, Stewart and Alice Arm, there is room for hundreds of prospectors. When the comparatively small areas on the Eastern Contact Belt at the heads of Portland canal and Observatory inlet are compared with the remaining, absolutely unexplored portion of the belt, from the head of Salmon river north to Atlin, a distance of 250 miles, some idea of the enormity of the mineralized country and its wonderful probabilities can be gained. The discovery and development of a few more properties such as the *Granby* mine at Anyox, the *Dolly Varden* at Alice Arm, the *Premier* at Stewart, and the *Engineer* in Atlin would make it the greatest mineral-producing belt in the Province. While there is a great deal of it that is inaccessible, very appreciable proportions can be opened up from the Unuk river, the Stikine and Iskut rivers, and the Taku river, which empties into Taku arm just below Juneau. It is a well-demonstrated fact in this north country that it takes years to prospect, explore, and develop any region to the producing stage, and the Province should therefore make every effort to make these areas accessible to the prospector as soon as possible. The policy of keeping development and ore reserves well ahead of production applies equally as well to the Province as to the individual mine.

Though developments are proving that the formations of the Eastern Contact Belt are particularly favourable for the occurrence of the economic minerals, the Coast granites and the Western Contact Belt, with their exceptionally fine transportation facilities, should not by any means be overlooked by the prospector. A low-grade ore that would be of no value on the Eastern Contact Belt could make a mine on tide-water. The importance of the massive granites as a prospecting-field is exemplified in the quartz-deposits of the *Belmont-Surf Inlet* mine and others on Princess Royal island which lie in crushed and sheared zones in the solid granite. Replacements along intruding dykes in the granite is another type of deposit, such as the *Drum Lummon* on Douglas channel. Within the granite area are also broad belts of highly metamorphosed sedimentary rocks which have evidently been in a very favourable position to become heavily mineralized from the waters and heat escaping from the surrounding granite. The immense bodies of solid iron pyrite, carrying small amounts of copper as chalcopyrite, found on the Ecstall river are excellent examples of this type of deposit.

The Western Contact Belt is highly altered sedimentaries intruded by many spurs and masses from the main granite range, as well as by dykes of all kinds of igneous rocks, all tending to produce conditions conducive to the circulation of mineral-bearing solutions and ore-deposition. Apropos to this the following excerpt from F. W. and C. W. Wright's report is quoted: "It is probable that at many points along the western flanks of the batholiths (granites) the schists

now visible were so deeply buried at the time of the intrusion that the invading granite did not alter them so materially as to produce wide contact change. Strata near the surface at the time of intrusion should show more pronounced alteration from the magmatic solutions and the heat. It is significant that in these deep-seated schists and gneisses near the granite-contact no ore-bodies of consequence have been found, while rocks farther away from the granite and nearer the surface during its invasion in many localities show traces of contact metamorphism, as in spotted schists, and contain valuable metalliferous deposits."

While the off-shore islands as well as the Queen Charlotte group are in general well mineralized, there have not as yet been developed any large bodies of shipping-grade ore. Farther north, however, on the larger islands off the Alaska coast, there are several shipping properties. The *Salt Chuck* mine at the head of Kasaan bay, on Prince of Wales island, should be particularly noted, since it is the only mine on the Coast shipping ore in which the chief values are in palladium. The ore is a basic igneous rock, gabbro, carrying bornite disseminated and in small bunches. It therefore would be well for prospectors to have similar ore tested for platinum and palladium.

THE MINING SITUATION.

The past year has done much toward clearing the mining air in this district, and I believe that conditions are better and the outlook more favourable than ever before. Conditions were rather "feverish" in the spring owing to the many incorporations by broker operators who had the *Dolly Varden* and *Premier* veins "extended" for miles in all directions; however, the public were conservative in speculating in such promotions and the "boom" did not advance very far for that class of mining.

The provisions in the "Mineral Survey and Development Act" for the protection of investors (it would be impossible to protect speculators) are having a good effect in lessening "wild-catters." The investor should obtain information of the property from the prospectus which is required to be filed with the Registrar of Joint-stock Companies and submitted to the Resident Engineer, instead of being influenced by newspaper and handbill advertising.

Apparently, many prospectors are not aware of the fact that provision is also made whereby any one taking an option on their claims, either to purchase or to work, must give security for wages, payable every two weeks, to the Gold Commissioner, Government Agent, or Mining Recorder, otherwise they are personally liable for such wages. It would save a lot of trouble if every prospector, or any one in any way connected with mining, would familiarize himself with the "Mineral Act" and the "Mineral Survey and Development Act."

A great amount of work has been done in the Stewart and Alice Arm regions by companies and individuals who have had properties under option, and by the claim-owners themselves. While some of the results have been disappointing, in general they have been distinctly encouraging. In many cases the continuation of operations depended on the striking of high-grade ore, and this failing to happen the options were thrown up. Such properties are far from being condemned and will now be available to those with adequate capital to conclusively test them. It is being realized that it is not a "poor man's country."

There are a number of properties throughout the district under development that give every promise of reaching the shipping stage.

While Alice Arm and Stewart have probably been the centres of activities, the increase in the number and operations of prospectors in other sections of the district has been noticeable. The Coast and Coast islands have had considerable prospecting; the Queen Charlottes have been investigated by several engineers, and later in the fall and this winter much interest is being taken in the oil-shale areas on Graham island; the Kitsumgallum Lake section has had a lot of prospecting; and reports from the Atlin and Rainy Hollow sections show more lode-mining than for some years.

The Dease Lake country, while not making the production this year anticipated on account of the amount of dead-work that has had to be done, has nevertheless had quite a revival of interest in placer and hydraulic mining, and with the amendments to the "Placer Act" regarding leases coming into effect this year more extensive development may be expected. General conditions affecting gold-mining have, of course, been particularly severe on this outlying section, and combined with extreme scarcity of labour and the difficulties of transportation it is worthy of note that there has been any activity. The Atlin placer-diggings have had a very quiet year, there being fewer men engaged in this class of mining than for several years.

Transportation facilities have been greatly improved in all parts of the district, providing ways for getting in machinery for exploratory and development work and getting out ore. A great deal of assistance has been given by the Mines Department to claim-owners for trails to their holdings; to prospectors for rough trails into new areas; and in sending reconnaissance parties into new fields.

The returned soldier prospector scheme was tried out during the summer and proved fairly successful in so far as my district is concerned. About 50 per cent. of the men took a real interest in the work.

The Geological Survey of Canada completed its work in the Salmon River area this summer and made a preliminary topographical survey of the Kitsault River area. The Salmon River work was started in 1919 by Dr. J. J. O'Neil and completed this year by Dr. S. J. Schofield. The wide publicity given this area as an important producer of bonanza gold and silver ore will make the report and maps of great interest, not only to the local prospector and operator, but to all interested in the occurrence of such ore. It is to be hoped that this report and accompanying maps will be available at an early date.

Similar work in 1921 in the Kitsault River area would be of great value to that important mining section.

The following is a list of the shipping properties in District No. 1 and their outputs for 1920:—

PRODUCTION FOR 1920 FROM DISTRICT NO. 1.

Name of Property.	Location.	Ore Mined.	Gold.	Silver.	Copper.
		Tons.	Oz.	Oz.	lb.
Granby Consolidated Mining, Smelting, and Power Co., Ltd.	Anyox	802,667 17,786* 18,000†	7,615 1,715 ...	381,742 58,064 ...	25,404,950 ... ...
Golskiesh Mines, Ltd.	Anyox	3,454	475	1,960	...
Taylor Engineering Co., Ltd. (Dolly Varden)	Alice arm	93‡ 27,944	... ...	82,298 749,340	... ...
Esperanza group	Alice arm	18	4	3,788	...
Premier Gold Mining Co., Ltd.	Stewart	799	2,283	77,180	...
Patterson group	Porcher island	9	41	17	...
Ikeda Mines, Ltd.	Ikeda bay	141	27	805	21,088
Drum Lummon Mines, Ltd.	Drum Lummon Bay.	1,000	85	928	42,109
Belmont-Surf Inlet Mines, Ltd.	Surf inlet.	108,082	44,051	20,104	685,259
Totals for 1920 (exclusive of placer)		979,993	56,246	1,375,726	26,153,406
Totals for 1919 (exclusive of placer)		758,857	60,076	920,413	20,411,421
Increase		202,904	...	455,313	5,731,985
Decrease		...	3,820	...	...

* Fluxing quartz containing values. † Fluxing quartz containing no values. ‡ Sorted.

The placer-gold production of Atlin, Stikine, and Liard Divisions was $138,600, a decrease from that of 1919 of $38,400. The production from Skeena, Nass River, Portland Canal, and Queen Charlotte Divisions was $3,000, as compared with $17,000 in the preceding year.

Note by the Provincial Mineralogist.—The official returns of the Granby Company show that there was mined and smelted 802,667 tons of copper ore, containing 7,615 oz. gold, 381,742 oz. silver, and 25,404,950 lb. copper (losses in slag deducted). In addition, there was mined or quarried and used as flux in smelting the copper ore 35,786 tons of quartz, valued at $150,000, and 47,189 tons of limestone, valued at $48,000. In compiling the statistical tables for this Annual Report the value of this quartz and limestone flux has been placed in Table V. under the heading of "Crushed Rock and Flux," and the gold and silver contents of a portion of the quartz flux have not been entered in Table IX. The figures of metal production given by Resident Engineer Clothier in the above table differ, therefore, from the district totals in Table IX. by the amount of gold and silver contained in the quartz flux.

It will be seen by the above production that this year's output exceeds last by about $770,621, and compared with the output of 1915, the first full year of the Granby Consolidated operation at Anyox, of $4,400,000 shows an increase of $2,500,000 in five years. In that time the *Belmont-Surf Inlet*, *Premier*, and *Dolly Varden* mines have been added to the shipping-list.

This year the district produced about 46 per cent. of the gold, about 39 per cent. of the silver, about 58 per cent. of the copper, and altogether about 35 per cent of the total mineral production of the Province, including lead and zinc, of which there is no production in this

district. The increase in tonnage mined was over 180,000 tons. The only decrease in values was in gold, which fell off about 8,000 oz., due to the decrease in placer output and the smaller yield from the *Belmont-Surf Inlet* mine. Silver increased about 400,000 oz., due mainly to the splendid production of the *Dolly Varden*, and also to a substantial increase in the Granby output. Copper increased by 5,742,000 lb., due entirely to the increase of Granby's output of that metal.

The shipments from the *Premier* were less in value this year than last, though the tonnage was about 311 tons greater. The returns show 1,000 oz. less gold and 31,000 oz. less silver.

The Taylor Engineering Company's *Dolly Varden* mine increased its tonnage from 6,700 to 28,037 tons, the silver content increasing from 423,952 to 831,638 oz., or double of last year.

The *Belmont-Surf Inlet* mine increased its tonnage, mined and milled, by about 6,000 tons, but a decrease is noted in gold, amounting to over 7,000 oz.; in silver, 10,000 oz.; and in copper, about 125,000 lb.

The Granby Consolidated this year smelted 172,700 tons more than last year and materially increased its production of gold, silver, and copper. The increase in gold amounted to 4,470 oz., due to the increased tonnage smelted and to the gold contents of the quartz mined at Granby point and used for fluxing purposes. The silver increase was 71,400 oz., the excess over normal production being also due to the silver contents of the Granby Point quartz. The copper increase amounts to 5,860,000 lb. The by-products output of this company is given under the heading of the Granby Consolidated.

There is every reason to believe that the above-mentioned heavy producers can at least maintain their output for several years to come. In the case of the Premier Gold Mining Company the production next year will show a large increase; in fact, at the time of writing this, the middle of February, about $500,000 in gold and silver values have been shipped. Taking everything into consideration—the maintenance and probable increase of the outputs of the present producers, the very favourable outlook for more properties developing to the shipping stage within the next year or two, and the number of promising prospects throughout the District—I see no reason for other than a very optimistic forecast for the mining industry in this portion of the Province.

The district will be reviewed under the main headings of the Mining Divisions, subdivided into sections, as follows:—

Bella Coola Mining Division.

Queen Charlotte Mining Division—Graham Island section; Moresby Island section.

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

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

Portland Canal Mining Division—Portland Canal (proper) section; Marmot River section; Bear River section; Salmon River section; Meziadin Lake section; Unuk River section.

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

Liard Mining Division—Dease Lake Section.

Atlin Mining Division—Rainy Hollow section; Atlin section.

BELLA COOLA MINING DIVISION.

Interest is being shown in the magnetite-iron deposits on Seymour inlet, Dean channel, etc., as the prospects of the establishment of a steel industry on the Coast become more probable.

The Smelters Steel Company has been mining and shipping magnetite from its property on Dean channel to its smelter in Seattle.

Some stakings and yearly assessments on old claims are about all there is to report on mining.

SKEENA MINING DIVISION.

This Division takes in about 200 miles of the Coast range and Coast line and islands to the mouth of Portland inlet, and also includes a small portion of the Eastern Contact Belt from Lakelse lake north to the southern boundary of the Nass River Mining Division.

The outer Coast islands consist mainly of altered sedimentaries and probably mark the immediate contact of the Western Contact Belt with the main granites. The granite range is penetrated almost to the Eastern Contact by Douglas channel and Gardner canal. The latter

will, in all probability, some time be the outlet for all that mineral area east of the Coast range and known as the Sibola country.

Any part of the Coast or islands may now be reached from the different canneries and mills which are ports of call for Coast-plying boats. Prince Rupert, the western terminus of the Grand Trunk Pacific, is the distributing centre for up and down the coast, the Queen Charlottes, and the Interior.

There has been a noticeable increase in the amount of prospecting done this year throughout this Division. Prospectors will find that they will have no trouble in having their claims investigated, since there are Engineers in the field at all times who are very willing to look up anything of merit.

COAST SECTION.

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

Belmont-Surf Inlet Mines, Ltd.

This is a subsidiary company of the Tonopah-Belmont Development Company. The property and plant have been fully described in former reports; consequently this will be only a review of this year's operations. Development-work consists of 2,444 feet of raises, 1,900 feet of drifting, 911 feet of crosscuts, distributed over all the mine, and 133 feet of shaft-sinking to the new 900-foot level, a total of 5,388 feet. The mine has now three levels—700, 800, and 900—below the main working-tunnel, the 550-foot level. Ore has been proven on the 900-foot level on the west vein and is now being drifted on north from the shaft. New ore-bodies have been opened up during the year on the upper levels between the east and west veins and consist of irregular lenses, in many cases connected with the main veins.

Several new buildings have been added to the mine camp, including another bunk-house, laundry, a fine recreation-hall, a locomotive-shed, and seven cottages, making it one of the best-equipped mining camps, in every way, in the Province.

There were mined during the year 108,082 dry tons of ore, of which 107,976 tons went to the concentrator and 107 tons shipped direct to the Granby smelter at Anyox. Of the total tonnage mined, 100,313 tons was produced from stoping and 7,770 tons from development-work.

From the milling-ore 9,687 tons of concentrates was produced, which was shipped to Tacoma, yielding: Gold, 44,051 oz.; silver, 20,104 oz.; copper, 685,259 lb. Comparing these returns with those of last year, it will be seen that, though the tonnage is the greatest yet produced, the average metallic contents of the mine-run is somewhat lower, and the quantities of the three metal products therefore under the output of last year.

The average number of men employed throughout the year was 198—102 underground and 96 on the surface. Labour was scarce for the first ten months of the year, cutting down the year's output by about 25 per cent.

Development-work was carried on all year in the *Pugsley* mine, which has been purchased by the company. Over 2,000 feet of drifting has been done on this property.

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

Well's Claims.

This group is owned by Fred Wells, who was one of the original owners of the *Belmont-Surf Inlet* property. It is situated about a three-hour walk from the *Belmont-Surf Inlet* camp. Mr. Wells has built a fair foot-trail to the property, but the short distance in which to attain the elevation of the camp, 2,300 feet, makes it very steep in places. However, he has packed up his whole outfit, consisting of a car, rails, blacksmith outfit, mining-tools, etc., on his back, and driven a tunnel about 300 feet long.

The general rock formation is massive granite in which a shear-zone up to 10 feet in width has been partially replaced by quartz mineralized with pyrite and carrying gold and silver values, and similar in every way to the *Belmont-Surf Inlet* showings.

The work consists of a tunnel on the vein and some surface strippings. The vein is exposed on the left side of the creek above the cabin and has been open-cut with a few shots, exposing at this place about 10 feet of vein width. Three feet on the hanging-wall is banded quartz and gneissoid granite; then 2 feet of quartz; then 3 feet of gneissoid granite; then 2 feet of quartz to the foot-wall. The tunnel was started below this surface showing and follows the vein all the way to the face, a distance of about 300 feet. The first 150 feet exposes a small vein, up to 2 feet wide, of pyritized quartz. At this point the tunnel has been turned to the left and continued on a vein on the hanging-wall for the balance of the distance to the face,

the last 60 feet running from 4 to 5 feet in width. The face now shows a width of 3½ feet of well-pyritized quartz, which, judging by the *Belmont-Surf Inlet* ore, should be of good milling grade.

Altogether it is a very promising showing and will no doubt be further explored. Should sufficient milling-ore be opened up there will be no serious difficulties in putting in a tramway from the lake to the mouth of the tunnel. Mr. Wells has done good work under difficult conditions.

There has been considerable prospecting done on Princess Royal island this year and a number of claims staked on the north end in from Rivers bight. There was no one on the ground at the time of my trip, consequently I did not get over the showings; however, I am informed that the veins are the typical pyritized quartz ones of other parts of the island, and as yet are not sufficiently opened up to form any conclusive opinion as to their value.

Whale Channel Mines, Ltd.

This company was incorporated January, 1920, under a capitalization of 200,000 shares at $1 a share. The office is at 330 Homer Street, Vancouver. Its holdings consist of the three mineral claims—*Moose*, *Moose 2*, and *Moose 3*—situated on the north-western end of Princess Royal island just south of Rivers bight. The camp is on the beach about 200 yards below a small bay which is fair anchorage in good weather.

The showings start at about 425 feet elevation above the camp, from which there is a foot-trail about a mile in length. The first or lowest exposure shows a quartz vein about 8 feet in width, lying in a brownish schistose rock with some hornblende-schist, slightly intermixed with quartz on the walls of the vein. The vein strikes N. 70° E. and dips flatly to the north at about 40°. A tunnel has been driven at this point, crossing the vein at a small angle for 25 feet, then turning to the right for a further distance of 45 feet to the face, leaving the vein about 18 feet back from the face. This work shows the vein here to consist of barren quartz. About 200 feet farther up the hill, at 500 feet elevation, a shaft has been sunk on the vein, which, though full of water, I judge from the amount of material on the dump to be 12 or 14 feet deep. Some sorted quartz shows traces of chalcopyrite and a little pyrite in small veinlets on the fracture-seams. Both the tunnel and the shaft are evidently old workings. Farther along on the vein two open-cuts have been put in this summer showing the quartz to be more broken up, and, apparently as a result of this fracturing, the mineralization is better, but of low average copper content. The upper of these cuts discloses the vein 8 feet wide and shows it fairly well mineralized, but badly broken and distorted. The upper end of the cut shows the vein to be broken up into a number of stringers tailing out to nothing in the country-rock. No work has been done above this to prove what happens. The country-rock at the upper showings appears to be more of a fine gneissoid granite, due to intense crushing and shearing action, rather than the schists showing below.

What work has been done would indicate that where the vein has been crushed there has been an infiltration of mineral-bearing solutions and deposition of iron and copper sulphides in the cracks. Not enough of the vein has been opened up to conclude whether the ore-shoots are extensive or valuable enough to work. The claims are well timbered and favourably located for working.

Great West.

This claim is owned by W. Warner and is situated on the east side of Banks island, about 8 or 10 miles from the north end and opposite the anchorage on McAuley island. It is located at the head of a small bay which can be picked up by running close inshore. Warner's camp is on the right-hand side near the head of the bay, from which there is a trail across to the showings, or by landing at the head of the bay and following up the creek the workings can be found.

The showing on the claim is a small quartz vein about a foot in width, in which occur bunches of clean chalcopyrite. The vein lies in a small dioritic dyke cutting across a belt of gneissoid granite. Both the dyke and contained vein appear to be cut off or faulted by the granite at the top of the cut. Three or four cuts have been driven on the vein, opening it up for a length of 50 feet and, as stated, exposing some bunches of chalcopyrite, but I think it too small and tight in the surrounding formation to become of much importance.

Payroll Claims.

These are two in number—*Payroll* and *Payroll No. 2*—owned by James Hickey, of Prince Rupert, and partner. They (the claims) are situated at the head of Kiltuish or Long inlet, which is about 3 miles in length, with a fine

anchorage at the head. Care must be taken in going through the entrance. The inlet is on the south side of Gardner canal, opposite Low point, about 15 miles south of Verney passage.

The rock formation in which the vein lies is hornblende-schist, probably enclosed in the granite, as the rock float in the creek and slides is mainly granite. The showing is on the beach just above high tide and consists of a quartz vein about 6 feet wide where exposed, heavily mineralized with pyrrhotite, and a little chalcopyrite disseminated throughout the quartz and iron sulphides. The ore is low grade, about 1 per cent. copper, with only traces of gold and silver; however, I think the showing worth some work to get a few feet into it. It was only staked this summer and a couple of shots put in at the beach. Its location is so favourable that a comparatively low-grade ore would pay to work.

Up the hill at an elevation of 500 feet, and also in the schist formation, the owners have dug into the soft decomposed schists and disclosed a width of from 10 to 15 feet of graphite. It occurs in widths from 1 inch to 2 feet interstratified in the schists. If there is any market for such material this is surely easy of access, and conditions for extracting and loading are ideal.

Drum Lummon Mines, Ltd.

This company has its registered office at 1115 Dominion Building, Vancouver. The property, situated on Drum Lummon bay, 26 miles above Hartley bay, on the west side of Douglas channel, has been working steadily all season with a small crew of men. The property was reported on in 1919 Minister of Mines' Report. This year's work consists of driving the main drift, extending a raise towards the surface, some crosscutting, and the stoping of about 1,000 tons of ore. The main drift was extended about 170 feet, making a total of nearly 600 feet, the vein showing all the way, except in the last 100 feet, which followed the acidic dyke along which the vein has been made. The last 60 or 70 feet of the vein, to the pinch, showed good ore and about 1,000 tons was stoped from here. The barren quartz was sorted out as well as possible and the balance put through the mill, producing 37 tons of concentrates, yielding $620 in gold, $543 in silver, and $6,930 in copper. (Manager's statement.)

The milling process consists in crushing as finely as possible, about ¾ inch, in a small jaw-crusher; the crushed ore then passes over two sets of screens; the oversize from the first screen goes to a bull-jig, which makes a shipping concentrate and tailings. The undersize from the first screen passes to the second screen, from which the oversize goes to a fine jig and the undersize to a finer jig, each making a clean concentrate and tailings. The slimes are treated in a K. & K. flotation-cell. All jig tailings are impounded for future treatment.

The vein matrix is peculiar in that it is segregated into masses of quartz and feldspar with mica bordering these masses next to the granite walls. The best ore lies interlaminated with the mica and disseminated in the quartz and mica along the walls of the vein, though masses of pure bornite occur embedded in the quartz and feldspar. In mining, the barren quartz and feldspar can be taken down from the centre of the vein and the bordering ore broken out later, furnishing a good-grade mill-feed. Some fine gold nuggets are obtained on the jig screens. Mr. Thom has been in charge at the property this season.

Bald Mountain Group.

This group, on Porcher island, was fully reported on in the Minister of Mines' Report of 1916, since which time only assessment-work has been done. Briefly, the claims cover a shear-zone about 1,000 feet wide, lying between massive granite on the south and a wide quartz porphyry or pegmatite dyke on the north. Within this gneissoid-granite zone are lenticular segregations of hornblende-schist, with garnetite, epidote, etc., sparingly mineralized with chalcopyrite. Numerous open-cuts have been put in on these lenses, but none of them have been proven of any continuity. Diamond-drilling has been suggested as a means of exploring the ground, but in my opinion the surface showings, as yet, do not warrant the amount of diamond-drilling it would require to prove or disprove the existence of commercial ore-shoots in such a width of possible mineralization.

Porcher Island.

Patterson Group.

This group is situated on the north-western corner of Porcher island and was described in the 1919 Report. This year a very creditable amount of work has been done on the property by Percy Sharpe, who has had it under some sort of option. More open-cutting has been done on the main showing and a considerable tonnage of ore put on the dump for sorting or treatment. The vein is exposed for mining for a length of about 80 feet. I am informed that about 17 tons of ore was sorted out and shipped this season, giving returns of 50 oz. gold and 30 oz. silver.

Besides the mining-work a lot of construction has been done. A small ore-bunker was built just below the level of the lowest cut, the intention evidently being to start taking out ore from that level. From this a tramway 300 feet long was then constructed to carry the ore from the bunker to an arrastra being built to grind the ore. Power will be obtained by an overshot water-wheel, to which the water is carried from a ditch by a flume about 50 feet long. A ditch has been dug around the side-hill for over 1,000 feet to carry water from a small creek draining a considerable area on the east side of the mountain. Mr. Sharpe is deserving of success in his scheme for concentration for the amount of work he has accomplished in one season. This is a promising small property.

Eagle Claim.—The owner, Joe Dawson, has worked on the property all summer, but in his absence I was unable to examine it.

There are good reasons to believe that some of these small quartz veins on Porcher island will prove worth working, and I think that this area warrants close prospecting.

Ecstall River.

The Granby Consolidated Mining, Smelting, and Power Company has had a bond on the pyrites property of the British Columbia Pyrites Company on Ecstall river for the past two years, during which time several thousand feet of diamond-drilling has been done. No information is available as to the results obtained from this work, but the bond was thrown up this summer. The property has again been bonded to Charles Banks and associates, who have been operating this year in the Salmon River country. A number of additional claims have been staked in that vicinity by the bonders.

Grand Trunk Pacific Section.

There has been very little mining activity this year along the railroad and very little investigation by field engineers, for the reason that no inducement is offered in freight rates for opening up anything but high-grade ore. The freight on copper ore of $125 a ton values from Pacific, a point 119 miles east of Prince Rupert, to Anyox is $10.40 a ton in car-lots. On a lead ore of $25 a ton values the rate from Pacific to Tacoma is $5.40 a ton, and on a sliding scale up to $100 a ton values, on which the freight is $7.80 a ton.

Several claims were staked by Phil. Chesley and Doc. Stanwood on the opposite side of the Skeena river from Salvus. These cover a large area of granite in which there is a small percentage of graphite. If it should prove of concentrating grade there is evidently an immense tonnage available.

Lakelse Valley (Thornhill Mountain) Section.

This year's mining consisted of assessment-work on several groups of claims. On the *Ptarmigan* group the Michaud Bros. obtained some very fine samples of molybdenum. I did not have time to examine this or the *Society Girl* group, on which the owners, Bell & Mason, did some work.

Lucky Seven Group.

This group of claims is owned by Oleson & Dahl. Since reporting on these claims in 1918 no work has been done on any of them except the *Diamond*. At an elevation of 3,700 feet there is a vein of quartz varying from a seam up to 12 inches in width, lying very flat in a belt of dioritic-looking rock, from which the owners have taken out with mortar and pan between $3,000 and $4,000 from two or three small pockets. Considerable work has been done at this showing this year; an open-cut 75 feet long has been faced up for from 10 to 20 feet high along the vein and a tunnel started to drift in on the dip of the vein. The quartz itself carries a little free gold, but the main values are obtained from the oxidized seams and vugs. Sparing amounts of iron sulphides and galena are found in the quartz and considerable siderite is found in the decomposed portions. Heretofore it has been necessary to remove all the rock above the vein to the surface, but sufficient depth has now been obtained to allow them to drive a tunnel on the vein, which work may prove the gold content of all the quartz sufficient to pay. The property is worth investigating, for there are a number of veins that might be developed to produce enough tonnage to feed a small, centrally located milling plant.

Since writing the above I have learned that one of the partners, Andrew Oleson, has died of typhoid fever. He was a quiet, intelligent, hard-working "old-time" prospector in this section and will be missed.

Iron Hat. This claim was also owned by A. Oleson. The tunnel has been driven on the vein a further distance of 10 feet this summer and is now in 70 feet. The face shows about 3 feet of mixed quartz and country-rock fairly well mineralized with iron sulphides, which carry gold values up to 2 or 3 oz. to the ton, and when roasted pan free gold. The tunnel looks as if it were getting into the ore-shoot exposed on the surface by two or three open-cuts. Should the ore-shoot develop sufficient tonnage a small concentrating plant might pay. There is enough water in a small creek just below the tunnel to furnish power and milling-water for three or four months in the year.

Golden Penny. This claim is owned by Ernest Hault and adjoins the *Iron Hat* claim on the north. A tunnel has been driven 36 feet, following a quartz vein about a foot wide in a schistose country-rock. It is a similar occurrence to that on the *Iron Hat*, but not as well mineralized, and shows a little chalcopyrite in places. It is worth some more prospecting.

KITSUMGALLUM VALLEY SECTION.

This section has had an appreciable increase in mining activity this year. Several prospects have been developed by the owners and a number of new prospectors have been going over the country. Though the wagon-road from Terrace to Kitsumgallum lake is badly in need of repairs in places, supplies can be taken in by wagon to the lower end of the lake. From the lake it is only a matter of slashing out prospectors' trails up the different creeks flowing into it to make a big area accessible for prospecting. This year such a trail was built up Nelson creek by Cliff Baldwin and partner a distance of 13 miles, opening up that creek for exploration. This is the sort of work necessary all over this district and deserves encouragement.

Treadwell No. 2.—This group, situated on the east side of Kitsumgallum lake, has been worked all summer by the owners, Joe Belway, McLaren, and partners. Nothing important is reported.

Motherlode Group. There are three claims in this group—*Motherlode*, owned by Oscar Gendron; *New York*, owned by Jack Couture; and the *B.C.*, owned jointly by Gendron & Couture, of Terrace. I understand that Oscar Olauder and Paul Brodine have acquired an interest in the claims for work performed. The claims are located at the head of the South fork of Falls creek and about 5 miles by trail from Kitsumgallum lake. A good pack-horse trail has been built by the owners of this and the *Bear* group. A good cabin had just been finished on August 9th at an elevation of 5,200 feet, for which the logs were hauled about a mile.

The rock-slide just above the cabin is covered with float consisting of slaty-looking rock, in which are bands of quartz mineralized with zinc-blende, galena, chalcopyrite, grey-copper, with an occasional flake of native silver. The vein had not been definitely located in the bluffs above at the time of examination, and it was the intention of the owners to start a tunnel near the head of the slide and crosscut into the hill. The quality and quantity of the float-ore give every reason to believe that there is a good width of mineralization of at least milling-grade ore, with a good chance of finding plenty of ore that can be sorted to a shipping grade. Because of the elevation the working season is very short, about three months from snow to snow. It is a very interesting-looking property and the owners are deserving of credit for the aggressive manner in which they have gone at it under difficult conditions.

Later information is that the tunnel was driven about 40 feet, the last 20 feet showing stringers of ore through the country-rock. The owners claim to have found a width of mineralization of from 30 to 50 feet on the surface, and that the tunnel must be continued to get under the best-looking portion of the zone.

Bear Group. This group consists of four claims—*Bear*, *Hawk*, *Whistler*, and *Goat*—owned by Mat Allard, of Terrace; D. Wilson and P. Chesley, of Salvus; and G. F. Moncton, respectively, and situated at the head of Falls creek and about 5 miles from the lake. There is a good pack-horse trail from the lake to the property, built by the owners of this and the *Motherlode* group.

The prevailing country-rock is a schistose slaty rock, striking N. 10° E. and dipping easterly. The work has been done on the *Bear* claim and consists of a shaft and a number of open-cuts exposing for a distance of 600 or 700 feet a bedded quartz vein up to 4 feet in width, mineralized with iron pyrites and galena. A shaft has been sunk about 12 feet from the bottom of an

open-cut, exposing about a 20-foot face on the vein, showing a foot of solid ore, mostly galena. Free gold can be panned all along the vein where broken into, the honeycombed, disintegrated quartz panning very high in fine gold, due no doubt to the weathering-out of the iron sulphides. A depth of probably 60 feet could be obtained by drifting on the vein from the lowest open-cut, at the shaft, to underneath the highest point, which is at an elevation of 4,700 feet.

There are other parallel veins on the claims, but this is the only one on which any work has been done. With a small concentrating plant on Falls creek, about 600 feet below the croppings, where there is plenty of water-power and accessible to the lake, the vein, though small, might be profitably worked.

Sunlight Group.

There are two claims in this group—*Marmot* and *Sunlight*—owned by A. Egan and A. McKinnon, of Terrace. The claims are located at the head of Falls creek, on the opposite side of the valley from the *Bear* group. A trail was built last summer to the foot of the hill below the claims, branching from the *Bear* group trail and following up Falls creek. A. Egan has been working on the claims all summer and has done a very creditable amount of prospecting.

The rock formation is a banded slate striking N. 80° E. and dipping about 30° N. The vein is quartz varying in width from a seam on the west end, where the tunnel is started, to 12 feet on top of the cropping, and conforms in strike and dip with the country-rock. The tunnel was started on the steep face of a gulch cutting the vein on the west end; an open-cut 12 feet long was driven and continued a further 14 feet underground. All this work shows the vein to have pinched to a seam of black gouge, but, judging from the surface, the tunnel should in about 20 feet cut under a point on the vein on the surface where it crops 12 feet wide. The tunnel is at 3,800 feet elevation or about 3,400 feet above Kitsumgallum lake. Farther east a shaft has been sunk 17 feet on the dip of the vein, showing the quartz to be sparingly mineralized with iron pyrites and traces of chalcopyrite, with a few inches on the hanging-wall fairly well mineralized with zinc-blende and galena, assaying 40 per cent. lead, 20 oz. in silver, $2 in gold, and 3 per cent. copper. The vein is exposed for several hundred feet on the surface, but has not been broken into. Although the mineralization in the quartz is rather sparse and the values low, I think the size and strength of the vein sufficient to justify the continuation of the tunnel to the quartz.

Assessment-work has been done on the *Blue Grouse* and *Hunter* groups, about 6 miles up Cedar river from the crossing of the Telegraph trail. A good trail has been built from the crossing to these groups by the owners with Department of Mines' assistance. Very little prospecting has been done along the eastern side of Cedar river; in fact, the whole country in the vicinity of Kitsumgallum lake is well worth the prospectors' attention.

QUEEN CHARLOTTE MINING DIVISION.

The mining situation has not materially changed since reported last year. The old reliable shipper, the *Ikeda*, closed down early in the summer until such time as capital can be raised to develop the numerous showings on other parts on the property and equip it with a concentrator. Some little prospecting and development has been done on the west coast of Moresby island in Kootenay harbour.

The usual bunch of oil locations have been filed on Graham island. Last year about thirty oil locations on the east coast of Graham island, from Skidegate inlet north to Lawn hill, were acquired by W. A. Lewthwaite and Andrew Wright, of Victoria. The ground was thoroughly examined by their "oil expert," Henry Jory, and announcement made that drilling would commence as soon as a rig could be put on the ground, and that at least $150,000 would be spent on drilling. A hole about 30 feet deep was drilled on the beach, but the hole was not "brought in" in that depth and operations ceased.

Investigations are under way by people interested in oilfields elsewhere of the shales in the central portion of Graham island. A considerable area has been taken over by them and tests are being made of the oil content of the shales. This work has resulted in the staking of all the country surrounding the original group and about a hundred claims have been recorded. I would consider it a very doubtful investment for any one, outside of those directly interested in the industry, to put money into oil-shale lands at the present stage of the oil-shale industry on this continent. A plant to handle 1,000 tons a day would cost from $1,500 to $2,000 a ton, and judging from the yield of Scotch shales, about 24 imperial gallons a ton of shale, the contents

of the Graham Island shales would have to be appreciably greater. There is, however, a good chance of some drilling being done for oil.

Interest is again being shown in the coal-showings on Graham island.

In connection with the much-talked-of establishment of a steel industry on the Pacific coast, the magnetite-iron deposits on the mainland and the more northerly Coast islands of this district have been examined this year. There are extensive surface showings of magnetite on Moresby, Lyell, Louise, Porcher, and other islands indicative of immense possible tonnage, but as yet no exploratory work has been done by way of drilling or otherwise to prove any definite quantity of this iron ore. The discovery of appreciable bodies of hæmatite or limonite near tide-water would be of the greatest importance to the steel industry. The limonite-deposits on the Zymoetz river about 40 miles from Terrace are worth investigating. Nothing has been done beyond digging a few trenches to prove the extent of these deposits.

GRAHAM ISLAND SECTION.

South Easter Mining Co.

This property has had a couple of men employed on surface work during the summer, but there is no intimation of resuming work on a large scale. Judging from the nature of the ore on the surface and which extended to a depth of 50 feet, it is reasonable to suppose that other similar lenses of ore will be found in the veins below or beyond the present soft and broken vein-filling. The property was described in the report of 1918.

MORESBY ISLAND SECTION.

Blue Mule Group.

This group is comprised of three mineral claims—*Blue Mule*, owned by J. H. Jones, of Skidegate; *Paystreak No. 1*, owned by E. P. Wiggs, of Queen Charlotte; and *Paystreak No. 2*, owned by George McRae, of Skidegate. The claims were staked last fall and have been grouped for assessment and sale purposes. They are situated on the west coast of Moresby island, on the South arm of Kootenay harbour. This is a fine, landlocked, deep-water harbour, affording anchorage for any sized vessel, and is about 30 miles south of the western entrance to Skidegate channel. The claims are reached from Queen Charlotte, a port of call for the Grand Trunk Pacific boats from Vancouver and Prince Rupert. In favourable weather the trip from Queen Charlotte takes about a day each way. A good comfortable cabin has been built on the beach and a considerable amount of work done on the showings by the owners.

The lower claim of the group, the *Blue Mule*, is about half a mile from the beach. The rock formation from the beach to the foot of the hill is a belt of dark grey, bluish limestone in which are veins and stringers of pure calcite. The main mountain on which the claims are located consists essentially of a diabasic rock in which lie parallel shear-veins of brecciated country-rock and quartz more or less pyritized. The vein gangue varies from diabase, in which are numerous veinlets of quartz, to pure quartz. The values are mainly in gold contained partly in the pyrites and partly as free gold in the quartz and iron. Specks of free gold can be seen in the quartz and colours can be panned from almost anywhere along the vein.

The "lower" vein crops on the *Blue Mule* claim about 100 feet north-east of the contact between the limestone and the diabase. It strikes N. 60° E. and has been traced by open-cuts for over 100 feet. At the discovery posts, at an elevation of 125 feet, a sample was taken across the vein of about 26 inches of brecciated material, giving assay returns of $10 a ton in gold and 0.5 oz. a ton in silver. Farther west the vein pinches to about 8 inches in width.

A short distance farther up the hill another small vein crops, but no work has been done on it. Quartz knocked off the cropping where a small creek cuts it panned colours of gold.

Farther up the hill the "big vein" has been traced on the surface for 600 or 700 feet. It is easily followed by the outstanding croppings and open-cuts. At the cropping farthest west the vein is crossed by a small creek, showing it to be about 1 foot wide and consisting of banded quartz and country-rock. Pieces of quartz broken off show free gold. About 50 feet east of this point, at an elevation of 400 feet, the vein has been shot into exposing 2 feet of good-looking quartz on the foot-wall. A sample across this gave $2.40 in gold and a trace of silver to the ton. No visible gold could be detected in the sample. Just east of this cut the full width of the vein is exposed, consisting of 4 feet of quartz on the foot-wall and 3 feet on the hanging-wall of country-rock shot full of small veinlets of quartz. The vein has not been broken into here, but several pieces of quartz were broken off showing free gold. This will be a good place to obtain

a little depth by drifting on the vein. At a point 100 feet farther east along the vein a few shots have been put in, showing it to be from 2 to 3 feet in width and showing an occasional speck of gold. A grab sample from a small pile of the quartz gave only 80 cents a ton in gold and a trace of silver. Farther east about 300 feet the vein is well exposed along a perpendicular bluff, which would be a very favourable point to obtain about 200 feet depth on the vein with a comparatively short crosscut tunnel. A drift both ways on the vein for 100 feet or more would prove the average values in the vein. Still farther east the vein is cut by a creek and exposed on either bank for a height of 25 feet. It is here about 2½ feet wide of brecciated quartz and country-rock, with the quartz predominating. Beyond this the overburden is very heavy and the vein has not been exposed.

The old *Chapman* claim, now the *Paystreak No. 2* of this group, had very little work done by the original owners for the time and money spent. Some specimens of free gold were found.

There are other quartz veins on this property parallel to the above that have had no work done on them. Taking everything into consideration, I think the property one well worth investigating.

Swede Group. This is an old group of eight claims at the entrance to Klunkwoi bay. The showing consists of an immense deposit of low-grade copper ore, chalcopyrite, and bornite disseminated in diabase. Recent tests made on samples show appreciable values in platinum, which might warrant a thorough investigation of the property. All conditions for mining on a large scale are very favourable. Since the discovery of platinum and palladium values in the copper-bearing basic igneous rocks, gabbro, of Prince of Wales island, testing for such metals in similar formations in other localities should not be overlooked.

Shuttle Island.—No further development of any importance has been done on these claims and no gold produced from the beach placer claim this year.

Copper Queen Group. This group is owned by J. S. McMillan and situated overlooking Jedway harbour. Considerable work was done several years ago on the low-grade copper-showings, but only the yearly assessments have been done lately. The property was examined and sampled twice this summer, but nothing further has developed. Later the showings were examined as possible producers of magnetite-iron ore.

Campbell Island. This property is situated just outside of Jedway harbour. In the absence of the owner of the claims, W. Campbell, the only new work noticed was the sinking of the shaft a few feet. It was full of water, but judging by the dump the ore is chalcopyrite and a hornblende gangue. The chalcopyrite does not appear to be in sufficient quantity to admit of sorting to a shipping product. The island is low and heavily overburdened.

Producer Group. This group has been under bond and development for the past two years to Seattle interests, who ran a crosscut tunnel 375 feet to the vein and drifted both ways on it. Some bunches of fair-grade copper ore were found, but on the whole the work did not prove sufficiently encouraging to continue work. The claims have reverted to the owners, Thompson & McKinnon, of Jedway. There is about a foot of fair-looking ore in the face of the south drift, which drift, I think, should be continued to prove whether or not the ore-shoot showing on the surface rakes to the south. If it does the ore is still south of the present face. There is a very serviceable, small equipment of compressor, machines, and mining outfit on the property.

Ikeda Mines, Ltd. This property, which has been a consistent small shipper of copper ore for a number of years, under the management of A. Ikeda, closed down about the end of July. There was shipped this year 141 tons of ore to the Granby Consolidated Company's smelter at Anyox, yielding 27 oz. gold, 305 oz. silver, and 21,088 lb. copper, which is somewhat less than last year's output. The shipping grade of ore has been exhausted from the present workings, and Mr. Ikeda has been endeavouring to interest sufficient capital to explore several showings of low-grade ore cropping at different places on the claims, and in the event of successful results the later installation of a concentrating plant. There are several thousand tons of milling-grade ore on the old dumps. To this end capitalists from Japan, with their engineers, thoroughly investigated the property, and I am reliably informed that, with the return of financial conditions to normal, there is every probability that the property will be extensively developed. It is to be hoped that the *Ikeda* mines will be restored to the shipping class.

None of the properties on Collison bay, the *Thunder* group, *Meal Ticket* group, *Wireless* claim, or the property of the old Collison Bay Mining Company, since restaked, have had any work done on them this year.

NASS RIVER MINING DIVISION.

The area of this Division has been cut about in half; the northern portion, above a line from Mount Brown on the eastern boundary of the Portland Canal Division to the point on the eastern boundary of the Nass River Division crossed by the 56th parallel, being added to the Portland Canal Division.

The mining centres of the Division are Anyox and Alice Arm, reached by Grand Trunk and Union Steamship boats from Prince Rupert. From Alice Arm the Dolly Varden Railroad extends up the Kitsault river 18 miles; the balance of the distance to the glacier at the head of the river, about 8 miles, has a good pack-horse trail. Good foot-trails branch from the main trail up the different tributary creeks and to the more developed properties. There is a trail up the Illiance river, which flows into the head of Alice arm, for a distance of about 16 miles. From Mill bay, at the mouth of the Nass river, one can get as far as Ayansh by gas-boat, from which point there is an old trail up the Nass river to Meziadin lake. There is a trail along the Dominion Telegraph Line from Kitsumgallum lake to Ayansh, and from there through to Alice Arm, on the Eastern Contact Belt all the way.

The optimistic view expressed last year on the mining outlook has been verified this year not only by the actual production, but by the progress made in the exploration and development of a number of very promising prospects to the stage where they give every promise of becoming shipping properties in the near future.

Though this Division is probably the smallest in area, yet it is the greatest mineral-producing Division in the Province; this year's output from the two mines, the *Granby* and the *Dolly Varden*, aggregated about $5,646,900, of which the *Granby* is responsible for a little over $4,856,274 outside of the by-products from the coke plant. I see every reason to predict the steady growth of the mining industry in this Division. The present shippers may be expected to approximate their present rate of production, a number of the properties now under development should become shippers, and last, but not least, there is a good class of prospectors in the country. The increase in the amount of work done by prospectors in excess of requirements for assessments has been very apparent. The activities of the "claim-stakers" (not to be confused with "prospectors") is evidenced by the fact that over 1,100 claims were recorded at the Mining Recorder's Office at Anyox this year; of this number the majority will be restaked by the same men next year.

OBSERVATORY INLET SECTION.

This takes in the country from the mouth of Portland inlet to the head of Observatory inlet at Anyox and is practically all in the Coast Range granites.

Golskeish Mines, Ltd.

This company is capitalized for 50,000 shares of $1 a share, with its registered office at 602–605 Pacific Building, Vancouver. Its holdings consist of four mineral claims—*Golskeish No. 1*, *Golskeish No. 2*, *Silver Cup Fraction*, and *Silver Cup Fraction No. 4*—situated on Deep bay, 4 miles below Anyox. The mine, under the management of H. Heidman, has produced this year 3,454 tons of ore, yielding 475 oz. gold and 1,960 oz. silver. The ore, which is a slightly pyritized quartz, assaying between 88 to 92 per cent. of silica and a small percentage of alumina, is sold as flux at a minimum fixed rate to the Granby Company; any value in excess of the rate is received by the company. The ore is delivered by scows handled both ways by the Granby Company.

The vein is quartz, averaging about 6 feet in width and lying in a country-rock of argillite. About 3,000 tons has been mined from an open-cut about 450 long and from 20 to 25 feet deep. This cut shows the vein to be very regular in width, strike, and dip. Last winter a crosscut tunnel was driven from a point at a convenient loading-height above tide-water, a distance of 226 feet to the vein, obtaining a depth on the vein of about 90 feet, and drifts then run both ways. At the time of my examination (October 31st) the north drift had been driven 100 feet and the south drift 30 feet from the tunnel. Ore-chutes were being put in and preparations made for stoping about 100 tons a day. The vein at this depth is very uniform in every way and when opened up can be mined and shipped very economically. It strikes N. 10° E. and dips 55° E. into the hill.

Some very fine specimens of free gold have been found in small bunches and stringers of galena. As stated, the quartz is slightly mineralized with pyrrhotite carrying average gold and silver values of about $4.50 a ton. Judging from other quartz veins in this vicinity, small pockets of higher-grade ore may be expected.

A small gas-driven compressor plant has been installed on the beach at the mouth of the tunnel with a blacksmith-shop in the same building, and the mine has been well equipped with machines, steel, cars, etc. Good camp buildings have been erected on the beach, accommodating fourteen men at the time of my examination. Altogether it is a well-operated, profitable little property, due to the management of Mr. Heidman.

Granby Consolidated M.S. & P. Co.

This company has been operating continuously throughout the year, employing an average of 1,277 men, as follows: Mining, 368; smelting, 285; coke plant, 131; housings, 140; and service departments, 353. There has been a very substantial increase in the tonnage mined and smelted from the company's *Hidden Creek* mine and a consequent increase in metals production. The *Hidden Creek* ore mined and smelted totalled 802,667 dry tons, yielding 7,615 oz. gold, 381,742 oz. silver, and 25,404,950 lb. copper. In addition to this, the quartz mined at Granby point and used for fluxing purposes amounted to 17,786 tons, yielding 58,064 oz. silver and 1,715 oz. gold, or over $5 a ton. The total production was therefore 820,453 tons smelted, yielding 9,330 oz. gold, 439,806 oz. silver, and 25,404,950 lb. copper, an increase over last year of 172,987 tons of ore smelted, 4,466 oz. gold, 91,398 oz. silver, and 5,860,362 lb. copper. The disproportionate increase in gold and silver to the increase in tonnage is due partially to the values in the fluxing-quartz, and the balance would indicate an increase in those values in the *Hidden Creek* ore smelted. The company also mined 18,000 tons of fluxing-quartz from the *Rambler* claim, but as it carried no values is not included in the above tonnage. The quarries at Swamp point, on Portland canal, produced 47,189 tons of limestone for flux.

The 100-ton "pilot" concentrator ran steadily up to the end of November on experimental work under the superintendency of P. E. Peterson. I understand that tests made with the flotation-cells designed by Mr. Peterson have proven very satisfactory in the differential flotation of the low-grade copper-iron sulphide ores.

The coke and by-products plant converted 146,000 short tons of coal, mainly from the company's coal-mines at Cassidy, on Vancouver island, producing 77,290 short tons of coke, 5,986 short tons of breeze (fine coke), 757,057 imperial gallons of tar, 2,465,955 lb. sulphate ammonia, 1,203,954 cubic feet gas, and 121,734 imperial gallons refined benzol.

During the last two months of the year the weakness of the copper market necessitated the curtailment of operations and threatened the complete close-down of the plant; however, the situation was thoroughly discussed by the management with the employees, who voted to accept a reduction of wages and the continuation of operation. The general management of the property is now under H. S. Munroe with E. E. Campbell as assistant manager.

Hastings Arm Section.

There are several properties up from the head of Hastings arm on which the owners have been working for several seasons. I have not had the time to get into this section, but I am informed that there are some good-looking prospects and that the trail is badly in need of repair. There is no reason why it should not be as good a prospecting country beyond the granite-contact as is the Kitsault river.

Alice Arm Section.

There are no properties of any note on the arm, but good reports are heard of the showings on Roundy and Lime creeks, which flow into the east side 3 or 4 miles from the head. I expect to get over these areas early in the spring as soon as the snow is gone.

Kitsault River Section.

Owing to the lateness of the season when I was able to get into this section, the snow was already on the higher ground and I was therefore unable to examine any properties of high elevation. This section includes the Kitsault River valley and tributary valleys from the head of Alice arm to the head of the Kitsault river, about 26 miles. The Dolly Varden Railroad is in operation from the beach to the mine, 18 miles up the river, from which point the Government trail extends to the glacier, a further 8 miles. Branch trails have been built up the East fork,

Paul Kladuc creek, to the *La Rose* workings, Trout creek to the *Last Chance*, to the *Vanguard* group, and from there to the *Matilda* and *Fox* claims.

The section has had an extraordinarily active season and an immense amount of exploratory and development work has been done. The *Dolly Varden* has made a wonderful production and probably a dozen other properties are in a fair way of becoming important producers. The prospectors have done a large amount of work on their claims and many new prospects have been staked. The "claim-staker" has been exceptionally busy in this section, and next year will no doubt be a "claim-restaker" to the exclusion of the worth-while prospectors.

This section represents a small area in the Eastern Contact Belt and is proving wonderfully rich in silver ores. No doubt there are other portions of this belt equally as well mineralized, and being several hundred miles in length it has scarcely been touched as yet. The reader is referred to last year's report on this section.

Black Bear or Esperanza Group.

This group has three claims—*Black Bear*, *Aldebaran*, and *I Chance It*—and was formerly known as the *Roundy* property. It has been a small shipper of high-grade silver ore for several years. Pedro Salinas, one of the owners, this year mined and shipped 18 tons of ore that gave returns of 3.4 oz. gold and 3,788 oz. silver. This is a property which, if prospected and developed on a larger scale, might show some valuable ore-shoots. Toronto interests were negotiating for it, but I am not informed whether it was bonded or not.

Alice Arm La Rose Mining Co.

This company was organized early in the year and took over the *La Rose* group, on Paul Kladuc creek, from the owners, Miles Donald and partners. It has been a small shipper for several years, producing high-grade silver values in grey-copper and silver sulphides. The company is capitalized for 1,000,000 shares at $1 a share, with its head office at the office of E. H. Mortimer, Prince Rupert. Some work was done this summer by the new company under the supervision of Miles Donald. The old shaft, from which former shipments were mined, was retimbered and put in shape to continue sinking. A crosscut tunnel was driven 42 feet to the "big quartz vein" cropping on the surface, striking N. 80° E. and dipping north about 60°. This tunnel had just struck the vein when work was closed down for the winter. Small values in silver, 2.2 oz. to the ton, were found, with traces of chalcopyrite and galena, which is encouraging as none of the croppings showed values.

Central Group.—This group of three claims, owned by MacFarlane & Kennedy, of Alice Arm, was fully described in last year's report. This year's work consists in the extension of the upper tunnel for assessment-work. Nothing new has been reported.

Ruby Group.

Work was continued on the property this year by J. C. Smith, of Seattle, Wash., to whom it is under bond. Unfortunately, work had stopped and Mr. Smith had left the camp when I made my trip this fall; consequently I did not get over the property again.

Toric Group.

This group, owned by John and Gust Strombeck, of Alice Arm, was bonded early in the spring, but apparently no arrangement for work was made in the agreement, as nothing was done until the bond expired in the fall. Some further work was then done by the owners by way of open-cutting in tracing the vein up the hill, and I am informed by them that ore showing native silver was found. It has the car-marks of a valuable property.

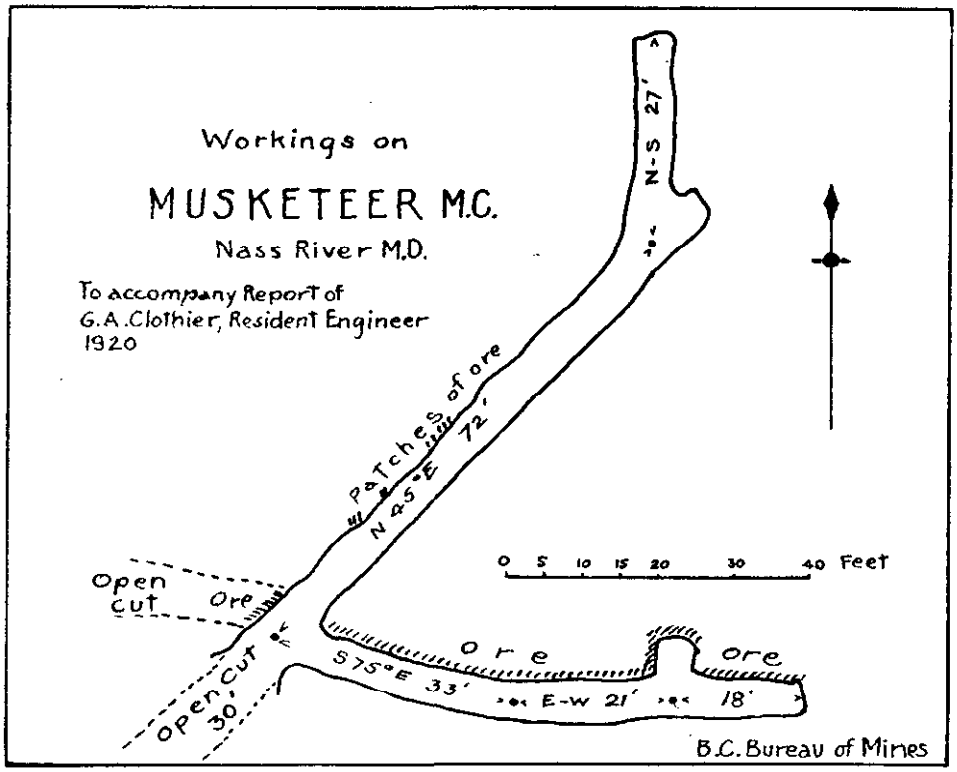
Tiger Group.

This group is composed of two claims—*Tiger* and *Lion*—owned by Ed. Pickett, of Alice Arm. The property was under bond to H. B. Price, of Victoria, and considerable exploratory work done and diamond-drilling and tunnelling. The owner being absent on account of ill-health, I was disappointed in not being able to examine the property since the above work was done. He, however, seems in no way discouraged as to the merits of the property and will continue development next year.

Musketeer Group.

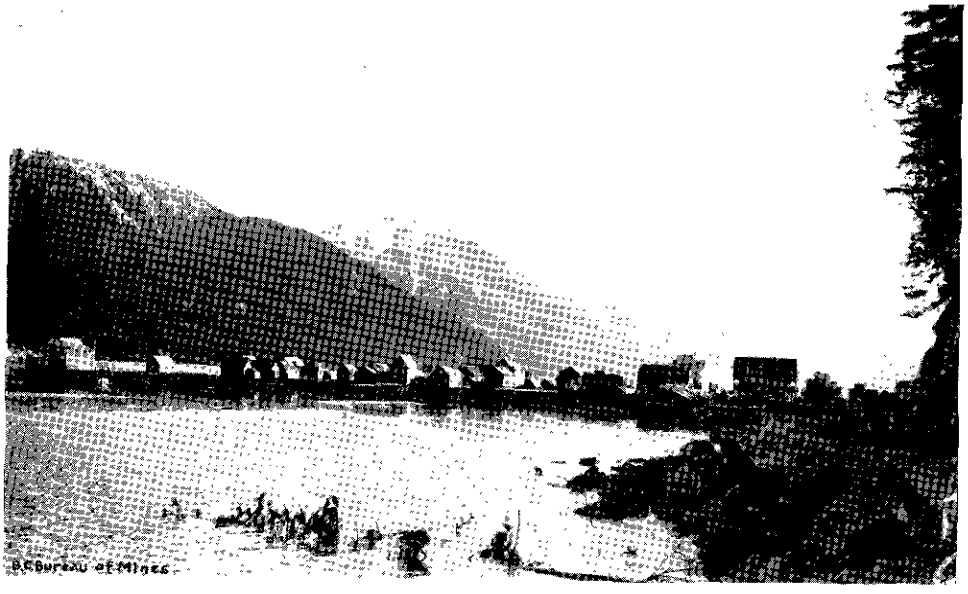
This property has been purchased by A. D. Meenach, of Seattle, Wash., from the locators and owners, Al. Miner, Miles Donald, *et al.*, of Alice Arm. There are five claims in the group—*Athos*, *Porthos*, *D'Artagnan*, *D'Artagnan No. 1*, and *Armes*. The property was reported on in the Minister of Mines' Report for 1919, since which time about 200 feet of work has been done in tunnelling and an open-cut. The work is started about 25 feet above the railroad-grade and driven 30 feet as an open-cut,

reaching the ore disclosed in the old lower cut. From this point the tunnel was driven along the wall of the vein on a bearing of S. 75° E. for 33 feet, where it turns 15° to a bearing of east for a further distance of 39 feet to the face. A crosscut was driven 7 feet across the vein at a point 18 feet back from the face. No samples were taken, but the ore, quartz mineralized with iron and sprinkling of galena, I judge to be of milling grade. Mr. Meenach claims to have obtained high-grade silver values in samples from this prospect. This work proves a strong, well-defined vein for a length of 64 feet, a very encouraging showing for the amount of work done. Good depth will be obtained on the vein by the continuation of this tunnel.

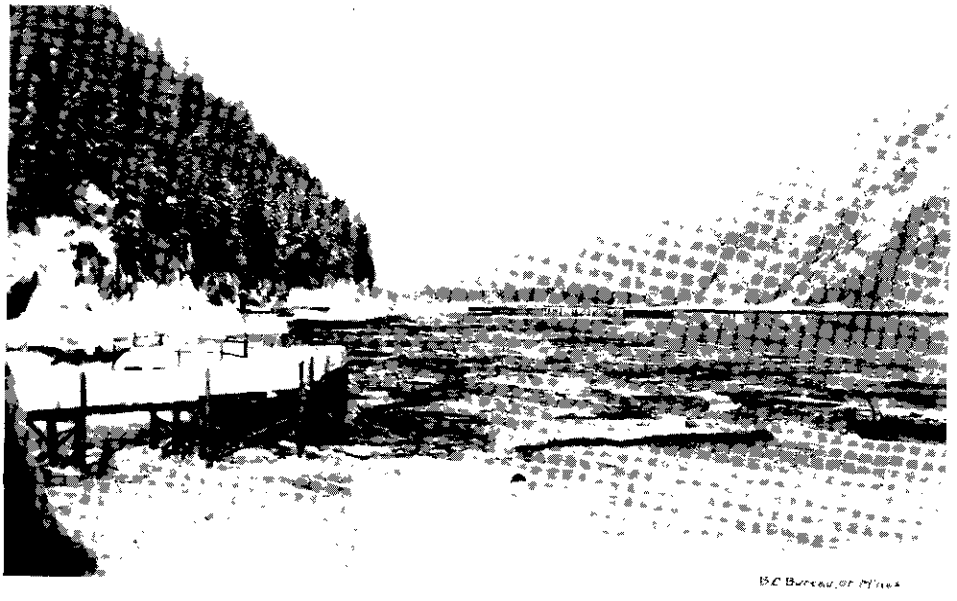


From the mouth of the tunnel (*see* sketch) a crosscut tunnel was driven 72 feet on a bearing of N. 45° E., turning at that point to a north-south bearing for a further distance of 27 feet. Ore shows in the back and upper portion of the crosscut in spots for some distance from the vein at the mouth of the tunnel, but beyond that to the face and in the north portion of the tunnel no ore was encountered. This is one of the promising properties of this section.

Wolf Group. This group, situated north of and adjoining the *Musketeer* group, is part of the holdings of the Dolly Varden Mines Company, now operated by the Taylor Engineering Company. The Dolly Varden Railroad has been partially graded between this and the *Dolly Varden* mine and will eventually be completed through. The power plant of the company has been installed on the *Wolf* this year and an extensive programme of development has been outlined for this winter. The only work done on these claims is a tunnel 35 feet long driven in on the vein and crosscuts both ways from it across the full width of the vein, which is shown to be about 60 feet. Several thousand feet of diamond-drilling was done by the old company, satisfying them that there is an immense tonnage available of milling-grade ore. This, and very probably the ore-bodies that will be opened up from now on in the *Dolly Varden*, will necessitate the addition of a concentrator suitably located to handle the outputs of both mines.



Hyder, Alaska, at Mouth of Salmon River, Portland Canal M.D.



Stewart, B.C., from Hyder, Alaska.

Climax Group. This group is composed of two claims—*Climax* and *Climax No. 2*—owned by O. Besner, of Prince Rupert, and M. P. Olson, of Alice Arm, and situated on the north side of Trout creek. A trail has been built by the Government up Trout creek, serving the *Climax*, *Moose*, *Last Chance*, and other properties farther on towards Green lake. Considerable work was done last year on the property, for which reference is made to last year's report. No work except assessment has been done this year, but the development of the *Moose* group, adjoining this on the north, will have a direct bearing on the *Climax*.

Moose Group. This group consists of five claims—*Moose No. 1*, *Moose No. 2*, *Moose No. 5*, *Moose No. 6*, and *Moose Fraction*—and adjoins the *Climax* group on the north. It was staked by Don Cameron after selling the *Wolf* group to the Dolly Varden Mines, Limited, and has been bonded by him and associates this summer to Vancouver interests which have been incorporated as the Moose Group Mining Company, Limited, with a capitalization of $100,000 of 1,000 shares. The property was reported on by, and is now under the supervision of P. W. Racey, M.E., of Vancouver.

Since last year's report Cameron drove a tunnel a distance of about 35 feet to get under the best surface showing, consisting of 2 feet of high-grade ore and about 12 feet of mixed ore. The work proved rather disappointing, in that it was found the vein was broken up at that depth.

The present company had just completed two good log buildings when I was on the property, October 23rd. The bunk-house is 16 by 25 feet, and the mess-house 16 by 21 feet, with a root-house between. They had built a trail from the Trout Creek trail below the old camp to the new camp, at an elevation of 2,200 feet.

There are ten open-cuts on the claims, tracing the vein a distance of about 600 feet on the surface, within a vertical distance of about 300 feet. Development-work outlined for this winter includes a tunnel to be started about 125 feet below the camp to get under two open-cuts showing fine ore, at one place 230 oz. silver to the ton across 3 feet; another tunnel above this and midway between the lower and Cameron's tunnel; and the extension of Cameron's tunnel. Up to the end of the year about 200 feet of tunnel-work had been done and several more open-cuts put in. The No. 1 or Cameron tunnel had been extended 60 feet, making its total length about 100 feet. The later work in this tunnel is said to be opening up an exceptionally fine showing of ore, in places assaying several hundred ounces of silver to the ton and averaging around 50 oz. a ton. No. 2 tunnel has had a little work done in it. No. 3 or lower tunnel has been driven 128 feet and is exposing a shoot of commercial ore. This property has every chance of developing very quickly into a shipping mine.

Last Chance Group. There are four claims in this group, owned by Archie McPhail, George Kolbeck, and Pat Morley, of Alice Arm. The claims lie east of and adjoining the *Moose* group and are about half a mile up Trout creek from the Kitsault trail. H. B. Price, of Victoria, had the property under bond last year and up to this spring, during which time it was explored by diamond-drilling. There is a very promising surface showing about 60 feet wide which had been shot into in a few places by the owners. I am informed that horizontal drill-holes from the base of the hill proved the width and contents of the vein to be very encouraging, but down-holes to prove it at depth were very disappointing. As a result of the work the option was not exercised and the property reverted to the owners.

Columbia Group. This group consists of three claims owned by Pete Anderson and situated on the north bank of Clearwater creek. As stated in 1918 report, there is a big, well-defined quartz vein on the claims carrying little or no values where exposed. This year Pete drifted 80 feet on the vein, packing all supplies on his back from the end of steel at the *Dolly Varden* to the claims, about 8 miles. He reports that the vein exposed in this tunnel carries very little value, his highest assay going $6 a ton in gold.

Mineral Claims Development Co. This company was organized two years ago with a capitalization of 1,000,000 shares of $1 a share, with its head office at 1004 Standard Bank Building, Vancouver. Its holdings consist of the *Homestake* group at the head of the Kitsault river and described in 1918 report. Since taking over the claims this company has done practically nothing towards developing the property, though I believe the payments are being made to the owners. I judge that this kind of mining is unsatisfactory to shareholders, and it surely is not beneficial to the section in which the property is situated.

Matilda claim, owned by A. Smith, and *Fox* claim, owned by Oscar Flint, are situated above the *Homestake* group. A trail was built by the owners this summer from the *Vanguard* trail around the side-hill and some work done on the claims.

Vanguard Group.—This group is owned by Morris Petersen and the Strombeck Bros. I am informed considerable work has been done by the owners in the tunnels. I did not get to this or any of the higher properties on account of the early snow.

North Star. The Alice Arm Silver Mining Company, Limited, owns this property, which lies north of and adjoining the *Dolly Varden* and has been under development for the past two years under the supervision of James McAleenan, of Alice Arm. This year's work consisted of driving the lower tunnel a short distance, the installation of a compressor plant, and the equipment of the mine with cars, track, machines, etc. The property was idle for three or four months during the summer, but resumed work in December. It is reported that the extension of the tunnel is showing up very fine ore. It is stated by the manager that ore will be rawhided to the Dolly Varden Railroad this winter for shipment in the spring, when railroad operations are resumed.

Dolly Varden. The Mines Department of the Taylor Engineering Company, Limited, has been operating the *Dolly Varden* mine all year under the management of C. B. North. The work during the winter and early spring, until snow conditions permitted putting the railroad into commission, consisted of shipments of small tonnages of very high-grade ore, taken from the mine to the dock by dog-team and double-end sleds, and development-work. The underground work was confined mainly to driving the No. 5 tunnel a distance of 970 feet, a little beyond the face of the No. 4 level. No more development-work was done after shipments commenced, and the heavy production throughout the balance of the year from June 1st practically depleted the ore reserves in the workings above the No. 4 level.

For the last seven months, with the exception of the latter part of December, production averaged about 150 tons a day, the total output for the year being 28,037 tons, yielding 831,638 oz. silver, shipped from Alice Arm by scows to the Granby Company's smelter at Anyox. To provide for these shipments the railroad had to be practically regraded, heavier rails laid for several miles on the upper end of the line where the grades are the heaviest, and additions made to the rolling-stock. A Climax engine was put on the upper end to handle ore-cars from the mine to the foot of the heavy grade, lighter engines being used from there to the dock. With three or four Climax engines the daily capacity of the railroad could be raised to 400 or 500 tons, which would be adequate for the production of the valley for some time. More power was supplied for the mine by the addition of another small compressor, and mine equipment was furnished. The mining end was under the superintendency of J. Milligan, with underground work under the direct supervision of Dan Tatrie.

In addition to this, the future requirements of the property were anticipated in the construction of an 800-ton capacity ore-bunker at the dock, connected by a high line with the main railroad. The railroad-grade was extended about a mile beyond the mine towards its completion to the *Wolf*, and the rails laid to ore-bunkers built in preparation for the driving of No. 6 level this winter. A hydro-electric power plant of 500-k.w.h. capacity was installed on the *Wolf* property, power being obtained by diverting a portion of Trout creek to Wolf creek, from which a head of about 400 feet was obtained. The small compressors at the mine were later replaced by one large one.

An extensive programme of very necessary development-work has been outlined for the winter, and will include the driving of the new No. 6 level for 300 feet, from which point an incline raise will be put through to the No. 5 level, a distance of 450 feet; No. 5 level will be thoroughly explored and the ore-bodies above it, located by diamond-drilling, opened up for extraction of ore next summer. Several raises will be put up from No. 5 to No. 4 levels and No. 2 tunnel extended under extensive surface croppings of the vein.

While it is expected that much ore of shipping grade will be encountered, it is anticipated that eventually a concentrator will be needed for the treatment of both the *Dolly Varden* and *Wolf* ores.

Since the above was written the mine has closed down for the winter, meaning that no development-work is being done, which will probably seriously affect next summer's production.

ILLIANCE RIVER SECTION.

Reports from this section of the district are distinctly optimistic, and I regret that, owing to the lateness of the season and the consequent absence of all the propery-owners, I was unable to examine anything except the *Bellevue* group, which is being worked all winter. There are several very promising showings in this section, but it is badly handicapped in having the worst trail in British Columbia. Two years ago several thousand dollars were expended on the trail from Copper creek to the crossing, a distance of about 5 miles, which portion is in fine shape, but hard to reach from either end. The lower end, from 5-Mile down, should be relocated to follow the river-grade instead of taking to the hills. In its present condition it is fairly navigable where the mud is not too thick.

Bellevue Group.

This group consists of four claims and a fractional claim—*Bellevue*, *Bellevue No. 2*, *Bellevue No. 1*, *Snow Fraction*, and *Blenheim*—from the south up the valley in the order named. The claims were staked some years ago by John Stark as agent for Dr. W. T. Kergin and associates, of Prince Rupert. The property is now under bond to the Alice Arm Consolidated Holdings Company, Limited, with A. J. Hughes in charge at the property. The company was incorporated in Vancouver with a capitalization of $100,000 of 500 shares.

The property is situated about 13 miles from tide-water up the Illiance river, which flows in at the head of Alice arm. There is a trail along the river over which supplies are taken on horses, though it is badly in need of repairs. There is a good grade for a wagon-road from the beach, the elevation at the camp being 2,300 feet. Very little work had been done on the property previous to being acquired by this company and nothing of importance had been found. This summer good camps were erected and a lot of surface prospecting done by way of open-cuts, trenches, and stripping. A tunnel had just been started at the time of my examination to a crosscut to the vein under one of the best showings, which is exposed in an open-cut on the south end line of the *Blenheim* claim.

The prevailing rock formation at this portion of the Illiance valley is an altered, porphyritic andesite, more or less schistose and slightly pyritized throughout. In this formation are belts or zones of soft schists, probably the result of intense shearing action, which had been replaced in part by lenses, stringers, and parallel bands of quartz, mineralized with iron pyrites, zinc-blende, galena, and grey-copper, in which are gold and silver values.

The main mineralized belt on the property is from 25 to 50 feet in width and has been traced on the surface for a length of over 3,000 feet. Other small belts have been exposed, but as yet are of no importance. As stated, there are several open-cuts on the main vein, the best exposure being on the south line of the *Blenheim* claim. Here the vein has been exposed for a width of 20 feet, 3 or 4 feet on the hanging-wall being quartz exceptionally well mineralized with galena and grey-copper, which could be easily sorted to a shipping-grade ore. The balance of the vein, as far as could be seen, is heavily pyritized, with stringers of galena running through the quartz and iron sulphides, and I judge a good grade of milling-ore. I am informed that Mr. Racey's sample across 15 feet from the hanging-wall averaged $1.40 gold, 23.05 oz. silver, 3.4 per cent. lead, and 5.4 per cent. zinc. It is without doubt a very promising surface showing. Should the ore extend down to the level of the tunnel, about 100 feet vertically, and the ore-shoot prove of any length when drifted on from that level, retaining its width and values, it will make a very valuable property. The extent of and values in the surface showings certainly warrant the extensive exploration of this mineralized zone. The chances are very favourable for opening up a sufficient tonnage of milling-ore to justify the erection of a concentrator.

In the event of the property developing satisfactorily, the transportation problem to tide-water would not be a difficult one.

I have been informed that a well-mineralized, well-defined vein, evidently the same as exposed on the surface, has been encountered at 185 feet in the crosscut tunnel.

United Metals Mining Co., Ltd.—Nothing has been done on the company's claims this year, and as they were fully described in 1918 and 1919 reports there is no need of again going into details.

Silver Star Group.—(See 1919 report.) The owners, A. R. Hodgson and associates, of Anyox, have had two men working on the tunnel all summer, and so far as I can learn the results have been very satisfactory.

Silver Bell Group.—This property has been fully reported in the last two years' reports. The owners worked on it all summer, but I had no chance to examine the work on account of the snow.

Monarch Group.—No work has been done this year.

The claims on McGrath mountain have all had the yearly assessments done by the owners. G. W. Morley and A. Clary and partners are enthusiastic over the results of the season's work on the *Silver Band* group.

PORTLAND CANAL MINING DIVISION.

The boundaries of this Division were changed this year, taking effect on and after July 2nd, and are officially defined as "Commencing at Ramsden point, etc." (*see* 1919 report). This means that all the country around Meziadin lake, the upper basin of the Nass river, and the headwaters of the Unuk river, that formerly had Anyox for Recording Office, will now be recorded at Stewart. This, I think, is a very convenient arrangement, as all the additional area, except the Unuk River district added to the Portland Canal Division, is reached by way of Stewart, and therefore all records are now available without going to Anyox.

The area at the head of Portland canal, which has been in the mining limelight for the past two years, resulting from the wonderful development of the *Premier* mine, is reached by way of Stewart, the most northerly seaport in the Province, 120 miles from Prince Rupert, from which there is a weekly boat service. From Stewart to the head of Bear river is 26 miles, 14 miles of which is over a fair wagon-road to the forks of Bear river and American creek, from which point to the head is a first-class pack-horse trail that continues on through to Meziadin lake and beyond that to the Groundhog coalfields, a distance from Stewart of about 90 miles. In 1910 and 1911 a standard-gauge railroad was built by D. D. Mann from Stewart for 14 miles up the Bear River valley, its objective being the Goundhog and interior country by way of the Bear River pass.

From Stewart to the heads of Salmon river and Cascade creek by way of Hyder, and up the Salmon River valley, is about 26 miles. There is a good winter road to the *Premier* mine, which is yearly being improved into a wagon-road by the Alaskan and the British Columbia Governments. It is being continued from the *Premier* road on up to the head of the valley, a further distance of 7 or 8 miles, which is now served by a good pack-horse trail to the *Forty-nine* mine on the west side of the valley, and to the *Spider* mine on the east side. Prospectors going over the divide at the head of the valley to the Nass slope can have supplies packed to either the *Forty-nine* or the *Spider*. From the *Forty-nine* to the foot of the glacier over the divide is about 8 miles, and from the *Spider* over Long Lake glacier is about the same distance. Some prospecting was done on the Nass slope this year and about fifty claims staked. High-grade silver ore is reported from surface showings which is most encouraging. This route to the head of the Unuk river was tried out by a party sent out by the Mines Department this summer. The conclusions of this party were that it is too long and difficult a country for prospectors to pack supplies over on their backs. (*See* Unuk River section.)

The general mining situation of the Division is very satisfactory and will be discussed more in detail under the headings of the different sections into which the Division is divided for this report. A great number of properties were bonded last winter and companies were incorporated on them, giving quite an old-time "boom" air to these sections. However, the lack of engineers' reports on the majority of these properties put them in the "wild-cat" class, and the general public did not fall for the wonderful opportunities offered. Nevertheless, a great deal of exploratory work was done throughout the Division, resulting in disappointment in several cases, but with general results that give every reason to believe that the mining industry in this section will steadily advance from now on.

When the excessive cost of everything pertaining to mining is considered; the high prices asked for prospects in the first place; the high prices of mining labour and mining supplies of every kind; and the high cost of packing; with no chance of obtaining proportionately high prices for metals if the property does make a shipper, I think the amount of exploration and development-work done during the past two years is extraordinary. I firmly believe that there will be, from now on, better chance of obtaining prospects on reasonable terms and better conditions for developing mining properties than in the past, and consequently greater mining activity may be looked for.

The Dominion Government built a dock early in the season at Stewart, which is connected with both Stewart and Hyder (in Alaska) by a highway constructed by the Provincial Government. This dock was badly needed on account of the dangerous condition of the old one, but has proven totally inadequate for the volume of freight going into the camp and the tonnage of ore being shipped out by the Premier Gold Mining Company.

A geological survey was completed this summer by the Department of Mines at Ottawa, with Dr. Schofield in charge of the party. This work was started two years ago by J. J. O'Neill, and when published will be of great aid to prospectors and operators in that belt, as well as giving a good idea of what to expect in other portions of the Eastern Contact Belt. It is to be hoped that this Geological Survey Report, with its accompanying maps, will be available at an early date.

The only shipping property in this Division this year is the Premier Gold Mining Company, whose production is somewhat less than last year, due to winter hauling conditions. Considerably more has already been shipped this winter, and with the completion of the concentrator in the spring this property will become a steady, big producer. When the wagon-road is completed into the upper valley of the Salmon river there should be several small shippers from that area.

PORTLAND CANAL (PROPER) SECTION.

This section takes in the canal only, from Portland inlet north to its head at Stewart, and is not to be confused with Portland Canal Division. Any part of it is easily reached by launch from Stewart or Prince Rupert. A number of claims were staked on the east side this summer (the west side is in Alaska), but no work of any account has been done on the older prospects since the 1918 report, to which the reader is referred.

Georgia River Mining Co.—(*See* 1918 report.) This company, owning the *Guggenheim* group on Georgia river, did a little work on the property this summer, but nothing new is reported.

Swamp Point.—The limestone-quarries were operated only a portion of the year by the Granby Consolidated Company.

MARMOT RIVER SECTION.

This includes all the area reached by way of the Marmot river, which flows into Portland canal on the east side about 4 miles south of Stewart, from which point it is reached by boat. There is a good cabin on the beach and a good horse-trail all the way up the river to the glacier, about 5½ miles, and for 3 miles up the North fork. There has been a great deal of prospecting done in this area this summer and some very fine high-grade silver ore found. It is a very accessible section, though somewhat dangerous in places from snowslides when the snow is running early in the spring.

Montana Group. This group, situated about 5 miles up from salt chuck, was under bond to the British Columbia Exploration Company, Limited, whose office is at 706 North-West Building, Vancouver. A little exploratory work was done and I understand that the bond has been extended. This is the only property in the section that has had any work of note done on it this year, and last year's report describes the other prospects.

Sterling Mining Co. This company was incorporated in March, with a capitalization of 1,000,000 shares at 25 cents a share, with its registered office at 537 Pender Street West, Vancouver. It took over the *Grandview* group, situated on the North fork of Marmot river, and consisting of four claims—*Grandview 1, Grandview 2, Grandview 3, Grandview 4*—owned by Messrs. Magee, Fraser, Gilfillan, and Cullin.

BEAR RIVER SECTION.

This section takes in all the Bear River valley and its tributaries, Goose, American, Bitter, and Glacier creeks. The upper portion of the valley, from Bitter creek up, was seriously handicapped for about a month in the early part of the spring by extremely high water, which did a great deal of damage to roads, trails, and bridges. The Portland Canal Short Line Railroad had been repaired by the Algunican Development Company, under arrangement with D. D. Mann, but unfortunately was put out of commission before it had been of much service. However, a greater amount of prospecting and development-work was accomplished than has been noted for some years. The wagon-road from Stewart to its terminus at American creek should be cleaned out and put in good repair, and the trail from there to the summit put in good shape,

for there will be a lot of supplies taken in next season. From the summit to Meziadin lake should be made passable for prospectors.

Bear River.

Silverado Group. There are two claims in this group, names not known, owned by the Stewart Bros. and John Haake, of Stewart. The claims were staked this summer and only a little work done on them. The vein, which lies very flat, has been traced for 300 or 400 feet on the surface and a few shots put in on it, showing from 4 to 14 inches of quartz mineralized with grey-copper. A sample assaying 5 per cent. copper gave 360 oz. a ton silver and $10 a ton gold. The showings are at an elevation of 3,500 feet, a short distance south of the big glacier across the Bear river from Stewart.

Bayview Group. This group consists of twelve or thirteen claims situated on the west side of Bear river just above the town of Stewart. The original holdings were two claims—*Bayview No. 1* and *Bayview No. 2*—owned by George Cameron and W. A. Cameron, of Stewart. Ten or eleven additional claims have since been staked by the present bonders and included in the Bayview Syndicate holdings. The additional claims are *Lucille, Kent, K.P., Tacoma, Zealander No. 1, Zealander No. 2, Zealander No. 3, Zealander No. 4, Beth, Vicky Fraction,* and *Mary.*

This year a good horse-trail has been cruised out and built by George Cameron to the camp-site on the claims, starting at a point about half a mile above the Bear River Bridge. It is 5 miles long, climbs to an elevation of 3,400 feet in that distance, and is a creditable piece of location-work and construction. A cabin was built at the bridge to serve as an office for Mr. Stamford, who is in charge of the property for the owners, as well as a storehouse for supplies going up the hill.

The rock formation from the river to the camp is granite, a spur from the main range to the south, and above or west of this, and containing the veins, is a belt of metamorphosed sedimentary rocks in contact with the main granite range on the west. There are two quartz veins on the property; the lower and smaller one lies in the contact between the granite spur and the altered sedimentaries, strikes N. 30° E., and dips 65° W. into the hill and apparently away from the granite. This vein crops only at intervals for 300 or 400 feet and has been exposed in two or three open-cuts. It varies in width from a seam of quartz up to 2 feet of parallel bands of quartz, mineralized with pyrrhotite, zinc-blende, galena, and some grey-copper. The mineralized portion, or ore-shoots, are small, short lenses; the heavier sulphides, especially the galena, where showing grey-copper, carry high values in silver. Though there has not been enough work to prove this vein in any way, it looks small and unimportant on the surface. A 100-foot crosscut tunnel was being driven by contract at an elevation of 3,700 feet to gain a depth of 80 feet under one of the croppings of the vein. I have later information to the effect that the vein, or at least any mineralization, was not located in this tunnel.

The upper vein is the important showing on the property, and, though not so advantageously situated, is the one that should have been opened up. From what can be seen on the surface, I judge it to be a shear-zone in the altered schists, in which are long lenticular bodies of quartz, sulphides of iron, lead and zinc, and country-rock. The mineralization is in places on the surface 6 feet in width, showing up to 1 foot of galena, with grey-copper, assaying as high as 300 oz. to the ton in silver, and mixed sulphides also carrying good silver values. These croppings are decidedly interesting and well worth opening up. The vein lies 600 or 700 feet west of the small vein and could be attacked by a crosscut tunnel started from a bench about 200 feet below the croppings, which are at an elevation of 4,500 feet. I would suggest extensive surface work on this big vein, in exploring the surface showings and tracing the vein both ways in order to ascertain the most favourable and likely point to attack it to obtain depth. The line of the croppings strikes about N. 30° W., or about 60° variation from the lower vein, which it may intercept going south.

Altogether this a very promising property, well located for mining, well timbered on the lower claims, available water-power, and in the event of developing into a shipper could be equipped with an aerial tramway to tide-water.

Mobile Group. (*Gibson* group.) This has had a little further work done on the showings this year. One open-cut exposes a 4-foot vein, of which 2 feet is good-looking ore and the balance oxidized material. In another small cut in the

same vein a sample across 1 foot of the best of it gave 134 oz. a ton in silver, while from another small cut below this 104 oz. a ton in silver was obtained. A drift on this vein might open up a shoot of shipping-ore. A good horse-trail could be easily built to it from the *Portland Canal* mine in about half a mile. (*See* last year's report.)

Prince John Group.—This property was reported on in 1918 and 1919. I understand that the owners did considerable work on the claims this year, but I did not get a chance to examine it.

Royal Irish Group.

The following claims are included in this group: *Boyne, Connacht, Royal Irish, Ulsterman, Leinster*, and *Munster*. They are situated along the Portland Canal Short Line Railroad, commencing about a mile north of Bitter creek and crossing Bear river to the west side at the canyon and extending through to Goose creek. They are owned by P. M. Miller, F. S. Clements, *et al*, of Prince Rupert.

The formation is a broad belt of granitic rock from 1 mile to 2 miles wide, running in a north-westerly direction, crossing Bitter creek at its mouth and extending to and up Goose creek. Within this belt is a wide vein of quartz, or probably a number of parallel veins, running with the belt and seen cropping along the railroad below the canyon and in the low bluffs on the opposite side of the canyon. Some work has been done by the owners this summer in open-cutting these croppings. The quartz exposed in all of these cuts has so far proven very low grade, one sample only assaying over $5 a ton in gold.

On account of the width of the quartz-zone, which to all appearances is several hundred feet in places, it might take an immense amount of work to obtain any conclusive information. Diamond-drilling has been suggested and appears to be about the only method of attacking it, but the apparently small general values and the lack of any concentration of minerals anywhere certainly does not recommend such an expenditure.

Aztec Group.

There are four claims in this group, as follows: *Tillamook* and *Wollaby*, owned by George Cameron, of Stewart; *Aztec*, owned by W. A. Pratt; and *Bellarophon*, owned by John Watt. They are situated on the west side of Bear river, about opposite the mouth of Bitter creek, and extend, I believe, from the river to the top of the mountain. The country-rock is greenstone, locally known as the "Bear River formation."

There are two veins on the group—the "Iron vein" and the "Copper vein." The Iron vein crops at an elevation of 2,300 feet, where an open-cut shows it to be 9 feet wide and composed of very heavily pyritized quartz, containing also a little chalcopyrite. An average sample across the vein assayed $4.80 a ton in gold, 0.8 oz. in silver to the ton, and 1.3 per cent. copper. There are 3 or 4 inches on the hanging-wall of a better grade of chalcopyrite, assaying $5.20 in gold, 1.4 oz. in silver to the ton, and 2.7 per cent. copper. The vein has again been exposed farther down the hill, showing the same heavy iron content.

The Copper vein crops higher up the hill, the gangue consisting of a breccia of quartz and greenstone country-rock, mineralized with iron and copper sulphides, with a little magnetite showing in places. The mineralization occasionally extends into the wall in small stringers of quartz for 2 or 3 feet. The first outcrop is at 2,600 feet elevation, showing a vein width of 3 feet, across which a sample assayed $1.40 in gold, 2.3 oz. in silver to the ton, and 0.3 per cent. copper. About 40 feet beyond this and higher up the mineralization is about 6 feet wide, of which about 1 foot on each side is fairly solid iron and copper sulphides, a picked sample assaying a trace of gold and 16 per cent. copper. About 150 feet farther along on the vein it is about 2½ feet wide of fairly solid sulphides, which assayed 2.2 oz. silver a ton and 3.2 per cent. copper. There are outcroppings again at 3,600 feet elevation, apparently the same vein, but not positively traced through on account of the rugged bluffs. At 3,850 feet elevation, the highest showing, an open-cut 12 feet long shows a width of 2 feet of 13-per-cent. copper ore and is the best showing so far on the vein. This is a promising-looking vein that could be easily opened up by drifting, and, together with the Iron vein, makes the property worth examination.

Ruby Silver Group.

This group has five claims situated on Mosquito creek, about 1½ miles from the junction of American creek with the Bear river. The property has been under development by Mr. LeSueur, of Victoria, during the past season, who informs me that about 90 feet of drifting has been done on a 6-foot vein and two crosscuts driven from the tunnel. I did not know of this work when in that section, but will look it up on my first trip to Stewart in the spring.

Vetron Group.

This group consists of four claims—*Vetron*, *Vetron No. 1*, *Vetron No. 2*, and *Vetron No. 3*—owned by Ben Erickson and W. Forrest, both "old-time" prospectors in this section. The claims are situated on the north side of Bear river, about 6 miles up from the end of the wagon-road and railroad at the mouth of American creek, or 20 miles from tide-water at Stewart. The four claims are staked in a square block, two above the vein and two below it. There is a first-class pack-horse trail from the end of the wagon-road to the foot of the hill on which the claims are located. From the foot of the hill to the *Comet* camp, at 3,375 feet elevation, there is only a prospectors' trail and it is "straight up"; however, there would be no difficulty in obtaining a fine grade for a trail about 4 miles long that would serve both properties.

The lower claims of the group are well timbered and any desired water-power can be developed from Rufus creek or Bear river. The prevailing country-rock is the Bear River formation, consisting of greenstone, agglomerates, breccia, etc.

At an elevation of 3,000 feet above sea-level and about 2,200 feet above Bear river, a quartz vein averaging about 2 feet in width has been traced by open-cuts for about 3,000 feet along the hillside. Where broken into the quartz is well mineralized with pyrite, chalopyrite, and a little magnetite and specular hæmatite. The vein strikes N. 60° E. and dips steeply into the hill, and on account of the steepness of the side-hill could be easily opened up at any point by short crosscut tunnels. An open-cut on the east end of the vein shows a mineralized width of from 8 to 10 feet in which are good bunches of chalcopyrite. Several felsitic dykes cut the vein at right angles, but apparently do not displace it in any way nor affect the mineralization. It is a promising showing.

Comet Group.

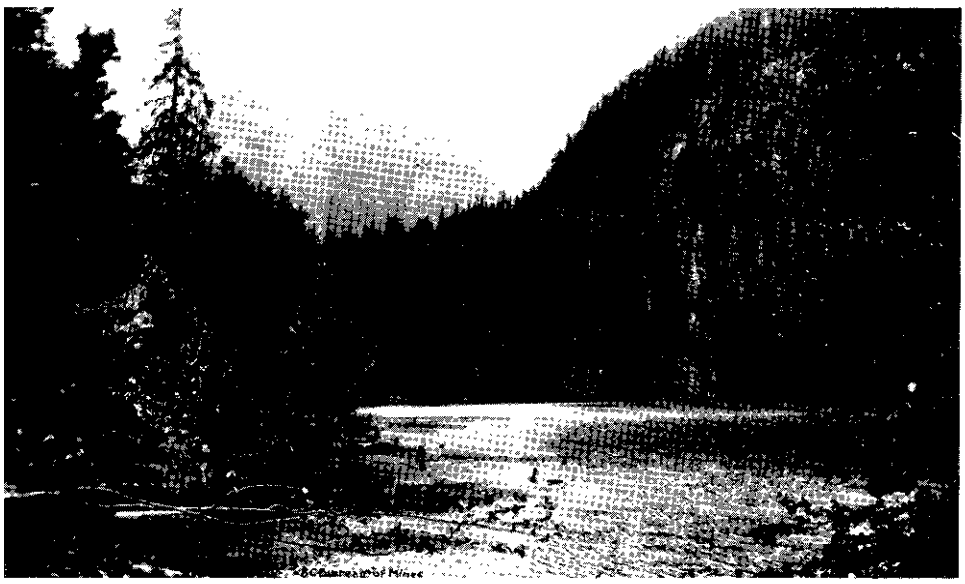
There are two claims in the group—*Comet No. 1* and *Comet No. 2*—owned by Ben Erickson *et al.*, of Stewart. They are situated above and west of the *Vetron* group. There are three claims below these in another group owned by Erickson, Forrest, and others. The camp (tent) is at the edge of timber-line at an elevation of 3,375 feet and serves both this and the *Vetron* group. The showing on these claims is a vein up to 40 feet wide lying in greenstone formation and traceable on the surface for several hundred feet, the highest cropping being at an elevation of 4,750 feet. The vein gangue consists of quartz and calcite, well mineralized with arsenical iron, and in places considerable galena, carrying values in gold and silver. Values of $32 a ton in gold have been obtained from the arsenical iron. The strike of the vein is about N. 20° E. up the hill and its dip almost vertical. This year the owners gave an interest in the claims for a certain amount of work to be performed. This work consisted in sinking a shaft to a depth of 14 feet on the veins on a steep side-hill where the same depth could have been obtained with a drift of 20 feet on the vein. Here the vein is exposed for a width of 10 feet, which is evidently not its full width, as it crops just above showing mineralization across 40 feet. Very little work has been done other than the shaft, but it should be an easy matter to trace such a vein down the hill to near timber-line, where it could be opened up to much better advantage. This is certainly a splendid surface showing and well worth extensive development.

Another quartz vein, known as the "Blue vein," has been discovered lying several hundred feet to the west of the big vein and striking toward it. The owner claims it to be from 6 to 18 inches wide, carrying galena and chalcopyrite, with silver values of over $100 a ton. It crops in an overhanging cliff about 1,000 feet above the glacier, and with a few inches of snow on the ground I was perfectly content to take the owner's word for it.

Red Top Group.

This property, owned by J. McNeil and J. J. Connors, has been under bonds since last spring to G. Seiffert, of Seattle, Wash., and associates. It is one of the older locations and had considerable work done on it in the early days, which, however, did not prove it either way. Under the personal supervision of Mr. Seiffert several hundred feet of crosscut tunnelling has been done this summer in a very miner-like manner. Conditions in the spring, owing to the destructive freshets, were very discouraging, and it looked for a time improbable that supplies could be got in to the property in time to get anything done. However, the main road and trail were repaired and mining-work finally got under way about a month later than under normal conditions. The old foot-trail from the main Bear–Nass trail to the camp, about 1½ miles, was improved to a horse-trail, and a good horse-trail also built from the camp to the upper tunnel.

Salmon River Valley from Premier Mine.



Bear Lake, Portland Canal M.D.

There are two showings on the property occurring in the Bear River formation (greenstone). At an elevation of 3,850 feet, about 400 feet above the camp, a fine showing of galena has been exposed in an open-cut. The vein at this point is about 5 feet wide, of quartz and calcite gangue, with inclusions of greenstone country-rock, all mineralized with galena and pyrite. On the hanging-wall is about 18 inches of banded quartz in which are small bunches of galena; the balance of the vein is a coarse conglomerate of quartz, greenstone, galena, and pyrite, the whole vein assaying, I should judge, about 20 per cent. lead. The silver content is 16.8 oz. in ore assaying 70.7 per cent. lead. The vein strikes east and west and dips with the hill at about 55° S. It has been traced diagonally down the hill for several hundred feet. At a favourable point on the steep side-hill, at an elevation of 3,510 feet, a crosscut tunnel is being driven on a bearing of N. 30° W. to cut the vein. It is estimated that it will require from 210 to 240 feet of a tunnel, of which 180 feet had been driven when it was necessary to quit on account of the heavy snow. This is a very promising showing, and considering the topography of the hillside I think it is being opened up in the best possible way.

At the camp another crosscut tunnel is being driven to get under the copper-showing briefly described in the 1919 report. It is 178 feet horizontally from the mouth of the tunnel to the showing, but as the dip of the vein is into the hill it will require a somewhat longer tunnel to reach it. The tunnel has been driven 132 feet, the first 50 feet through slide-rock, which required timbering and was therefore very slow work. Although this tunnel is expensive for exploratory work, I think Mr. Seiffert's judgment sound in getting the depth, especially when the bunchy and distorted nature of the surface showings are taken into consideration.

I understand that work will be resumed in the spring, and the extension of both tunnels will certainly be of interest and importance to this locality.

George Copper-Mines.

The owners did some surface work between the "white" and "green" veins and I believe extended the tunnel a few feet. However, the greater part of the season's work consisted in building a trail from the main Bear-Nass trail to the upper camp on the claims. This will be completed in the spring. The property is under option to the Algunican Development Company, Limited, and the trail-work is preparatory to extensive development-work next year. (*See* reports of 1917, 1918, and 1919.)

American Creek.

The trail was brushed out this year for 4 miles up from the mouth of the creek by the Public Works Department.

Two or three properties were investigated during the summer by engineers, and I am informed that there is every probability that work will be started on one in the spring. There was considerable development-work done in this valley in the early days, especially on the *Mountain Boy* group and the *Northern Terminus* on the opposite side of the valley. Some high-grade silver ore was shipped from the latter property and the *Montana* group some years ago.

Bitter Creek.

Jutland and Saint Elmo Groups.—The owners have been working on these two groups all summer and report encouraging results.

L.L. & H. Group.

This group of claims was staked in the early days of Stewart by Messrs. Lydden, Lade, and Hartley, and has had considerable work done by the owners in stripping, open-cutting, and tunnelling. The claims are situated up Hartley gulch, on the north side of Bitter creek, about 8 miles up from its mouth. The property is now under option to Mr. Tubman and associates, of Victoria. Mr. Tubman has been on the property all summer and a very creditable amount of preliminary work has been done.

There has been little activity on this creek in the past few years; consequently the Government trails have not been kept in repairs. This season's work, therefore, consisted largely of building a new trail up Bitter creek from the Bitter Creek trail to the camp, building a new cabin, putting in a trail from the camp to the workings, and later in the season doing a little surface work on the claims. Everything is now in good shape to go ahead with the development of the veins.

There are three parallel fissures lying in a somewhat broken and distorted country-rock of argillite intruded by greenstone. They strike at about S. 70° E., paralleling the gulch, and dip 60° N.E. into the hill. The vein-filling is partly quartz and partly broken and ground-up country-

rock, all more or less mineralized with arsenical iron and small amounts of galena and chalcopyrite in places.

The upper vein has been exposed on the surface by open-cuts and some depth obtained on it by a crosscut tunnel 35 feet long. The vein where cut by this tunnel shows about 1 foot of black, plastic mud on the foot-wall; then 16 inches of quartz; then about 16 inches of black, ground-up argillite slightly mineralized with iron pyrites. The quartz is mineralized with pyrite, disseminated and in bunches, zinc-blende, and a little galena, and carries fair values in gold and a little silver. Picked samples of the coarser heavy sulphides assay very well in gold. The tunnel was driven 7 feet beyond the vein in a greyish rock disseminated with iron pyrite, which may be a part of the vein-filling. The elevation of the tunnel is 3,700 feet.

About 300 feet (vertically) lower another tunnel has been driven 232 feet. It has cut the lower vein and cannot be very far from the middle vein. A very heavy flow of water was encountered from an open fissure in the rock, which makes it very disagreeable for working. This tunnel cut 45 feet of a more or less silicified and pyritized rock that should be investigated for milling-ore. About 4 feet of this next to the hanging-wall is well-mineralized quartz averaging, it is claimed, $44.60 a ton in all values.

To eliminate the difficulties of getting supplies, timber, and other material up the steep side-hill to the tunnels, Mr. Tubman proposes to start work farther up the creek, pick up the veins there, probably with a short crosscut from the edge of the creek, and drift on them. This work would obtain good depth on the veins, as well as be much more convenient for mining. Everything considered, the property is looking very promising, and I think the showings so far justify Mr. Tubman's plan of development.

Goose Creek.

Independent Group. This was reported on last year. The Algunican Development Company had an option on the property this summer, put a diamond drill on it, and drilled two holes. I understand that the vein was cut, but that there were little or no values in it; consequently the option was thrown up. No other work is reported on Goose creek.

Glacier Creek.

Lakeview Group. (*See* 1918 report.) Fetter & Carlton, of Seattle, had this group under option for the past year, during which time considerable exploratory work has been done under the supervision of Al. Harris. There are two veins on the claim. The main vein was picked up by further work in the tunnel a hundred feet below the cropping, which had been driven previously for this purpose without success. Drifting and raising on it on this level proved it to be as strong as on the surface and fairly well mineralized, but the values were very low and disappointing.

Work was then started on the upper vein, a small quartz vein from which high-grade silver ore had been extracted at the surface and shipped in early days by the owners. A 10-foot open-cut was made along the showing, a tunnel driven on the vein for 25 feet, and a shaft sunk from the open-cut to a depth of 57 feet on the vein. Some fine ore was found in the open-cut and values proved very satisfactory for a depth of 25 or 30 feet, below that becoming gradually less and very spotted. Some further work would have been done in the shaft, but an extension of time on payments due was objected to by the owners and the option was terminated.

Dunwell. This claim is owned by Stewart Bros. and W. Noble, of Stewart, and is situated about 2 miles up the west side of Glacier creek from the Bear River wagon-road. The general rock formation is argillite, termed by McConnell the "Bitter Creek formation." The vein, brecciated quartz and country-rock, fills a well-defined fissure in this formation, striking N. 70° W. and dipping flatly to the south-east at 38°. It has been well exposed by means of ground-sluicing for a length of about 300 feet and at intervals in that distance by three open-cuts. The upper of these cuts shows the vein to be about 6 feet wide, of which 4 feet on the hanging-wall side is mainly quartz heavily mineralized with pyrite, galena, and zinc-blende, the remaining 2 feet containing more argillite and less quartz and also well mineralized. I had not time to sample the vein; consequently can give no idea of the values. It is of good width, well defined and well mineralized, and altogether very promising-looking.

Columbia and Evening Sun, Excelsior and Eagle.—W. W. Rush, one of the owners of these two sets of claims, has been working on them all summer. I did not get over them this year, but they were reported on in last year's report.

For other properties the reader is referred to my report for 1919.

SALMON RIVER SECTION.

This section takes in a small portion of the Eastern Contact Belt up the Salmon River valley, north of the Alaska-British Columbia boundary-line to the divide between the Nass and Salmon rivers. In area it is from 3 miles wide at the lower end to about 6 miles wide at the head of the valley and about 13 miles long—about 60 square miles. This is rather insignificant when compared with the immense area of this belt from the head of Salmon river north to Atlin, a distance of about 250 miles, which is absolutely unexplored.

A number of prospectors have been exploring the country over the Salmon River divide on the Nass River slope and some very fine specimens of high-grade silver ores are shown. Several claims were staked in there this summer. Trail facilities should be extended over both the Salmon and Long Lake glaciers into that region to permit of supplies being packed in on horses to a convenient point below the glaciers, say Tide lake, from which prospectors could then work in all directions.

An adequate amount of trail-work has been done throughout the section this year and the *Premier* wagon-road extended about 2 miles toward the head of the valley. This road when completed through, a further 4 miles, will provide the upper valley with freighting facilities for freighting in machinery of any kind and winter shipments of ore. The Alaska Road Commission has had the lower end of the road, from the boundary-line to the beach, in hand this year and will eventually make a first-class truck-road out of it.

There has been a noticeable increase in the amount of exploration and development-work done by owners and operators who have properties under bond. Since practically all of this preliminary work is done by hand, and consequently of limited amount, it takes two or three season's work to obtain any conclusive information. In the majority of cases the work has been sufficiently encouraging to warrant further development. In a few instances options have lapsed, not on account of disappointing showings, but due to lack of capital to proceed. Several companies were incorporated on prospects that had just been staked and on which no work had been done and no authentic examination made, the result being that not enough capital could be raised by stock-sales to commence work.

Considerable diamond-drilling has been done on several properties. By far the most noteworthy feature of the year for this whole area was the proving by diamond-drilling of the continuation of the high-grade ore-shoots to depth in the mine of the Premier Gold Mining Company. This not only assures the future of this property, but is of the utmost importance to the whole Salmon River valley and any other area in the Eastern Contact Belt of like formation.

Considerable has been written on the geology of this section, from which the following general deductions are made: R. G. McConnell's diagram, accompanying the Summary Report of 1911, shows three formations in the Salmon River area—granite, granodiorite, and quartz porphyry; the Bear River formation, consisting of porphyrite, breccia, agglomerate, and tuff; and the Nass formation, consisting of argillite and tufaceous sandstone. The oldest and predominating formation is the Bear River series, which is overlain in several places by the Nass series. These two series were intruded, first by quartz-porphyry dykes, then by the granodiorite of the Coast batholith, and lastly by numerous dykes ranging from quartz porphyry to augite porphyry. The quartz porphyry, known locally as greenstone, is the principal ore rock of the area. Ore-bodies are found in mineralized shear-zones in the porphyry, generally lying close to the tuff. Regional shearing roughly paralleling the granite range has developed these numerous shear-zones, the making of which was accompanied by silicification and pyritization, forming the primary low-grade ore-zones. Later fissuring occurred at an angle of 45° to the regional shearing and is represented by veins of quartz; high-grade silver minerals have been found in such veins and enriched deposits occur at the intersections of any of these three sets of fissures. These ore-bodies are in the form of lenses, irregular in shape, and have no well-defined walls or sharp limits between ore and waste. Opinions seem to agree that the principal high-grade ores of this section were unquestionably produced by the enrichment of the primary ores by ascending

secondary mineralizing solutions, and not from descending solutions containing metals dissolved from the overlying ores.

The majority of the properties in this section have been described in two previous reports, and readers are referred to these where details are omitted here.

Woodbine and Kitchener. These claims are owned by Dave O'Leary and are situated along the *Missouri* trail, on the west side of Cascade creek, about a mile above the bridge. Considerable work had been done by the owner in an open-cut along the side-hill, which opened up some fair-looking ore. An option was taken on the claims this spring by the Algunican Development Company and a diamond-drill outfit taken up. About 1,200 feet of drilling was done, but the results did not meet the requirements of the company and the option was terminated.

Pittsmont Group. This group consists of four claims and a fraction, situated about half a mile beyond the *Woodbine* claim and adjoining the *Indian* group on the south-west. The owners, Senator Ronan and associates, did some surface work late this fall and are well satisfied with the showing.

Glacier Group. This group comprises seven claims and a fraction, as follows: *Glacier No. 1* to *Glacier No. 7*, inclusive, and *Glacier Fraction*, staked last year and owned by Jancowski & Scoville. The claims lie west of the *Pittsmont* and *Boundary* groups, down to the Salmon glacier. The showing is a quartz vein from 3 to 4 feet wide, striking S. 80° E. into the hill and dipping about 45° S., where it is exposed along the side of a shallow gulch. The quartz is mineralized with pyrite and a little chalcopyrite. Values up to $240 a ton in gold and from 70 to 80 oz. in silver a ton have been obtained. The only work done is an open-cut into the vein where it is exposed on the side of the gulch, and another where the vein dips into the hill. Good depth could be obtained by drifting on the vein from the latter cut, and from its appearance it is well worth some development. The property is easily reached by trail branching from the *Indian* trail and skirting around Indian lake, in this way avoiding the glacier entirely.

Indian Mines, Ltd. (*See* 1918 report.) This company is one of the "early day" incorporations, with its registered office in Prince Rupert. L. W. Patmore is secretary of the company. The company's holdings consist of four Crown-granted claims. Its affairs are in good shape, only about 25 per cent. of the treasury stock having been used, and that for development-work on the property, which consists of 600 or 700 feet of underground work, with several open-cuts on the surface. This year considerable work has been done in open-cutting and stripping to trace the vein through from the "big cut" on the top of the bluff above the tunnel to the showing at the end line of the claim, over 1,000 feet. This work has proven very satisfactory. It shows a good width of vein, from 6 to 14 feet all the way, with milling values in gold and silver. Some of the cuts show 2 and 3 feet of good galena carrying about ⅓ oz. silver to the unit of lead. The consistency of the gold values contained in the pyrites gives reasons to expect that the continuation of the upper tunnel will probably open up a continuous body of milling-ore.

The face of the upper tunnel shows a width of 14 feet heavily mineralized with zinc, iron, and galena, 2 feet on the right-hand side looking exceptionally well. The extension of this tunnel is very desirable development. Altogether the property is one of the promising ones of the district.

Payroll Group.—This group lies just north of the *Indian*. Assessment-work only has been done this year.

Big Missouri Group. (*See* previous reports.) The group consists of sixteen full claims and four fractional claims, all Crown-granted, lying along the ridge east of the Salmon glacier for a length of 2 miles. It is owned by Dan and Andy Lindborg, of Hyder, Alaska, and associates. It has been under option for the past two years to the Pacific Exploration Company, Limited (D. D. Mann), with Dr. J. A. Bancroft acting in a consulting capacity. During this time it has undergone some exploration by open-cutting, tunnelling, and diamond-drilling. Last year diamond-drilling totalling 2,400 feet was done on the south-east corner of the *E. Pluribus* claim of the group, adjoining the *Mineral Hill* group. In all, nine holes were drilled. Five of these were vertical holes from the top of the ridge to prospect some very promising showings of high-grade silver ore that had been exposed on the surface in several open-cuts and trenches. While some very good ore was encountered in this

work, on the whole the results were not very satisfactory. A horizontal hole from the side of the hill and two flat holes and a vertical hole from the creek-level were also drilled, showing, I believe, little or no values. In the meantime a tunnel had been started just above the creek and driven about 80 feet. This year the tunnel-work was continued through the winter and driven a total of 360 feet on a bearing of N. 50° E., or diagonally across the two sets of fractures. No high-grade ore was encountered in the tunnel.

The diamond-drill was moved this spring to the "big showing" on the *Province* and other claims, and four holes drilled, aggregating 1,050 feet, three of 300 feet each and one of 150 feet; these proving to the satisfaction of the bonders that the showings, which extend over a width of about 1,000 feet and probably a length of two claims, or 3,000 feet, are only surficial and merely the residue of what must have been before eroded an extensive, flat-lying vein or ore-zone interbedded in the tufaceous country-rock. The results of this work on the *Province* claim and the previous findings on the *E. Pluribus* not coming up to expectations, the option was terminated by the Pacific Exploration Company.

An idea of the extent of the surface showings may be gained from the report of a prominent mining engineer, who estimated that every 20 feet of depth obtained would yield 1,000,000 tons of ore.

Similar conditions to those on the *Big Missouri* are found on the *Hercules* property, adjoining it on the north. Work this summer demonstrated that erosion has gone deeper and that the surface showings are the remains on the higher knobs of the flat ore-zone mentioned above. However, on the *Hercules* ground a very promising vertical vein has been discovered and will be explored next season. I think that after proving the surficial nature of the deposits on the *Missouri* more lateral drilling should have been done through the ridge and across the trend of the intruding mineralized quartz porphyries to prove whether or not there are any such dykes coming up to the flat ore-zone now remaining on the surface. Shear-zones along a contact of these quartz porphyries with the intruded tuffs are proving bonanza enrichments in the *Premier*.

Hercules Mines, Ltd.

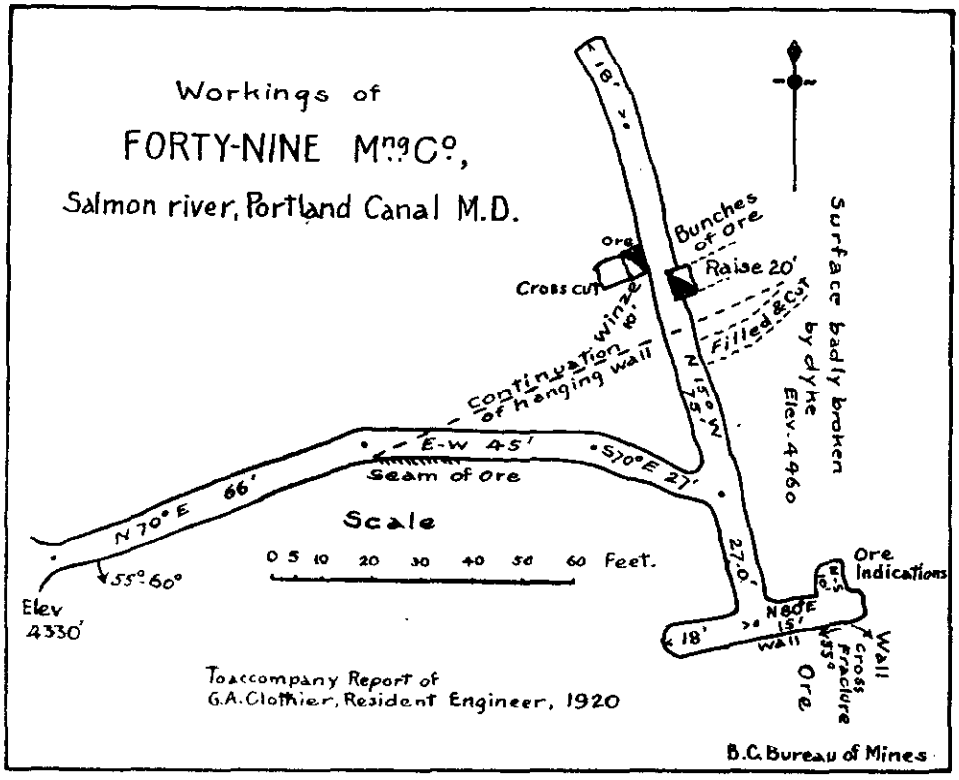
The holdings of this company consist of the Crown-granted claims *Glacier*, *Martha Ellen*, *Cornelius*, *Empire*, and *Leckie Fraction*, adjoining the *Big Missouri* group on the north. The property has been idle since 1911, but work was resumed this year under the management of General R. G. Edwards Leckie, with Joe Falls in charge of the work. The old work consisted of a number of trenches and open-cuts which exposed some exceptionally promising-looking showings of quartz and sulphides carrying good values in gold and silver. Very little depth, however, was obtained in any of this work. This year the principal work was the driving of a tunnel about 200 feet long under one of the most promising surface exposures and the sinking of a shaft about 30 feet on another cropping. The tunnel proved disappointing, in that no ore was found under the big surface showing. The shaft mentioned was sunk about 15 feet on an ore-body cropping on the surface, showing it to be cut off horizontally at that depth. The sinking was continued another 15 feet. This shows conditions about the same as obtained in the driving of the tunnels, and leads one to the conclusion that the ore found on the surface is the residue of a once extensive sill or bedded deposit of mineralized quartz porphyry contained in the tuff, and which has eroded until nothing remains but a few knobs here and there overlying the general Bear River formation. These are practically the same conditions found on the *Big Missouri* group, excepting that erosion has not been so intense on the *Missouri*, and the surface, therefore, is more extensively covered with ore.

Just north of the tunnel and following the bed of a small creek a quartz vein about 8 feet in width has been broken into in two or three places, tracing it for several hundred feet. Standing at the head of the gulch, the fissure occupied by the vein can be seen cutting the formation to the south. No work has been done except in a small canyon where the running water has kept the vein exposed. Samples across the vein here assay $10 a ton gold and 6.5 oz. a ton silver. This vein was not shown up until late in the season on account of the gulch being filled with snow. Winter camps were erected with the intention of getting underground on this vein before the snow came and continuing the work all winter. Sufficient preparations, however, could not be made and the winter supply of grub taken in; consequently the work was closed to be resumed next spring.

This company also has some promising holdings on Glacier creek, in the Bear River section, and elsewhere.

Forty-nine Mining Co.

This company is capitalized for $1,500,000 in 1,500,000 shares, with its head office at 701 Rogers Building, Vancouver. Its holdings consist of nine claims situated about 23 miles from tide-water on the east side of the Salmon glacier, and reached by the continuation of the *Big Missouri* trail. The claims have been surveyed this year and applications made for Crown grants. The property was worked all last winter with a crew of from eight to twelve men, but during the summer season only a couple of men were employed on some surface work. The main tunnel on the *Forty-nine* claim was driven 280 feet (*see* sketch), and the tunnel on the *Occidental* claim was driven 95 feet.



In the latter the first 50 feet followed a small vein of shipping-grade ore that will average about 8 inches in width. There would be about 50 feet of stoping-ground above this tunnel, and therefore some little tonnage of shipping-ore could be taken from here. From the end of the ore the ground is more broken up, but the vein-fracture can be followed all the way. A short crosscut of 6 feet has been driven to the right at the face following a cross-fracture, but no ore is showing in it. There are indications of ore in the bottom of the main face and more work should be done there.

The main showing so far on the property is on the *Forty-nine* claim and has had the greatest portion of the development-work done on it. This showing strikes N. 70° E. and dips between 55° and 60° to the south-east. The main tunnel was started on the hanging-wall of the vein and driven on a bearing of N. 70° E., or following the vein, for 66 feet. It then turned 20° to the east to follow a small stringer of fair-looking ore for 45 feet, and from there to the crosscut it swung a further 20° to the east for a distance of 27 feet. A crosscut was then driven on a bearing of N. 15° W., about at right angles to the strike of the showing, for a distance of 120 feet, 93 feet north and 27 feet south. At the end of the south crosscut a parallel fracture showing some ore was drifted on for 33 feet. In the north crosscut, about 45 feet back from the face, a raise was put up 20 feet and a winze sunk 14 feet on some bunches of high-grade ore which apparently mark the main ore-shoot, as the continuation of the first 66 feet of the

tunnel along the hanging-wall of the vein would have struck it. Above the crosscut on the surface it can be seen that the vein has been completely shattered by the splitting-up of a light-grey-coloured dyke, and therefore about the least favourable place for crosscutting. About the best that could be expected would be small bunches of ore following the fragments of the dyke, and this is exactly what was found. A crosscut at a point about 75 feet in from the mouth of the tunnel would have cut under the better portion of the showing on the surface at a depth of from 60 to 70 feet, and in my opinion would have been better work.

On the *Million Dollar Fraction* claim, about half a mile north of the camp, an open crosscut has been put in showing a width of 25 feet of mineralization. On the hanging-wall side there is about 12 feet of pyritized schist; the balance is quartz heavily mineralized with pyrite, and very promising-looking ore. Judging from the surface, there is about 10 or 12 feet more of well-mineralized quartz that has not yet been cut.

Altogether there has been done about 450 feet of work on this property that has not been very effective in so far as the showings on the claims are concerned.

Yellowstone Group. This group, owned by Bill Murphy, of Hyder, Alaska, and associates, has had a lot of surface work done on it, exposing some very encouraging-looking showings. I am informed that the survey of the *Forty-nine* group includes in that property some of the best showings that were always considered to be on the *Yellowstone* ground.

Salmon River Mother Lode Mining Co. This company was organized early in the year with a capitalization of $100,000 in 1,000,000 shares at 10 cents a share, with its registered office at 402 Holden Building, Vancouver. It took over the *Mother Lode* group of six claims—*Mother Lode No. 1* to *No. 6*, inclusive—situated along the west shore of Salmon glacier about opposite the *Hercules* mines. There was no one on the property at the time of my trip into this section, and no information has been gained as to what has been done on the claims.

Several claims and groups along the east side of the glacier, north of the *Forty-nine*, as well as those bordering Summit lake, have had assessments done this year by the owners, who expressed themselves as very optimistic of that portion of the section. Trail facilities should be improved to the *Forty-nine* and extended as far as possible beyond.

Montana Group.—This group consists of four or five claims lying south of the *Forty-nine* group and east of the claims of the Hercules Mines, Limited. The owners claim to have exposed some very promising ore with assessment-work this year.

Salmon River Silver Mines, Ltd. This company is capitalized for $50,000 in 500,000 shares at 10 cents a share, with its head office at 232–3 Pemberton Block, Victoria. Its holdings consist of two claims—*Sunset No. 1* and *Sunset No. 2*—situated at the south end of Dilworth mountain and adjoining the *Unicorn* and *Silver Tip* groups on the north. I have no information as to what work was done on this group this year. There was no one on the property at the time I was in the section this fall. These claims are not Crown-granted.

Unicorn Group. There are four claims in the group—*Unity*, *Unicorn*, *Unicorn No. 2*, and *Unicorn No. 3*—owned by John Hoveland, of Hyder, Alaska, and partners. They are located east of and adjoining the upper claims of the *Big Missouri* group, and have been under option to J. B. McDonald, who did considerable work on them both this and last year. Last year's work consisted mainly of open-cutting; this year some 700 feet of diamond-drilling was done and the tunnel driven 210 feet. It was driven across the greenstone formation, in which are small stringers of barren quartz; a diamond-drill hole was then run straight ahead from the face of the tunnel for 250 feet. So far as could be seen from the core, the last 5 feet was the only portion of it that showed any encouragement, consisting of quartz mineralized with iron pyrite. On account of the snow I was unable to get over the surface and gain any idea of the objective of the drilling. Though the option was thrown up, the owners claim that the work was not detrimental to the property in any way.

Silver Tip Mining Syndicate, Ltd. This syndicate was formed in Vancouver to develop the *Silver Tip* group of mineral claims—*Silver Leaf*, *Bella Coola*, and *May P. J.*—situated on Silver creek and adjoining the *Unicorn* group on the east. The property was reported on last fall by P. W. Racey, M.E., and has been under his supervision this year. The old workings on this property are on the south-west corner of

the *May P. J.* claim. The showing here is a small vein from 6 to 18 inches wide of fairly solid galena ore carrying in places silver values up to 120 oz. a ton. The vein, only open-cut in two or three places, follows the bed of a small creek which flows into Silver creek from the north. A tunnel was started from the bank of Silver creek to cut the vein, which lies very flat, and as a result the tunnel was driven all the way, about 40 feet, in the hanging-wall. This, however, is not an important showing for this group, as the vein would dip out of the property in a very short distance.

About 250 feet farther up Silver creek some work was done this summer on another ore-cropping. An open-cut was put in, disclosing a width of mineralization of about 16 feet, dipping south at about 45°. Across 8 feet on this cropping before it was broken into assayed 20 oz. silver a ton. The open-cut was driven 14 feet along the vein and continued as a tunnel a further 12 feet on the foot-wall. The face of the tunnel is now in evidently low-grade ore. Several open-cuts were put in above the tunnel in following the vein, which is badly leached and considerably closed in this direction.

The principal part of the season's work was done on the upper end of the *Bella Coola* claim at an elevation of about 3,800 feet, or about 500 feet above the camp, and consisted of numerous strippings, open-cuts, and deep trenches. The predominating country-rock is the Bear River formation overlain in places with slates. The altered intrusions of quartz porphyry through the volcanic tuffs and overlying slates are the chief mineral-carriers. Nearly all the work has been done on one of these dykes, showing it to have been crushed and the numerous diagonal fractures across it filled with quartz more or less mineralized with galena, sphalerite, and silver sulphides, some of these veinlets up to 2 inches wide assaying 400 to 500 oz. silver a ton. The dyke-rock itself carries little or no values; consequently the average values depend on the frequency and grade of the sulphides and quartz stringers. The dyke strikes east and west and the mineralization has been proven for a length of over 800 feet and from 25 to 40 feet wide. I have been informed by the engineer in charge, Mr. Racey, that the average values are satisfactory for a concentrating grade of ore. The ratio of concentration would be high and the concentrates very high grade.

Silver Crest Mines, Ltd.

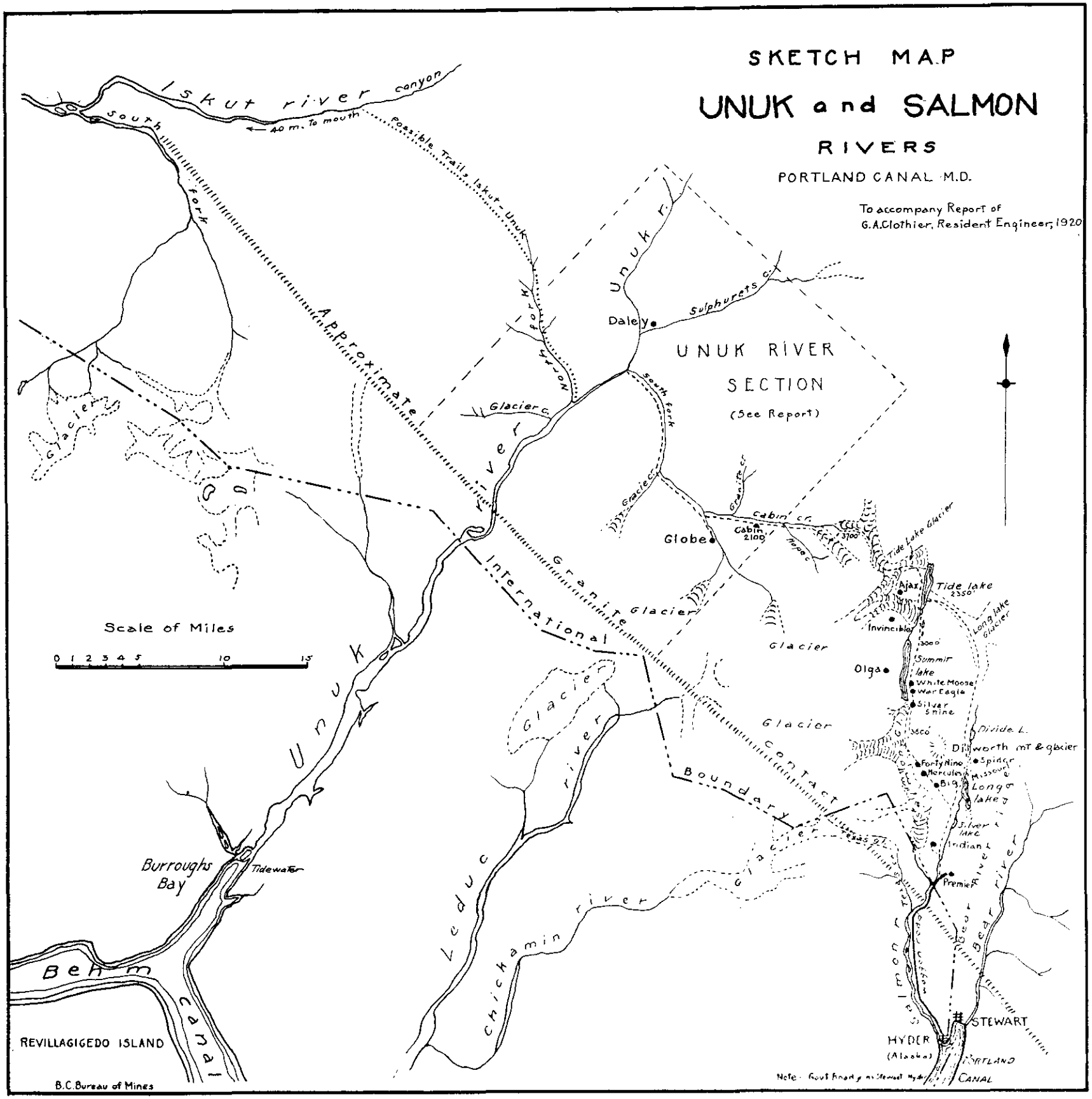
This company was incorporated under a capitalization of $500,000 in 2,000,000 shares at 25 cents a share, the head office being at 420 Rogers Building, Vancouver. The holdings consist of the *Silver Hill* group of eleven claims—*Ag. Fraction, September Fraction, Silver Crest Fraction, Argentite, Polybasite, Polybasite Fraction, Proustite, Pyrargyrite, Stephanite, Native, Hessite, Cerargyrite,* and *Stromeyerite*—situated on the east side of Dilworth mountain and adjoining the *Silver Tip* group on the north. The group has been surveyed and Crown grants applied for on eleven of the claims.

Similar geological conditions are found as briefly outlined on the *Silver Tip;* in fact, some work has been done on what looks like the extension of the mineralized dyke on the *Bella Coola* claim of the *Silver Tip* group. Altogether, more than twenty cuts have been put in to prospect small croppings of quartz. The majority of the work has been done on the *September Fraction.* Near the upper end line a long cut of about 50 feet has been put in, crossing a bunch of quartz stringers, all of which are barren, except about 1½ feet in width on the west end of the cut that assays 96.4 oz. silver a ton at a depth of 3½ feet. This showing was not found in open-cuts north of this which were evidently made to trace it farther.

South of these, four or five cuts were made on what seems to be the continuation of the dyke on the *Silver Tip.* The best showing here is about 3 feet of quartz assaying 20 oz. silver a ton. What appears to be the most important showing so far is at the south-west corner of the *September Fraction.* There are a bunch of small cuts here on stringers of quartz lying in rusty-looking slate, none of which look promising. However, a large cut across a porphyry dyke shows a mineralization of about 27 feet in width, striking east and west and dipping about 60° or 65° to the south, under the overlying slate. The average across this is about 10 oz. silver a ton, about 2 feet in the centre assaying $23 gold and 89 oz. silver to the ton. To the south-east of the cut another was made on the contact of the porphyry with the slate, exposing a width of 3 feet of ore assaying 20 oz. silver a ton. Although this is pretty close to the end line of the claim, probably 150 feet, a considerable tonnage of milling-ore might be opened up here. Taking *everything into consideration, I think this area of the upper Salmon valley worth more extensive* prospecting-work.

Salmon Glacier, Portland Canal M.D.

Silver Tip Claim, Salmon River.


SKETCH MAP
UNUK and SALMON
RIVERS
PORTLAND CANAL M.D.
To accompany Report of
G.A.Clothier, Resident Engineer, 1920
Iskut river canyon
← 40 m. To mouth
South fork
Possible Trails Iskut - Unuk
Approximate
Unuk r.
Sulphurets c.
Daley
UNUK RIVER
SECTION
(See Report)
North fork
Glacier c.
South fork
Glacier
Glacier c.
Granite c.
Cabin c.
Cabin 2100'
Globe
Tide Lake Glacier
Ajax
Tide lake 2350
Invincible
Long lake Glacier
3000
Summit lake
Olga
White Moose
War Eagle
Silver Spike
Granite Glacier
International
Unuk r.
Glacier
Glacier
Divide L.
Dilworth mt & glacier
Spider
Forty Nine
Hercules
Missouri
Big
Long lake
Silver Lake
Indian L.
Premier
Contact
Boundary
Glacier
river
Leduc
Chickamin river
Burroughs Bay
Tidewater
Behm Canal
REVILLAGIGEDO ISLAND
Bear River
Salmon River
STEWART
HYDER
(Alaska)
PORTLAND CANAL
Scale of Miles
0 1 2 3 4 5 10 15
B.C. Bureau of Mines

Spider Group. This group is comprised of three claims—*Spider No. 1*, *Spider No. 2*, and *Spider No. 3*—situated at the north-east end of Long lake. They were surveyed this summer and application made for Crown grants. The property is reached by pack-trail from "Joker Flat" over the low ridge between Silver creek and Long lake, a distance of about 1½ miles. Also there is a fair foot-trail branching from the *Premier* wagon-road to the camp of the Bush Mines, Limited, and following on up the East fork of Cascade creek, east of Slate mountain, to and along the west shore of Long lake. A wagon-road is under construction from the *Premier* road, crossing the East fork of Cascade creek and following along the west side of Slate mountain to Silver lake, and on up the valley to the *Big Missouri* and other properties. A branch from this road could easily be built to serve the *Spider* and other properties around Long lake.

This group of claims is owned by Bill Hamilton and Charlie Larsen, two old-timers of Stewart, and has been under bond to the Algunican Development Company, of Brussels, Belgium, for over a year. This company, under the very progressive local management of W. A. Meloche, has been very active this year and has spent approximately $100,000 in exploratory work on several prospects in the Stewart district. It is sincerely hoped that Mr. Meloche will be successful in making mines out of some of these prospects, for his company is certainly an asset to any mining district.

About 150 tons of supplies were taken into the property last spring, a distance of over 20 miles from the beach, on double-enders hauled by horses equipped with snow-shoes, and was the cheapest freighting done in this section, costing about $53 a ton. Camps were built, compressor installed, etc., and mining-work started early in May under the supervision of John Hoveland.

Surface showings indicate four or five quartz veins lying in an intrusive mass of augite porphyry. The north or No. 1 vein is the largest and oldest fissure and probably of lower grade contents than the balance. Later shearing action formed a series of roughly parallel, smaller, high-grade veins converging towards, and in one case intersecting, the larger and older vein. The No. 1 vein strikes S. 55° E. up the hill and dips about 65° E. No work has been done on this vein, except a couple of diamond-drill holes driven from the surface, which satisfactorily proved its continuity and values. On one of the smaller veins, No. 5, a tunnel has been driven about 700 feet, exposing several lenses of high-grade shipping-ore up to 3 feet in width. At a point 300 feet from the collar of the tunnel a raise for air purposes has been driven 60 feet through to the surface. On the No. 3 vein, south of No. 5, considerable surface work has been done in open-cutting along the vein, exposing a shoot of high-grade ore about 50 feet long and averaging 18 inches wide, assaying up to 300 oz. silver to the ton. The ore is a complex sulphide carrying zinc, copper, iron, lead, and silver. A crosscut will be run from the tunnel on the No. 5 vein to undercut this high-grade showing on the No. 3 vein, and should the high-grade ore be found at that depth, 150 feet, shipments will be made this winter. It may be expected that considerable enrichment will be found at the intersection of the small high-grade veins with the main vein.

Should the tonnage of milling-grade ore develop as expected, a concentrator is planned for next spring. The property has every appearance of developing into a profitable, small mine.

The country north of the *Spider* to the glacier has all been staked. This route is claimed by some prospectors to be the best into Tide lake, about 12 miles from the *Spider* camp over the Long Lake glacier. About fifty claims have been staked on the Nass slope and some provision should be made for a trail from the head of Long lake over the glacier. It should be staked out or marked in some way over the ice, so that there would be no difficulty in following it in any weather, and the approaches to the glacier made so that horses can be taken all the way through. With Tide lake as headquarters there is a big surrounding country for prospecting.

Mahood Mines, Ltd. This company was incorporated in March for $1,000,000 in 1,000,000 shares, with its registered office at 513 Pender Street West, Vancouver. The property consists of three groups of mineral claims—the *Divide* group, composed of *Divide No. 1*, *Divide No. 2*, and *Divide No. 3*, situated about 2 miles north of the *Spider* group and east of Divide lake; *Sunrise* group, composed of *Sunrise*, *Sunrise No. 2*, *Sunrise No. 3*, and *Sunrise No. 4*, situated along the east side of Long lake; and the *Mahood* group, consisting of the *S. & D. Fraction* and *Mahood Fraction*, situated at the foot of the glacier at the head of the East fork of Cascade creek; all of these groups being previously owned by

G. Mahood and partners. I have not seen any of the claims and have no information as to what or how much work has been done. It is claimed by the owners that high-grade ore has been found on all three groups. None of the claims are Crown-granted.

B.C. Silver Mines, Ltd.

This company was incorporated in October, 1919, by O. B. Bush for $1,500,000 in 1,500,000 shares, with the head office at 344 Pender Street West, Vancouver. The following claims were surveyed and Crown-granted this year and constitute the holdings of the company: *Oakwood, Holligan, Oakville Fraction, Oakville No. 2 Fraction, Texada, Texada Fraction, Humbolt Fraction, Humbolt No. 2 Fraction, Dixie, Mountain, Grandview, Bush Fraction, Neill Fraction, Halton, Simcoe, U. and I,* and *Rincon.* The first ten mentioned claims lie north of and adjoining the claims of the Premier Gold Mining Company, Limited, and the last seven lie south of the *Premier*, between it and the *International* group. Good camps were erected this summer on the ground north of the *Premier* and some diamond-drilling done. The property is under bond to Charles A. Banks, who intends continuing diamond-drilling operations next season.

Bush Mines, Ltd.

This company was incorporated over a year ago by O. B. Bush for $1,000,000, with shares at $1 par, the head office being at 344 Pender Street West, Vancouver. The property consists of the following sixteen claims, which were surveyed and Crown-granted this year: *Leslie M., Bell No. 2, Climax, Lesley No. 2, Lesley No. 3, Ax Fractional, Lesley No. 5, Gun Fractional, Lesley, Mahood, Lesley No. 4, Lesley Fractional, Limit, Lesley No. 6, Ten Fractional,* and *Bell.*

Some work was done on the property in the summer, but was closed down early in the fall. I did not get over the showings again this year and therefore refer the reader to last year's report. I am informed that nothing of importance was shown up this year, the work in the lower tunnel, at the big cut, exposing some stringers of high-grade ore, but not sufficient to be of importance.

Premier Gold Mining Co.

This company has been very active this year in putting the property in shape for producing on a scale commensurate with the extent and value of the ore-bodies. During the winter months 799 tons of ore was sledded to the dock and shipped to Tacoma, yielding 2,283 oz. gold and 77,180 oz. silver. The small tonnage is due to the unfavourable winter conditions for team-hauling. This winter two 5-ton Holt caterpillar tractors are being used and are proving very efficient. Up to the time of writing, February 1st, 1921, about 1,400 tons has been delivered at the dock from 9-Mile and shipped, and it is expected that as much or more will be shipped during the balance of the winter. Each tractor makes a round trip a shift from the beach to 9-Mile and return, and runs two shifts a day, hauling three sleds of 5 tons each to the load. The ore is delivered to 9-Mile from the mine, about 5 miles, by four-horse teams. In the summer the road from Hyder to 7-Mile is in an awful condition, but is each year being improved by the Alaska Government. An aerial tramway is contemplated from the mine to the beach.

An immense amount of construction-work has been done this year, though the season was short and disagreeable for outside work. A hydro-electric plant of 500-horse-power capacity was installed, power being obtained from Fletcher creek, with the power-house down on Cascade creek. A compressor plant and mining equipment were provided for opening up the mine by the Plate tunnel. Adequate and comfortable quarters for 100 men have been built. A concentrator of 100 tons daily capacity is in course of construction and will be in operation early in the spring. The flow-sheet for the mill will be approximately as follows: Mine-run ore to storage-bin of 100 tons capacity, bin to gyratory crusher, breaking to 1-inch size, to crushed-ore bin of 100 tons capacity, from crushed-ore bin over grizzly to rolls, crushing to ½ inch, to storage-bins of 100 tons. The crushing end is run by a 75-horse-power motor. From the storage-bins the crushed ore is fed automatically to a 5- by 10-foot Marcy ball-mill in closed circuit with a Dorr classifier; the overflow from the classifier goes to a 4- by 8-foot Denver ball-mill in closed circuit with a Dorr bowl classifier, from which the overflow, 150 mesh, goes to a K. & K. flotation-cell. The tailings from the flotation-cell go to a Dorr thickener; thence to an American filter-press, and from there to the first agitator of the continuous operating cyanide plant.

All of the above equipment of the property is evidence of the very gratifying results of underground development and diamond-drilling this summer, the latter proving the continuation and improvement of the high-grade ore-shoots now being mined from the Upper or No. 1 level.

For this winter's stoping a shaft was sunk 60 feet from the No. 1 level, midway between the No. 1 and No. 2 ore-shoots; a drift run both ways from the bottom of the shaft to open up both shoots, from which, as stated before, about 1,400 tons of high-grade ore has already been shipped.

With the opening-up of the property from the level of the Plate tunnel, which will give a depth of approximately 600 feet on the ore-shoots; the completion of the mill for the treatment of the low-grade ore; the provision of transportation to handle the shipping product; and with the known extent of the high-grade ore-shoots, this property bids fair to become the leading gold-silver producer in the Province.

Since the resignation of R. K. Neill the property has been under the management of Dale L. Pitt, with Bert F. Smith as assistant manager.

International Group.

This group is composed of eight claims and is owned by Pat Daly, of Stewart, and associates. The claims lie just above the boundary-line and are easily reached from the 11-mile road-house by a good trail. A little surface work was done this summer and the tunnel extended a short distance, with two men working. Nothing new reported.

UNUK RIVER SECTION.

This section is now included in the Portland Canal Mining Division, with its Mining Recording Office at Stewart instead of Anyox.

The mineralized portion commences about 3 miles above the Alaska-British Columbia boundary, furnishing prospecting-ground on both sides of the river to its head, a distance of over 20 miles. Two reconnaissance parties were outfitted and sent into this section this summer by the Department of Mines. Each of these parties consisted of three men. One party went up the Unuk river and the other over the Salmon glacier via Stewart, meeting each other on the South fork of the Unuk river, about a mile below the *Globe* group of claims and about 12 miles up from the main river.

The Salmon Glacier party had its supplies and outfits packed to the first camp just above the *Hercules* on July 9th, losing a portion of it fording the Bear river during the spring freshets. From this camp four relays were made in packing on their backs to the head of Tide lake, where a base camp was made on July 28th. From this camp several attempts were made to find a route over the glacier lying between Summit and Tide lakes to the South fork of the Unuk or a branch of it. Failing in this, they then tried over the next glacier at the foot of Tide lake, and after two attempts made the South fork on August 30th, following down Cabin creek from the foot of one of the branches of the main Tide Lake glacier and very luckily meeting the up-river party who were returning from a trip to the *Globe* group on the South fork. This work shows conclusively that there is no useful route from the Salmon glacier to the Unuk basin. The party reports a well-mineralized country from the *Forty-nine* to and in the vicinity of Tide lake, the formation being similar to that of the Salmon River basin. With about a mile of trail from the *Forty-nine* to get on the Salmon glacier, and 5 or 6 miles over a good grade from the end of the glacier to Tide lake, the country would be in good shape for transportation and prospecting.

The up-river party left Prince Rupert on June 14th for Ketchikan, proceeding from there by launch to a point about 4 miles up the Unuk river, which flows in at the head of Burroughs Bay. From this point the trip was made in a 24-foot river-boat by poling and lining along the banks and bars to the second canyon, a mile or two above the boundary-line. Supplies were portaged there and an old boat repaired for the balance of the trip. Owing to the abnormally high water this year, due to the sudden heavy rains before the snow had melted, the river was not navigable for a couple of weeks and difficult and dangerous all summer. On the return trip the party got tangled up with a snag about 10 miles up from the mouth of the river. The boat was smashed to pieces and a lot of personal belongings and the most of the remaining supply of grub lost. Fortunately the party was picked up a few days later by a party of United States surveyors coming down the river and landed in Ketchikan. This trip proved decisively that up the river is the only possible way of access to this portion of the district, and also that the water route is of no use to the ordinary prospector, being too expensive for outfitting, difficult, and dangerous. The only feasible way of making this area available to the prospector and ultimately to the operator is by means of a good pack-horse trail built on a wagon-road grade

from the mouth of the river to the mouth of Sulphurets creek, a distance of about 40 miles, and branch trails up the main tributaries.

It is about 24 miles from the mouth of the Unuk to the boundary, through Alaska; the balance of the work would be in British Columbia. About twenty years ago a wagon-road was partially constructed from tide-water to 2 miles beyond the boundary, of which portions are in not bad repair, but would require all new bridges and about 3,000 feet of rock-work in two places where the bluffs border the river-banks. From the boundary up the main river would not be a difficult or expensive trail to build.

This is an extensive, and very possibly rich, area of the Eastern Contact Belt that could be made accessible with a comparatively small expenditure, and on account of the easy grade is more favourably located for ore transportation than that portion of the district over the Salmon River divide on the Nass slope, though it is farther from tide-water. There is good land at the mouth of the river for raising horse-feed, and one of the ranchers has signified his intention of furnishing pack-horses if a trail were built.

The party, though having no time for any detailed exploration, report plenty of float minerals in the different creeks and generally a good-looking country for prospecting.

STIKINE MINING DIVISION.

An increasing amount of interest is being taken in this Division, and without doubt more activity will result when prospectors realize that there is a big area of the Eastern Contact Belt that is more accessible along the Stikine and Iskut rivers than in other more southerly portions of the District. Some little prospecting was done along the Stikine River and there were a couple of parties up the Iskut river working south toward the Unuk. From the map of the Boundary Survey I do not think there is any trail route via the South fork of the Iskut to the Unuk river. However, there may be a route across from the foot of the canyon on the Iskut to the head of the North fork of the Unuk, a direct distance of about 15 miles. (*See* sketch.) I think, though, that each of the areas on the Eastern Contact Belt will have to be opened up separately; that is, the Unuk area by way of the Unuk river from the coast, and the Iskut area by way of the Iskut river itself, with trails from the river up its different tributaries. The only use a trail along the eastern flank of the Coast range would be for a guidance to prospectors working between the drainage-basins of the different rivers cutting through the granite.

The eastern border of the Coast granites crosses about a mile below the head of Alice arm, about a mile above the head of Portland canal, 3 miles above the boundary on the Unuk river, follows the east bank of the South fork of the Iskut for some distance, and cuts across the Stikine river about 15 miles below the Grand rapids. It roughly parallels a line drawn from the mouth of Portland inlet to Juneau.

Very little mining-work was done in this Division this year, and the reader is referred to last year's report for descriptions of the more prominent prospects. The Jacksons have been working on their placer-ground up Clearwater river all season, but no information is obtainable as to results. The gravel-deposits along this river are worth investigating by drilling for hydraulicking and dredging purposes, and the area is well worth prospecting for mineral-deposits.

No work has been done on the claims of the Iskut Mining Company, which are situated about 36 miles up the Iskut from its mouth. These claims are all Crown-granted. Prospectors going up the Iskut must take advantage of the low water in the early part of the season, as navigation for small boats is practically impossible after the water rises. The feasibility of clearing a channel of snags, sweepers, and log-jams has been pointed out in previous reports, and until such work is done, giving some assurance to the prospector that his work will be of some benefit to him, the development of the country will be at a standstill.

LIARD MINING DIVISION.

This Division occupies the north-eastern corner of the Province and is the most remote and least known of any of them. The only portion of it that has had any development whatever is around Dease lake and along Dease river, which drains the lake and flows into the Liard river, which in turn empties into the Mackenzie river at Fort Simpson. About $5,000,000 was taken out in placer gold from Dease and Thibert creeks, flowing into Dease lake, and McDame creek, a tributary of Dease river. This part of the Division is reached by way of

Telegraph Creek, at the head of navigation on the Stikine river, from which point a good pack-trail runs to the head of Dease lake, a distance of 72 miles. Two pack-trains operate between Telegraph Creek and the head of the lake, leaving at five-day intervals. Freighting costs 8 cents a pound to the lake and an additional 1 cent a pound down the lake to Porter, a distance of 25 miles. There are no regular transportation facilities beyond the lake. Judging from the amount of gold that has been taken out from the small area operated, there is every reason to believe that a wider range of more thorough prospecting than was given the country in the early days would find as rich diggings. A number of mineral claims were staked years ago, but there has never been any real search for mineral in this section because of its isolation and the lure of the placer gold.

Last year's operations were productive of such good results that considerable interest has been taken in the section this summer in prospecting for hydraulicking-ground.

The principal work has been done on Thibert creek and its two tributaries, Deloire and Mosquito creeks. As noted in last year's report, the operations of George Adams on the old Thibert Creek Mining Company's ground proved very encouraging and gave quite an impetus to this whole section this year. It was found this spring that owing to the settling of the high bank along which the flume was built, due to the workings of the old company along the base of the hill, water could not be brought to last year's pit, and therefore necessitated the removal of the whole plant about a mile farther up the creek and the opening-up of new ground. With the scarcity of labour this looked like an impossible undertaking this spring, but was nevertheless done. Hydraulicking was then started in cleaning out an old pit and extending it farther into the bank, with the hope that the old channel had not been reached by the old workings as had been proven in last year's work down the creek. This dead-work, from which the clean-up was only about 100 oz., took the whole season and the results of the summer's work were therefore discouraging. Adams is working under a serious handicap of a lack of sufficient water to handle the excessive amount of overburden. The installation of about a mile of 36-inch steel pipe is necessary for the success of what has every appearance of being a very extensive enterprise. However, with only a pack-trail from the head of navigation, it will be impossible to get in such an amount of pipe. Mr. Adams has informed me that he will resume operations as early as possible in the spring.

On Deloire creek, a small stream emptying into Thibert creek about 2 miles up from the lake, a number of leases were acquired by Captain Barrington and associates, on which two men worked steadily all last winter driving a bed-rock tunnel. This work showed very satisfactory pay on bed-rock and it was decided to install a hydraulic plant in the spring and go after it. Owing to lack of labour it was, however, agreed to combine forces and concentrate on Adams's work; therefore nothing was done on this ground this summer. Latest information is that it will be worked next season.

On Mosquito creek, flowing into Thibert about 12 miles up, George Adsit has been working all summer on the lease that he has held for a number of years, and on which he has certainly done a lot of work for one man in getting the ground in shape to work. Although a good deal of the surface has been ground-sluiced away, bed-rock is yet about 20 feet deep, which means a lot of dead-work, and this summer his yield was only about 20 oz.

In 1918 two leases were acquired, lying about Adsit's ground on Mosquito creek by a party of returned soldiers. This year they succeeded in interesting the Provincial Department of Industries to the extent of granting them assistance to open up this ground, and a party of seven or eight went in early in May with a good outfit. Unfortunately the men, with one or two exceptions able and willing to work, were inexperienced in this kind of work, and the leader who had taken "command" of the expedition knowing nothing about anything in connection with placer-mining, the enterprise was inevitably a failure. The mouth of this creek proved rich diggings in the early days, and the lease above this, now held by George Adsit, shows good pay, so that it is fairly reasonable to suppose that the ground adjoining Adsit's above, and owned by the returned men, would prove equally as good. It is regrettable that, with a bunch of able and willing men, advantage could not have been taken of the assistance provided by the Government and sufficient work done to open up and prove the ground.

Some sluicing was done on Dease creek by Bryan & Hankin, who took out about 20 oz.

On McDame creek the Princess May Hydraulic Company, under the management of Amos Godfrey, built a new flume 240 feet long and moved considerable overburden, getting, I am

informed, some very encouraging prospects on bed-rock. Anderson and two or three others have been persistently prospecting on this creek for several years.

Various prospectors throughout the Division washed out probably 60 oz. more, bringing the total yield up to about 200 oz. for the year.

Coal was discovered and staked on the Tuya river years ago, but nothing further has ever been done toward exploring it.

A pack-trail was built in 1874 from Telegraph Creek to the head of Dease lake and is still used as a pack-trail. It answered all requirements for a number of years while operations were confined to placering, but, with the exhaustion of the placer and the development to hydraulicking and dredging, as exemplified in the Yukon and Atlin districts, the trail should have developed into a wagon-road to meet the requirements for transportation of the heavy machinery and outfits necessary for such operations. Under present conditions there is little probability of any prospecting for minerals being done. There is no doubt that the potentialities of such an immense area of the Province fully warrants the investment of the comparatively small outlay necessary to complete the wagon-road through to the lake.

Office statistics show that nine new leases were granted. The effect of the new "Placer Act" of 1920, whereby leases will have to be worked or revert to the Crown and again become available for staking, will have a very beneficial effect.

ATLIN MINING DIVISION.

Since I have been unable to cover any portion of this Division this year, I am indebted to J. A. Fraser, Gold Commissioner at Atlin, for my information of the mining situation. Mr. Fraser furnishes a very comprehensive report of the mining activities in both the Atlin and Rainy Hollow sections, and as anything I could say would simply be a repetition of this, I will refer the reader to this report on page 71.

It is worthy of note that lode-mining in both sections is apparently receiving merited attention. The success of the *Maid of Erin* property in Rainy Hollow and the improvement of transportation facilities to admit of its shipping would furnish the necessary stimulus for the thorough exploration of that very promising section. Reports of J. M. Ruffner's operations on Crater creek are very favourable, and there appears to be a chance of the legal affairs of the *Engineer* mine being sufficiently straightened out to permit its operation.

I intend getting over this division thoroughly next season.

In concluding this report, I wish to express my appreciation of the assistance given me by prospectors and operators throughout the district.

CASSIAR DISTRICT.

ATLIN MINING DIVISION.

REPORT BY J. A. FRASER, GOLD COMMISSIONER.

I have the honour to submit my report on mining operations in the Atlin Mining Division of Cassiar District for the year ending December 31st, 1920.

Of over 300 men who were in the district during the summer, at no time were there over 200 engaged in mining and prospecting. Of those so employed, at no time were more than 150 engaged in placer-mining, about ninety being engaged in actual production and sixty in prospecting or dead-work, getting down to bed-rock and pay-dirt.

About forty men were engaged in lode-mining and prospecting, but there was no output reported and no shipments made so far as I have learned.

In view of the situation herein-above revealed, the scarcity of labour, the limited supply of water on some of the creeks, and the shortness of the season generally, it is rather astonishing that the output was even as good as it was. Altogether the outlook for the next season is considered encouraging.

There was a falling-off in the output from that reported the previous season, but that was confined to three or four creeks where the operating forces were engaged for a good part of the season in moving plant and other dead-work, the benefits of which the operators expect to enjoy this coming season.

Notwithstanding the above-mentioned conditions, the amount of revenue actually collected was in excess of that of the two previous years.

McKEE CREEK.

Taking the creeks in the same order as for some years past, I may say that on McKee creek nothing was done beyond protecting the plant and workings during high water and such-like services, which kept one man in occupation practically throughout the season. Some activity was fully expected to have been undertaken there last season, but the president of the company died suddenly early in the summer and some reorganization appears to have been deemed necessary which apparently halted development; but I am pleased to report that some prospecting operations are being carried on there this winter, and it is hoped and expected that the results will justify the renewal of active hydraulic operations upon that creek next season.

PINE CREEK.

On Pine creek from twenty-five to thirty men were operating throughout the season, of whom between fifteen and twenty were operating hydraulically at three different points. Two outfits were operating on "lays" from the Discovery Mining and Power Company, Limited, and the other outfit was resluicing tailings upon ground held by the Atlin Gold Mines Company. The results of these operations appeared to be satisfactory to all concerned.

Two other small outfits were doing dead-work and prospecting throughout the greater portion of the season. One outfit did not recover any gold, but the other crew (from four to six men), while doing dead-work, which involves running a drainage-tunnel diagonally across under the bed of Pine creek with a view to providing gravitation drainage for the ground on Gold Run, were more fortunate and recovered a fair amount of gold in portions of the gravel encountered, and they are very sanguine of securing good returns when they get through. This work is being carried on throughout this winter, and it will take them some months yet to reach the pay-gravel they are after on the other side.

SPRUCE CREEK.

On this creek from thirty-five to forty men operated pretty continuously throughout the season and quite a number throughout the year; those latter carrying on drift-mining, of which more is done on this creek than on any other in the district.

During the summer quite a number of men were carrying on open-sluicing and still others were prospecting; perhaps 25 per cent. of those on the creek were prospecting or doing dead-work. Once more, however, this has been the banner creek for production and the output *per capita* was good, which means that a number of the operators did very well indeed.

One-half or more of the summer force is drift-mining on that creek this winter, and as several new leases have been located on the creek we may expect a continuance of those or similar operations for years.

BIRCH CREEK.

On Birch creek H. P. Pearse operated with a small force and secured good returns for the period of available water, but as that period was very short the season's operations were not what they might have been, but he is still looking forward to another season's operations and hoping for better conditions, which will enable him to speedily recover the minus balances of some past seasons, for apparently the gold is in the gravel if he can only secure sufficient water for a reasonable run throughout the open season to remove the gravel and recover the gold.

BOULDER CREEK.

About fifteen men were employed on this creek during the season, of whom at least one-third were engaged in installing new reservoirs and plant and other dead-work, but notwithstanding this the returns were satisfactory and the outlook for next season is encouraging.

On this creek a new operator in the person of W. F. Gore, of Seattle, Wash., has secured the holdings of J. H. Black & Co. on upper Boulder, and from the result of the season's operations he appears to be well satisfied and intends operating a much larger force next season.

Charles Miller operated on lower Boulder, but with a smaller force than usual, principally because men were not available.

RUBY CREEK.

On Ruby creek the Placer Gold Mines Company, under the management of T. M. Daulton, commenced operations on May 30th and ceased on September 20th. Camp was actually opened on May 6th, but much time was lost in moving plant, pressure-box, etc., up-stream, and as only about half a crew was obtainable the output was not as large as usual, but was quite up to the average for the time and force employed. They expect to operate in full force this coming season if labour conditions prove satisfactory. About twelve men were employed by this company during the summer and a number of men are "drifting" on the creek this winter.

On upper Ruby creek four or five men were engaged prospecting and sinking to find bed-rock, and one crew expended about $2,500 in their efforts to do so without reaching their objective, but they intend continuing next summer and will doubtless accomplish their purpose.

No gold was recovered in any of those prospecting operations, but it is expected that a much larger force will be operating on the creek next season.

WRIGHT CREEK.

On Wright creek six or seven men operated throughout the season, but again it was mostly dead-work throughout, but about the end of the season one crew of four men found themselves on the edge of the channel for which they were seeking, and they are eagerly awaiting the advent of another open season so as to continue their exploration.

The other operators recovered some gold, but not sufficient to cover the cost of the season's dead-work. They are also hopeful for the future.

OTTER CREEK.

On lower Otter the Mines d'Otter, under the superintendence of Henri Maluin, with J. E. Moran as foreman, commenced operations about April 25th and carried on until the end of October at an expense of about $16,000, but, I regret to say, without uncovering bed-rock proper, which, however, they believe they have uncovered in one corner of their last pit, which encourages them to continue the work next season. Piping was carried on from May 15th to October 17th and about 200,000 cubic yards of overburden and gravel was removed. In the prosecution of this work considerable gold was recovered upon a false bed-rock of hard clay, as was done during the last four seasons, but not sufficient to cover the season's expenses.

B.A. Bertrand, 05 March

Dog-team on Salmon River, Portland Canal M.D.

Discovery Creek, Atlin—Hydraulic Mining.

Two or three men operated and prospected on upper Otter for part of the season and recovered some gold, but were not encouraged to continue because of water conditions. I have had no report from them, so cannot speak confidently as to their financial success.

LINCOLN CREEK.

On this creek a small force of men operated for the greater portion of the season, but were again compelled to abandon their works because of the threatened danger from slides and caving induced by the presence of strata of glacial mud betwixt the strata of sand and gravel, so that another season has passed without revealing whether or not that creek is to be numbered amongst the producing creeks of the district.

The operators are more encouraged than ever to believe it will be if they can once reach bed-rock and secure a working-face, for they have found gold from the grass-roots down, and it has practically all the other characteristics of a good hydraulic proposition—good water, grade, dump, reservoir facilities at the head, and plenty of timber within easy reach. Doubtless operations will be resumed in some form as soon as local conditions will permit.

DAVENPORT CREEK.

This creek lies a little to the north of but not far from Lincoln creek, and encouraging prospects were found upon it some years ago, but nothing has been done on it for some time, principally because of the illness of the party who did most of the prospecting; but this party has at last secured sufficient capital to give it a reasonable test and men are prospecting it this winter by means of tunnels. If bed-rock reveals anything like what the surface indications seemed to warrant, I expect a plant of some kind—probably hydraulic—will be installed next season.

WILSON CREEK.

On Wilson creek six men part of the time and one or two men practically throughout the season were operating, mostly prospecting, and some gold was won, but not sufficient to cover the outlay; it was sufficient, however, to encourage continuation, and as some more leases were located on the creek last summer I expect there will be a much larger force operating there next season, provided men are available.

SLATE CREEK.

Two men were prospecting throughout the season on Slate creek and two also on Feather creek without attaining their objective, but they intend to continue next season.

O'DONNEL RIVER.

On O'Donnel river seven or eight men were operating the greater part of the season. Most of this work was of a purely prospecting nature, and although a certain amount of gold was reported by some of the operators, the fact that several leases have been located since January 1st by some of those who have not reported any results from their prospecting seems to justify the assumption that the said results were satisfactory, or encouraging at least, and we are justified in expecting the presence of a considerable force upon that stream next season, provided the men are available.

OTHER CREEKS.

Nothing has been reported with respect to development upon Bull, Burdette, Cracker, Fox, Graham, Granite, Hemlock, Horse, Union, or Volcanic creeks during the past season, although certain individuals have been reported as making good wages prospecting and sniping on some of them.

PLACER-MINING.

The recent amendments to the "Placer-mining Act" with respect to leases have had a beneficial effect in this district, the consequence being that about half the number of leases held in the district have been allowed to revert to the Crown, but the other half have been consolidated and the revenue materially increased by the payment of arrears, as well as current rentals, and there will not be any encouragement henceforward to hold considerable areas in lease form without any effort at development, as had become the practice in recent years. With respect to the leases which have lapsed, I am satisfied that very few of the lessees would have done any-

thing even if permitted to hang on indefinitely, and such holdings had become a detriment to the development of the district.

MINERAL CLAIMS.

Another year has passed during which apparently not much beyond what was necessary to protect title has been done with respect to quartz properties throughout the greater portion of the district. Two notable exceptions are with respect to the properties located upon or in the vicinity of Crater creek, a tributary of Fourth of July creek (about 14 miles from Atlin), and the properties commonly known as the *Maid-of-Erin* group in the Rainy Hollow section.

With respect to the silver-lead properties situated on Crater creek, I may say that J. M. Ruffner, who had spent considerable time and means in prospecting and investigating those deposits in 1919, secured control of twenty-five or more claims, and during last winter succeeded in organizing a small company in Seattle which undertook to supply the necessary capital to reasonably ascertain the probable potentialities of the group.

This he undertook to do systematically and commenced operations as early as climatic conditions would permit, and with a force of from five to ten men, amongst whom was a qualified assayer, pursued his exploratory work until midsummer, when apparently his backers found themselves unable to supply the necessary funds and the operations were consequently suspended for the time being.

This suspension was a matter of keen disappointment not only to the manager, but to every one interested in the development of the district, for the work done appears to have disclosed the existence there of a very large and continuous body of ore in which silver seems to predominate, but with lead, copper, and gold more or less closely associated. One main ledge is said to be traceable continuously for 3 miles or more, and some of the assay tests revealed values approximating or exceeding $400 a ton, while in some portions the gold values were estimated to be sufficient to cover cost of operation. In any event sufficient ore has already been exposed to warrant thorough investigation, which will be resumed as soon as the hills are bare again.

In Rainy Hollow R. W. Wiley, of Portland, Oregon, who had secured options on the above-mentioned *Maid-of-Erin* and associated claims (13½ in all), commenced operations about the end of June and prosecuted development until some time in November. His operations, I believe, were confined to the *Maid-of-Erin* claim, but, although considerable ore was sacked ready for shipment, the condition of the roads on both sides of the International Boundary precluded shipment, unless such has been undertaken since winter set in.

With respect to the *Engineer* mine, I may say that not much development has been attempted since the death of the late Captain James Alexander, who was the registered owner at the time of his death. Last summer four men were engaged in development-work for a portion of the season, but this work was halted from time to time to permit of examination of the underground workings by mining engineers representing prospective purchasers. No shipments of ore were made nor was the stamp-mill used.

As the ownership and even the title to the property has been challenged, not much, if anything, will be undertaken until the pending litigation is disposed of. It is unfortunate for the district that those difficulties have arisen, as they have a decidedly deterrent influence upon the development of this part of the district, for, whether reasonably or otherwise, prospective purchasers as well as present owners appear to be "marking time" awaiting developments with respect to the *Engineer*.

It is hoped that all those matters may be finally settled at an early date, so that some person may proceed with the development and operation of that property and thus set the wheels of progress in motion again.

Nothing has been done towards the development of the coal or hydro-magnesite deposits in this district since last report.

OFFICE STATISTICS—ATLIN MINING DIVISION.

Free miners' certificates issued (individual)	330
Free miners' certificates issued (company)	4
Placer records	5
Placer rerecords (representing 187 claims)	174

Leases applied for	17
Leases issued	32
Certificates of work (leases)	81
Leaves of absence (representing 104 claims)	30
Filings (placer)	2
Bills of sale, etc. (placer)	14
Bills of sale, etc. (hydraulic)	32
Bills of sale, etc. (mineral)	11
Mineral records	37
Certificates of work (mineral)	112
Filings (mineral)	6
Crown grants issued	2

Gold reported.

Gold-output reported or estimated—	
As won by individual miners and partnerships	$ 83,090 00
As won by companies	51,360 00
Total output	$134,450 00

Revenue.

Land revenue	$ 360 00
Water revenue (rentals)	93 60
Free miners' certificates (individual)	1,534 50
Free miners' certificates (company)	350 00
Mining receipts (lease rentals)	4,837 50
Mining receipts (lease applications)	340 00
Mining receipts (other sources)	1,961 90
Receipts from all other sources	12,238 68
Total	$ 21,716 18

STIKINE AND LIARD MINING DIVISIONS.

REPORT BY H. W. DODD, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on mining operations in the Stikine and Liard Mining Divisions of Cassiar for the year ending December 31st, 1920.

The year was a lean one as far as production is concerned, brought about by unsettled labour conditions and high cost, so that the expectations of 1919 were not fulfilled.

PLACER.

Thibert Creek.—On this creek George Adams had an average of six men working all season; the plant was moved up-stream three-quarters of a mile and a rock-cut put through the rim for 250 feet; two pits were then opened, one 100 by 50 feet and the other 250 by 150 feet, with satisfactory results.

Deloire Creek.—On this creek Captain S. Barrington had two men at work all season prospecting on Leases 50-102-6-7; an open-cut was made about 400 feet, starting at zero at the lower end of the leases and working up to 15 feet in depth, on which good prospects were obtained.

Dease Creek.—On this creek Bryan & Hankin have done considerable work on Lease 103 and have placed it in fair shape for the coming season.

McDame Creek.—On this creek the Princess May Hydraulic Company, under the management of Amos Godfrey, had eight men working the greater part of the season; a new flume of 240 feet was put in and considerable overburden removed; bed-rock was not all uncovered, but the prospects obtained were encouraging.

Nine new leases were granted during the year, and with the new "Placer Act" of 1920 into effect, a lot of the ground which has been lying idle will be either worked or thrown open.

MINERAL.

Apart from the necessary assessment-work in order to protect claims, nothing much was done.

As the annual report of the Resident Engineer, Geo. A. Clothier, will cover everything, I will have nothing more to add.

OFFICE STATISTICS—STIKINE AND LIARD MINING DIVISIONS.

Revenue collected from free miners' certificates	$ 593 50
Revenue collected from mining receipts	1,768 40
Revenue collected from other sources	4,584 79
Total	$6,946 69

SKEENA DISTRICT.

SKEENA AND BELLA COOLA MINING DIVISIONS.

REPORT BY J. H. MCMULLIN, GOLD COMMISSIONER.

I have the honour to forward you herewith the office statistics of the Skeena and Bella Coola Mining Divisions.

The report of the Resident Engineer fully covers the mining development for the year and I have nothing further to add to his report.

OFFICE STATISTICS—SKEENA AND BELLA COOLA MINING DIVISIONS.

Free miners' certificates (individual)	530
Free miners' certificates (special)	7
Mineral claims recorded	151
Certificates of work issued	143
Bills of sale, etc., recorded	52
Certificates of improvement issued	2
Filings	15

Revenue.

Free miners' certificates	$2,784 00
Mining receipts, general	1,558 15
Total	$4,342 15

NASS RIVER MINING DIVISION.

REPORT BY JOHN CONWAY, ACTING MINING RECORDER, ANYOX.

OFFICE STATISTICS—NASS RIVER MINING DIVISION.

Free miners' certificates (individual)	606
Free miners' certificates (special)	2
Mineral claims recorded	1,108
Certificates of work issued	670
Bills of sale, etc., recorded	381
Filings	88
Certificates of improvements recorded	17

Revenue.

Free miners' certificates	$ 2,588 00
Mining receipts, general	7,567 35
Total	10,155 35

QUEEN CHARLOTTE MINING DIVISION.

REPORT BY J. L. BARGE, MINING RECORDER.

I have the honour herewith to submit my annual report for the Queen Charlotte Mining Division for the year ending December 31st, 1920.

During the past year very little development-work worthy of mention has been in progress.

The *South Easter* and the *Ikeda* mines are, I believe, in process of reorganization and greater activity is expected during 1921.

Jones & McRae have a very promising ledge uncovered at Kootenay harbour, on the west coast of Moresby island, and are very optimistic as to its future.

Numerous small individual properties at the south end of Moresby island are being worked and ore accumulated ready for future shipping.

On the north and east coast of Graham island the holders of placer-mining leases and prospectors continue active.

Active operations are in progress among the oil-shales of the west coast of Graham island; a large deal is said to be pending.

OFFICE STATISTICS—QUEEN CHARLOTTE MINING DIVISION.

Free miners' certificates issued	87
Mineral claims recorded (quartz)	43
Mineral claims recorded (placer)	1
Certificates of work issued	81
Bills of sale and records entered	10
Filings	4

Revenue.

Free miners' certificates	$ 390 50
Mining receipts	649 00
Trade licences	270 00
Firearm licences	105 00
General receipts (P.C.F.)	450 00
General receipts (V.S.)	50
Marriage licence	5 00
Total	$1,870 00

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.

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 section; Hazelton section; Telkwa section; Sibola section.
Cariboo Division—Tete Jaune section; Fort George section; Ahbau Lake section; Barkerville section.
Quesnel Division—Quesnel section; Horsefly section; Keithley section.

During the first half of the year 1920 the mining industry made satisfactory progress in the North-eastern Mineral Survey District, but in the last half of the year a gradual decline set in. The year 1920 commenced with conditions favourable to the development of new mineral areas, but before the year had advanced far financial depression and the lowered market price of all the more important metals caused a curtailment in all mining development and production throughout the American continent. Considering these adverse conditions, the progress made in the North-eastern District during 1920 was satisfactory.

The production of the district for the year 1920 was slightly greater than in the preceding year. The output of silver, lead, and zinc for the district comes mainly from the *Silver Standard* mine at Hazelton, and this year this mine nearly doubled its shipments as compared with 1919. Practically no copper ore was mined in the district this year, but when an improvement in the copper market takes place some of the copper properties on Rocher Déboulé mountain and in other parts of the district should again make a production.

The placer-gold production, which comes almost entirely from the Cariboo and Quesnel Mining Divisions, was about the same as last year. Placer-mining in the Cariboo, Omineca, and Peace river seems to be about ready for a period of renewed activity during the next few years, as many prospective enterprises are about to be launched. The recent changes in the "Placer-mining Act" would seem to have been beneficial in encouraging development, and the impending era of lower prices, which automatically effects a higher relative price for gold, will undoubtedly stimulate the search for the yellow metal.

The following table shows the mineral production of the North-eastern Mineral Survey District for the year 1920, together with the corresponding figures for the year 1919:—

	1919.	1920.
Placer gold (oz.)	3,900	3,450
Lode gold (oz.)	147	218
Silver (oz.)	72,573	103,020
Lead (lb.)	180,455	189,488
Copper (lb.)	16,205	.....
Zinc (lb.)	224,539	453,512
Coal (tons)	1,752	1,400

It seems probable that the near future will see extended development of the coal areas of this district. The ever-increasing price of fuel-oil and its scarcity in the world's markets is causing renewed interest in all promising coalfields. The Telkwa river, Morice river, Zymoetz (or Copper river, as locally known), Peace river, and Groundhog fields have attracted attention this year and large-scale development may be expected before long. Undoubtedly these areas contain large quantities of good-grade coal, and but for the admitted transportation difficulties they might now be in the productive class. Some coal was mined by the Telkwa Collieries this

year and a short distance from this property a new seam is being opened up. This seam contains some high-grade blacksmith-coal and a small output will soon be marketed.

During the year grants were made from the Mines Development Fund to assist in building, improving, extending, or repairing a number of mining roads and trails in the district. Among the more important of such works were: Extensive repairs to the Cronin sleigh-road and the building of 1 mile of new road, linking this road up to the main road; extension from the McCabe trail on Driftwood creek to the *Victoria* group; extension from McCabe trail to the *Silver King* group; completion of Schufer trail on Hudson Bay mountain; trail from *Empire* group to Dahl Siding; continuation of work on Tahtsa River trail; extensive repairs to roads serving *Silver Standard* mine and mill; repair-work on the Manson–Fort St. James trail; laying-out of trail from Barkerville to Keithley Creek; repairs to Grouse Creek road; and a number of small grants where necessary.

Under the plan arranged by the British Columbia Department of Mines for assisting returned soldiers to prospect, five returned soldier prospecting parties were at work during the season in this district. Two parties examined country along the Skeena river, two parties were in the Peace River Division, and one party east of Ootsa lake. One party in the Peace River Division reported a successful season in finding some promising coal-seams, but no great success rewarded the efforts of the other parties.

OMINECA MINING DIVISION.

SKEENA SECTION.

Usk.

In the vicinity of Usk there was a considerable amount of mining activity during the season. In addition to certain mining-work, there were quite a number of prospectors out in the hills.

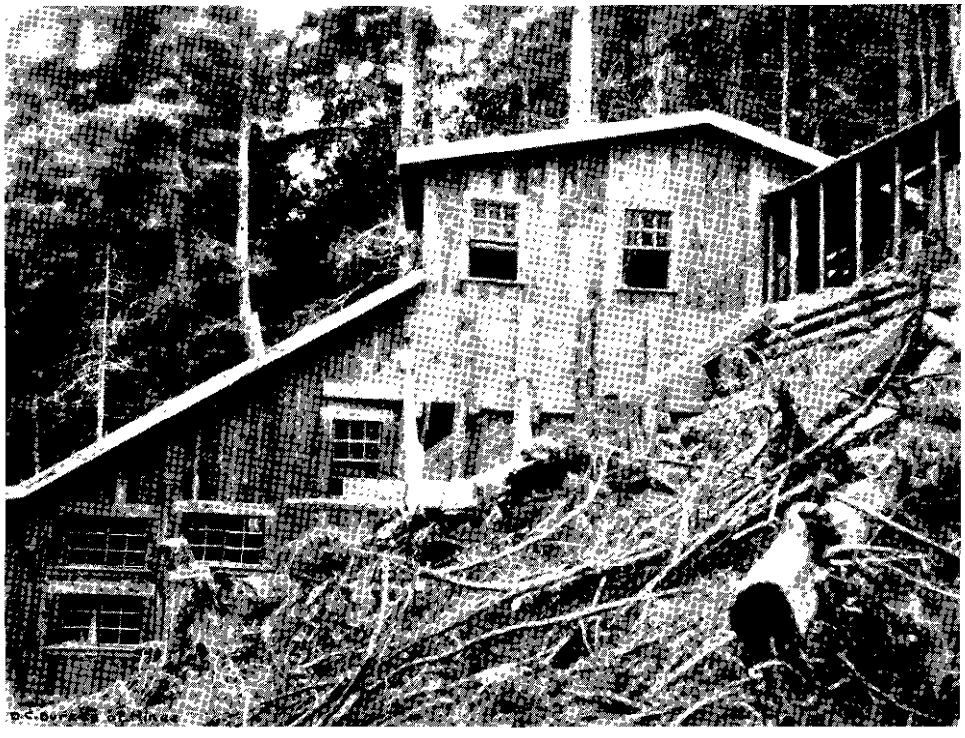
Kitsalas Mountain Copper Co.

During the past four years this company has been developing the *Cordillera* group, situated 1 mile in a southerly direction from Usk. There are several quartz veins on the property which carry in places pay-shoots of bornite and some free gold. The property has been fully described in previous Annual Reports. The erection of a small concentrating-mill was practically completed in 1919, and during the summer of 1920 this mill was in operation for a time, with, it is claimed, satisfactory results. Ore from surface cuts was treated in the mill, but as yet no ore has been stoped from the underground workings. About 200 tons of ore was milled, producing about 20 tons of bornite concentrates, which, however, was not shipped during the year.

The milling machinery consists of a Blake jaw-crusher, Gibson grinder, amalgamating-plate, and a Wilfley table on which the tailings from the amalgamating-plate are concentrated. The ore is trammed from the mine-workings to the mill, 500 feet, on a covered-in surface tramway. The ore goes through grizzlies, the undersize going directly to the 150-ton ore-bin, and the oversize to the crusher which crushes to about ½-inch size, and then to the same ore-bin. From the ore-bin an automatic feeder discharges the ore into the Gibson grinder, where it is ground to about 20-mesh size.

The Gibson grinder consists, in effect, of a large pestle and mortar, the pestle being given a grinding motion by the swinging of the top of it through a circle about 2 feet in diameter, while pressure of the pestle on the mortar is given by its own weight together with the downward pull of a heavy spring. The rated capacity of the Gibson grinder is 30 tons in twenty-four hours. Mercury for amalgamating the free gold in the ore is put into the grinder and most of the amalgam is caught on baffles in the machine, the remainder being caught on the amalgamating-plate, over which the pulp from the grinder discharges. From the amalgamating-plate the pulp feeds directly to a Wilfley table, where the bornite content of the pulp is taken off as a concentrate and the tailings go to waste. No figures are available to show what extraction the mill as a whole makes.

There are on this property several quartz veins which are mineralized in places with bornite, chalcocite, copper carbonates, and varying amounts of free gold. The first development of the main vein on the property was an incline shaft 72 feet deep. After this a crosscut tunnel was driven to strike this main vein at a point some distance south-west of the shaft. This tunnel was driven a total distance of 412 feet and crosscuts the main vein at a point 360 feet in from the portal. The vein was then drifted on 90 feet to the west and 70 feet to the east. From the



Kitsalas Mountain Copper Co.'s Mill, Omineca M.D.

Silver Standard Mining Co.'s Concentrator, Omineca M.D.

east drift a 50-foot crosscut has been run into the hanging-wall and from the west drift a crosscut 17 feet in length.

At a point 125 feet from the portal of the crosscut tunnel a blind vein was encountered which showed from 2 to 3 feet of quartz well mineralized with bornite. This vein was drifted on westerly for a distance of 22 feet, and at this point a winze was put down 14 feet in depth. From the bottom of the winze a drift to the west has been driven for 70 feet. The workings on this blind vein show irregular mineralization of the quartz, with, in places, bands of good ore in which specks of free gold are quite frequently seen.

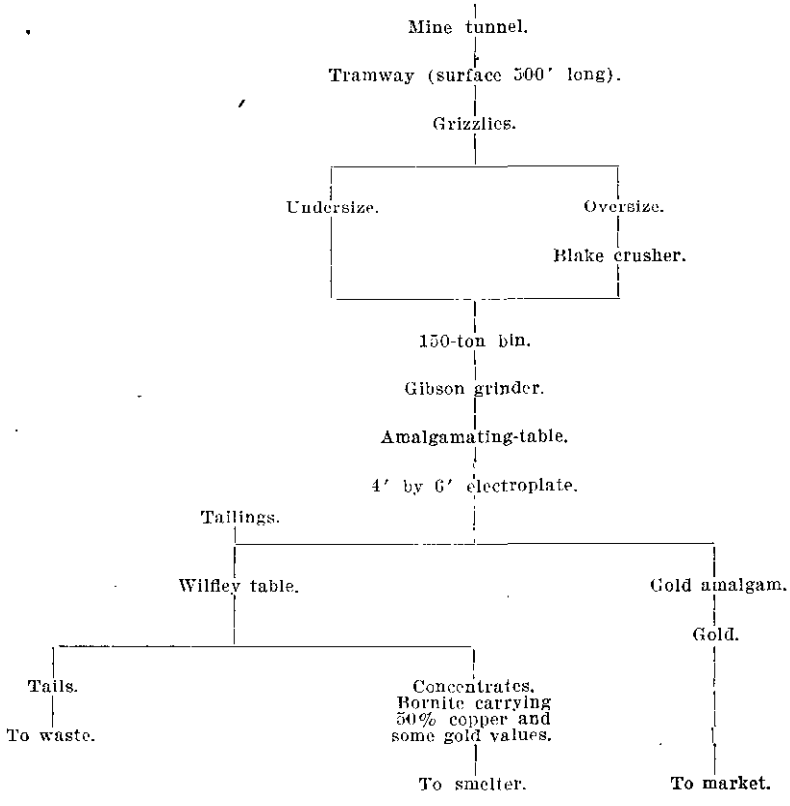
During the summer a short crosscut tunnel was driven to cut the main vein 110 feet to the north-east of the shaft. This tunnel is 46 feet long and shows the vein to have a width of about 4 feet, together with some parallel stringers in the walls. This tunnel-level is 36 feet below the bottom of the shaft on the dip of the vein.

Development of the mine was carried on during the summer with a force of from six to eight men under the superintendency of A. Thompson. Work was stopped in the fall, but will be resumed early in the spring. The ore apparently occurs in shoots with barren places between, so that considerable development will be required before much tonnage is blocked out.

The mill is housed in a good building, and there are, as well, a tool-house, blacksmith-shop, and concentrate-bin, and a fan-house at the mouth of the main tunnel. A covered tramway runs from this tunnel to the top of the mill building.

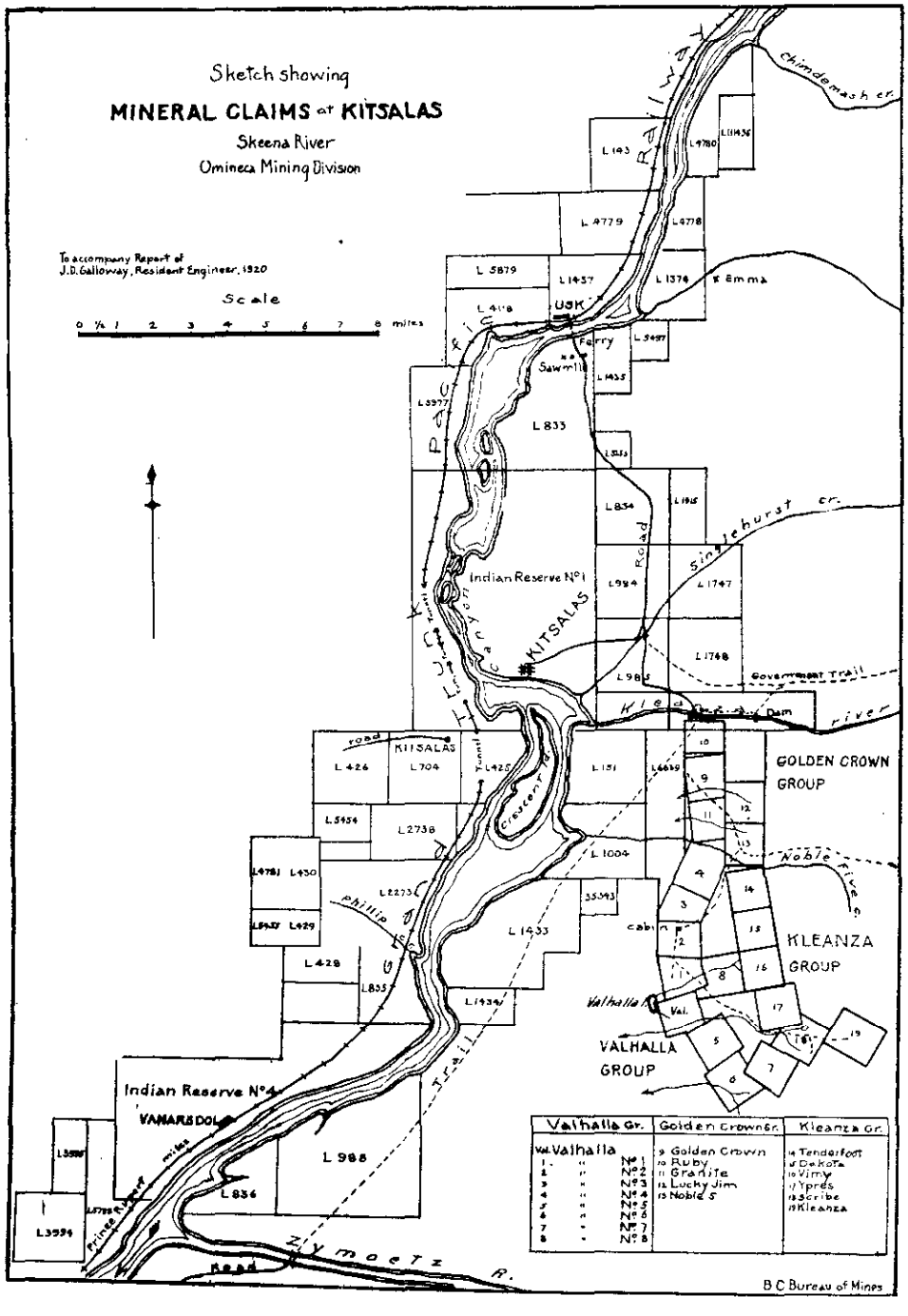
Accompanying this report is a diagramatic flow-sheet of the mill.

Kitsalas Mountain Copper Co. Flow-sheet of Mill.



Kleanza Co. This company continued the work started last year of developing the *Golden Crown* group, which property is held under option. A number of claims contiguous to the *Golden Crown* group and extending to the top of Kleanza mountain have been located by the company. These are known as the *Valhalla* and *Kleanza* groups. On this part of Kleanza mountain covered by these various groups of claims there are

a large number of approximately parallel quartz veins; so far about twenty-seven distinct veins have been recognized. The country-rock of the mountain is granodiorite, and in this the quartz veins strike in a general north-westerly direction. Some of these veins are irregularly mineralized with pyrite, arsenopyrite, and small amounts of chalcopyrite. The important value in the ore is gold, which appears to be associated with the arsenopyrite and to some extent with the chalcopyrite. (*See* sketch.)



The *Golden Crown* group has been fully described in previous Annual Reports. The work this year by the Kleanza Company was mainly done on the *Valhalla* and *Kleanza* groups. This work consisted of stripping, open-cuts, and short tunnels to prospect certain of the quartz veins.

On the *Dakota* claim an open-cut 30 feet long with a 25-foot face exposes a well-mineralized vein from 1 to 3 feet wide. This vein strikes north-westerly and dips at about 45° to the north-east.

The exploration-work was stopped in the fall when bad weather commenced, but will be restarted early in 1921. It is the intention of the Kleanza Company to carry on extended development-work on several of the quartz veins with a view to proving a sufficient tonnage of ore to warrant the erection of a mill.

Kleanza Creek.

The trail to the head of Kleanza creek from Usk has been in bad shape for the last three years, so a start was made by the Public Works Department this summer to improve it. Six miles of new trail was laid out and about half of this was constructed. There are a number of properties in this section which should attract some attention, but owing in part to the bad trail little or nothing has been done on them. The showings consist of sheared and sheeted zones, giving rise to vein-like deposits, in which there are found copper minerals, principally chalcocite and bornite. The prevailing country-rocks consist of a series of volcanic rocks, diabase, andesite, basalt, and breccias, which are, as a rule, considerably metamorphosed. For a more extended account *see* the 1914 and 1917 Annual Reports.

Peerless Group. This group, owned by O. T. Lindland, J. D. Wells, and partners, lies at the head of Kleanza creek, about 20 miles from Usk. There are several showings on the property of high-grade chalcocite and bornite occurring irregularly in fissures. During the year a small amount of development was done, consisting of a large open-cut and the commencement of a tunnel. This work is on a vein striking north and south (mag.) and dipping at 75° to the west. This vein is really a sheared zone with a well-defined hanging-wall and an indefinite foot-wall, with the width of mineralized material varying from a few inches up to 3 or 4 feet On the hanging-wall bands of nearly solid chalcocite occur in places.

A sample across 2½ feet returned on assay: Gold, trace; silver, 0.8 oz.; copper, 4.1 per cent.; and a selected sample representative of hand-sorted ore gave: Gold, trace; silver, 6.2 oz.; copper, 19.2 per cent.

The showings on this property are sufficiently promising to warrant further development.

Lucky Jim Group. This group of claims, which is owned by Fred Forrest, of Usk, is situated near the 12-Mile post on the Kleanza Creek trail. These claims have been held for some years by the present owner, who developed one showing by means of a shaft and tunnel. This year he started work on a new showing situated about 1,000 feet from the main trail at the 12-Mile post. This showing consists of a sheared zone occurring in dark-coloured volcanic rock. The zone is from 5 to 8 feet wide and is mineralized with bornite and copper carbonates. The development consists of an open-cut on the vein 25 feet long with a 15-foot face. The vein strikes N. 25° W. (mag.), going up and down the hill, thus giving a good chance for development by means of a drift-tunnel. The gangue consists of altered wall rock and some quartz.

A sample taken across 5½ feet at the face of the cut returned on assay: Gold, trace; silver, trace; copper, 3.5 per cent. A grab sample of the whole dump from the open-cut, and intended to be an average, assayed: Gold, trace; silver, 3.2 oz.; copper, 8 per cent.

Considering the slight amount of development so far carried out, this showing is a promising one.

Other Properties.—Other properties in this section on which work was done during the year were the *Hazel* group, owned by J. D. Wells and partners, the *Continental* group, and the Baxendale property.

Legate Creek.

Early this spring a number of claims at the head of Legate creek were secured by option and purchase by the British Columbia Exploration Company, of Vancouver. The more important properties thus secured were the *M. & K.*, *M. & M.*, and *Independence* groups.

A number of men were employed for about two months, and, while but little actual development-work was done, a pretty thorough examination and sampling of all the properties

were made. K. D. Woodworth was in charge of the work and an assayer with the necessary equipment was kept busy during the summer at Pacific. Professor W. L. Uglow, of the University of British Columbia, spent a month or six weeks on the properties, examining and reporting for the company.

As a result of the summer's work certain options held by the company were dropped, but others were retained. It was intended at one time to proceed with development of the *M. & K.* and *M. & M. properties this winter, but since stopping work in the fall nothing has been done* and the future plans of the company are unknown.

All the properties secured under option by this company have been described in previous Annual Reports, so that extended descriptions of them are unnecessary.

The mineral-showings in this section are sufficiently promising to warrant much further attention being given to the camp than it has yet received. A number of the properties in this locality have well-defined quartz veins carrying good values in silver. Galena and tetrahedrite are the most important metallic minerals in these veins, the latter as a rule carrying high silver values.

Another type of deposit occurring in this section, as shown on the *M. & K.* and *Frisco* properties, consists of sheared zones in which the principal values are in bornite, chalcocite, and chalcopyrite, which, in addition to the copper content, carry some silver values. In the case of the *M. & K.* a peculiar ore is also found consisting of a fine-grained crystalline intergrowth of galena and bornite.

There is a good pack-trail from Pacific to the forks of Legate creek, a distance of 12 miles. The various properties are situated at distances of 1 to 3 miles from the forks of the creek and are connected by branch trails to the main trails. A wagon-road could easily be built up Legate creek, so that these properties are well located as regards transportation. Timber is plentiful and there is an abundance of water-power available.

HAZELTON SECTION.

Glen Mountain.

The *Silver Standard* concentrating-mill was operated from early in the spring until the end of October. The year's operations were satisfactory and a larger tonnage of ore was milled than in any previous year. It had been hoped that production would have been continued all winter, but the management decided that this would be inadvisable. The difficulty of marketing silver-zinc concentrates, the lowered market price for silver, and the recent excessive rise in freight rates were the factors which caused the decision to close down. Marketing conditions have reached the point where the best policy is to leave the ore in the ground. Doubtless these conditions are but temporary and a resumption of operations may be expected in the spring.

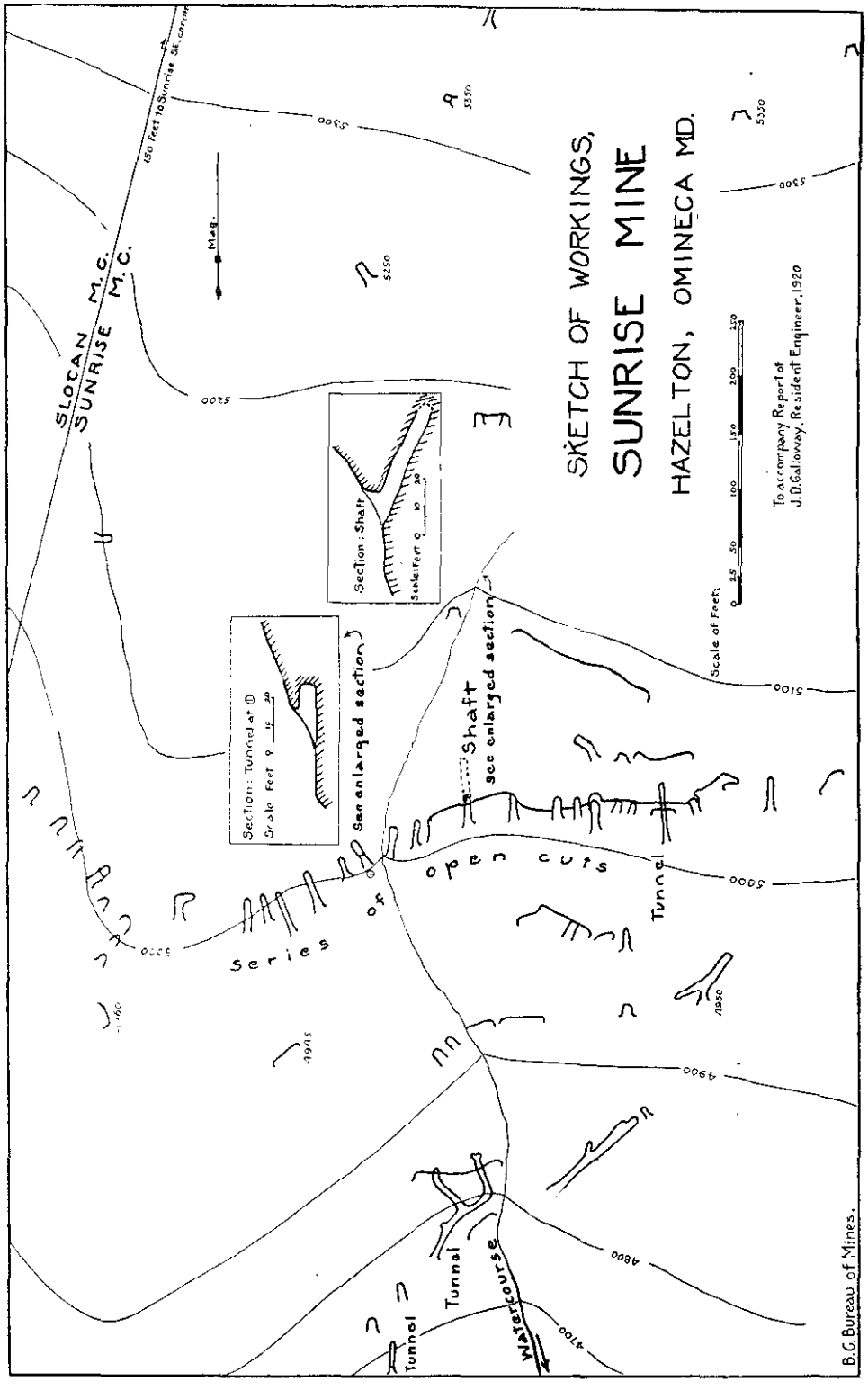
During last winter a low-level crosscut tunnel was started, and this work proceeded with but few interruptions until the mine was closed in October. This tunnel will cut all the veins at a considerable depth below the present workings and eventually will be the main entry of the mine. So far this tunnel has been driven about 1,000 feet and three veins have been cut by it and some stringers. The present objective of the tunnel is the No. 4 vein, which should be reached in a further distance of about 380 feet. This vein contained some excellent shoots of ore in the 250-foot crosscut-level workings, which are expected to continue at depth. Still farther ahead in the mountain lies the main vein, from which much good ore was extracted from the old shaft-workings and the 250-foot level.

The production for the year was 602 tons zinc concentrate and 279 tons lead concentrate, containing 218 oz. gold, 103,020 oz. silver, 189,488 lb. lead, and 453,512 lb. zinc. The tonnage of ore milled was about 4,000 tons.

The *Silver Standard* mine has been described in detail in several of the Annual Reports from 1911 to 1919, so that no extended description is necessary in this report. A plan showing all underground workings up to date is appended to this report.

Nine-mile Mountain.

There are a number of claims on the northern side of 9-Mile mountain which have showings of silver-lead ore; of these the *Sunrise* and *Silver Cup* are perhaps the best known. Nine-mile mountain at this point consists of a central core or boss of granodiorite which is intrusive into the sedimentary tuffs which form the main mass of the mountain.


SKETCH OF WORKINGS,
SUNRISE MINE
HAZELTON, OMINECA MD.
To accompany Report of
J. D. Galloway, Resident Engineer, 1920
Scale of Feet
SLOCAN SUNRISE M.C.
SUNRISE M.C.
Mag.
Section: Shaft
Scale: Feet
Section: Tunnel at ①
Scale Feet
See enlarged section
See enlarged section
Shaft
see enlarged section
series of open cuts
Tunnel
Tunnel
Tunnel
Watercourse
B.C. Bureau of Mines.

The veins on these properties occur both in the sediments and in the granodiorite; in the former they consist of well-defined quartz-filled fissures varying from 1 to 4 feet in width; in the granodiorite the veins are of the sheared-zone type with mineralization spaced across 5 to 20 feet, with, in places, narrow bands of high-grade ore on the walls.

The mineralization in all these veins is similar. The metallic minerals in the order of their abundance are galena, jamesonite, zinc-blende, arsenopyrite, pyrite, and tetrahedrite. The gangue consists of quartz and calcite, together with in places, crushed and silicified granodiorite.

Sunrise Group.

This group, which is owned by the Sunrise Mining Company, was secured under option late in 1919 by the American Smelting and Refining Company.

There are two well-defined mineralized zones on this property, occurring in granodiorite. The lower, which is at an elevation of 4,950 feet, strikes north-easterly and dips at 45° to the south-east. It has been slightly developed by open-cuts which show irregular mineralization across a width of 10 feet, and in places narrow bands of clean sulphides consisting mainly of galena and jamesonite. Surface cuts expose this zone at intervals for a distance of 300 feet.

The upper zone is at an elevation of 5,050 feet and has a width of from 4 to 8 feet. It strikes east and west (mag.) approximately and dips at 25° into the hill. It is a sheared zone apparently following one line of jointing in the granodiorite in which it occurs. The outcrop forms a nearly horizontal line along the mountain-side, continuing around a nose and outcropping again on the adjoining *Miller* property.

The mineral occurs in narrow stringers with granodiorite between, which carries in places some disseminated mineral content. The granodiorite forming the gangue of the zone is somewhat altered and in places quartz occurs as the gangue-filling.

All development-work by the American Smelting and Refining Company on the *Sunrise* was confined to the upper zone. This zone was stripped on the surface for some distance, and large open-cuts exposed the full width of the vein and were deep enough to get below the surface oxidation, thus enabling a systematic sampling of the vein to be made. An incline shaft was sunk on the vein to a depth of 40 feet. The whole vein was pretty thoroughly sampled by the engineer in charge of the work, Bert F. Smith, and an assay plan prepared. The assay results are not definitely known, but in the fall the company allowed its option to expire, the reason given being that the property did not give promise of producing a large tonnage of milling-ore. It is known that one shoot of ore 200 feet in length of satisfactory value was disclosed and that good ore occurs at the bottom of the shaft. It is probable that the property will be further developed by some one if an increase in the present market price of silver takes place.

Four-mile Mountain.

Four-mile mountain is situated about 4 miles north-east of Hazelton, just north of the Bulkley river, and is reached by a good wagon-road. It rises to 2,200 feet altitude, or 1,400 feet above the river. The mountain consists of a central core of granodiorite intrusive into sedimentary measures of the Hazelton formation.

A number of mineral claims have been staked on this mountain, the showings generally being at or near the contact of the granodiorite and the sediments. The ore occurs in quartz veins occupying sheared zones and striking from N. 10° E. to N. 45° E., with steep dips to the south-east. The minerals contained in these veins are galena, sphalerite, jamesonite, tetrahedrite, and pyrite. High silver values are carried in the ore, the silver being associated with the galena and tetrahedrite.

Erie Group.

This group consists of four Crown-granted mineral claims and is owned by Thos. Kinman, of Vancouver. The property was first worked prior to 1914, since when no further work was done until the present year 1920. The main showing is a vein varying from 2 to 4 feet in width and occurring near a contact of granodiorite and sedimentary measures. The first workings consisted of two shafts, one about 50 feet deep and the other about 20 feet. From the 50-foot shaft workings a shipment of hand-sorted ore was taken out which returned high silver values, together with some lead content. At the bottom of the shaft the vein is said to be faulted. A crosscut tunnel was then started at a point so as to cut the vein below the bottom of the shaft. This tunnel was driven 200 feet when the work was stopped some years ago.

The continuation of the driving of this tunnel was started this summer, and before closing down for the winter the tunnel was in nearly 500 feet. According to surveys, the point reached by the tunnel now is approximately where the vein should be, but as yet the tunnel has not reached it. The vein, however, may be faulted so as to cause it to be still farther into the mountain. It is probable that further work will be done on this property next summer. Apparently the vein could be reached in a short distance from the crosscut tunnel either by driving ahead or by raising. The high-grade character of the ore makes it a reasonable speculation to carry out further development of this property. W. S. Harris was in charge of the work this summer with a crew of about six men.

Comet Group.

This group of three claims, situated on 4-Mile mountain, is distant about 6 miles from Hazelton. The owners are Tommy Stevenson and Jim Dyer. There are a number of veins and stringers on the property showing mineralization with zinc-blende, jamesonite, arsenopyrite, and galena. Shallow shafts, open-cuts, and some tunnelling constitute the development. The owners carry on a little work each summer and are at present driving ahead a tunnel. This tunnel was started as a crosscut, but is now following stringers of ore which are mainly sulphides of antimony, arsenic, and iron. These stringers may be feeders to a vein or may come together so as to become a good ore-shoot. These showings lie at and near the contact of the igneous and sedimentary rocks and are somewhat irregular.

Rocher Déboulé Mountain.

In December, 1919, work was recommenced on the property of the Delta Copper Company and was continued for a couple of months. The work was then stopped, but during the summer arrangements were made whereby a definite development programme was laid out. It was decided to carry out further development by means of diamond-drilling, and a contract was let to a Spokane firm to do this drilling. In September a drill was taken up to the property, and all arrangements made to start, when an early and heavy snowfall necessitated the stopping of the work until next spring. The Delta Copper Company owns the *Delta* group adjoining the property of the Rocher Déboulé Copper Company, also the *Chicago* group, and has control of the Highland Boy Company, owning the *Highland Boy* group. A full description of these properties and the operations of the Delta Copper Company can be found in the Annual Reports, 1914 to 1919.

There are a number of veins on these properties, but up to the present time only two have received much attention. These veins are similar in character to those of the Rocher Déboulé Company and one is believed to be an extension of the main (No. 4) vein of the *Rocher Déboulé* property. The valuable metallic mineral present is chalcopyrite, with which are associated magnetite, hæmatite, pyrite, tetrahedrite, and bornite. The gangue consists of hornblende, quartz, calcite, and crushed altered granodiorite. The main value in the ore is copper, but in addition small values in gold and silver are obtained. The veins are from 2 to 8 feet in width and carry in places shoots of good copper ore. As in the *Rocher Déboulé* veins, bands of nearly clean chalcopyrite occur.

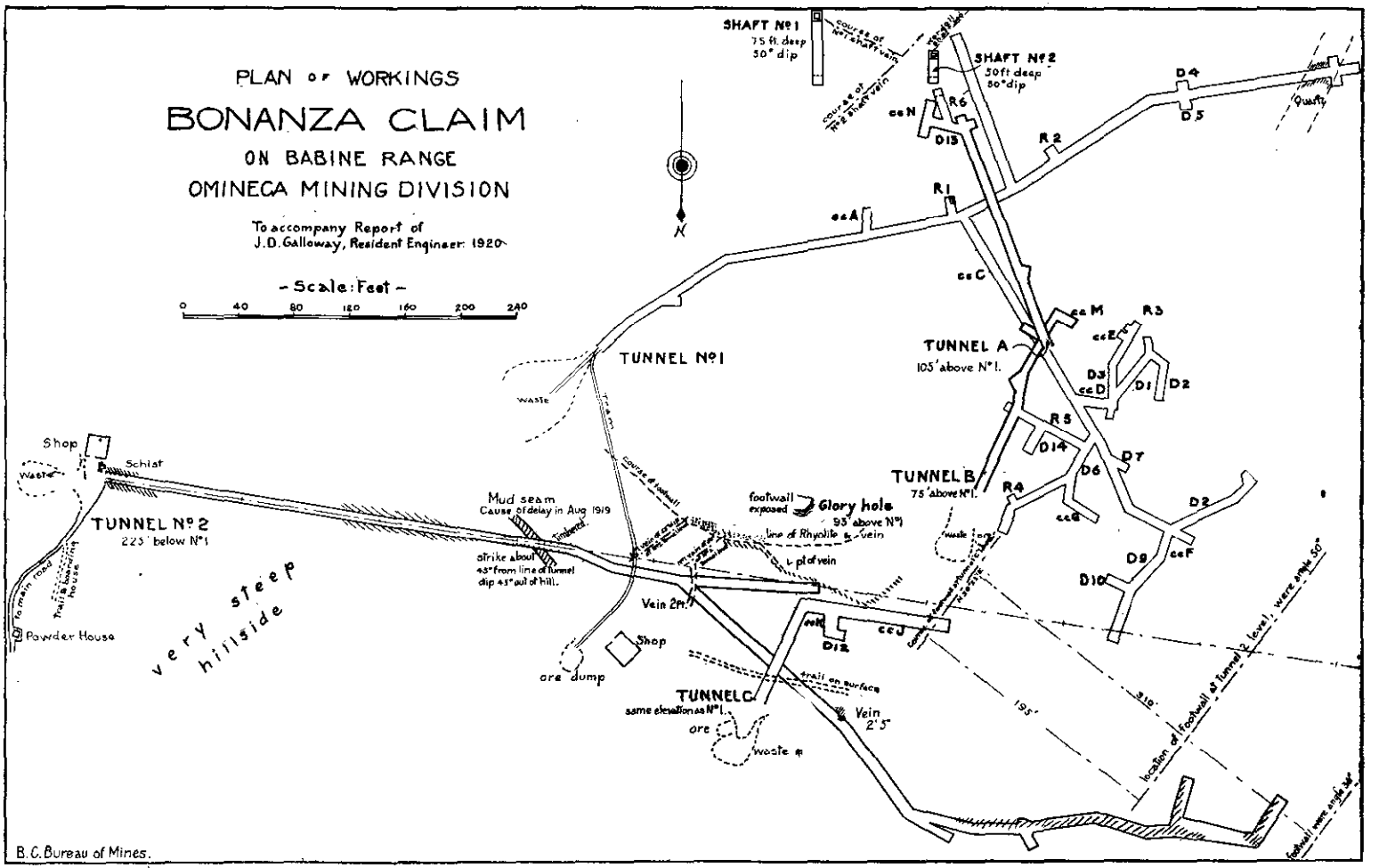
This property is so situated that use could be made of the tramway system of the Rocher Déboulé Company in transporting the ore to the railway.

TELKWA SECTION.

Babine Range.

Cronin's Mine.

The property of the Babine-Bonanza Mining and Milling Company, better known as Cronin's mine, was steadily developed during the year. For several years past the development of this property has been steadily proceeded with under the management of James Cronin, the principal stockholder in the company. This work had been successful in proving considerable tonnages of ore from the surface down to a depth of about 150 feet. In 1919 a long crosscut tunnel was started to tap the ore-bodies at a depth of 400 to 450 feet below the surface. This tunnel is now in about 1,000 feet and has been successful in striking one ore-body. Whether or not this is the main contact ore-body exposed in the upper workings is not yet definitely ascertained. The ore-body encountered has a width of 6 to 12 feet of good milling-ore, with many streaks of nearly solid sulphides. The ore is a


PLAN OF WORKINGS
BONANZA CLAIM
ON BABINE RANGE
OMINECA MINING DIVISION
To accompany Report of
J.D. Galloway, Resident Engineer 1920
- Scale: Feet -
0 40 80 120 160 200 240
N
SHAFT No 1
75 ft. deep
50° dip
SHAFT No 2
50 ft deep
50° dip
course of vein
course of the shaft vein
crosscut
Quarry
cc N
cc A
cc C
cc M
cc E
cc D
cc F
cc G
cc J
R1
R2
R3
R4
R5
R6
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D12
D13
D14
TUNNEL No 1
TUNNEL A
105' above No 1.
TUNNEL B
75' above No 1.
TUNNEL No 2
223' below No 1
TUNNEL C
same elevation as No 1.
Glory hole
95' above No 1
footwall exposed
line of Rhyolite & Vein
Mud seam
Cause of delay in Aug 1919
Shop
Schlaf
Waste
Powder House
To main road
Trail & boarding house
very steep hillside
strike about 45° from line of tunnel
dip 45° out of hill.
Vein 2ft.
Vein 2'5"
ore dump
ore
waste
trail on surface
Shop
Pt of vein
193'
210'
location of footwall at tunnel level; were strike 50°
footwall were single slip
B.C. Bureau of Mines.

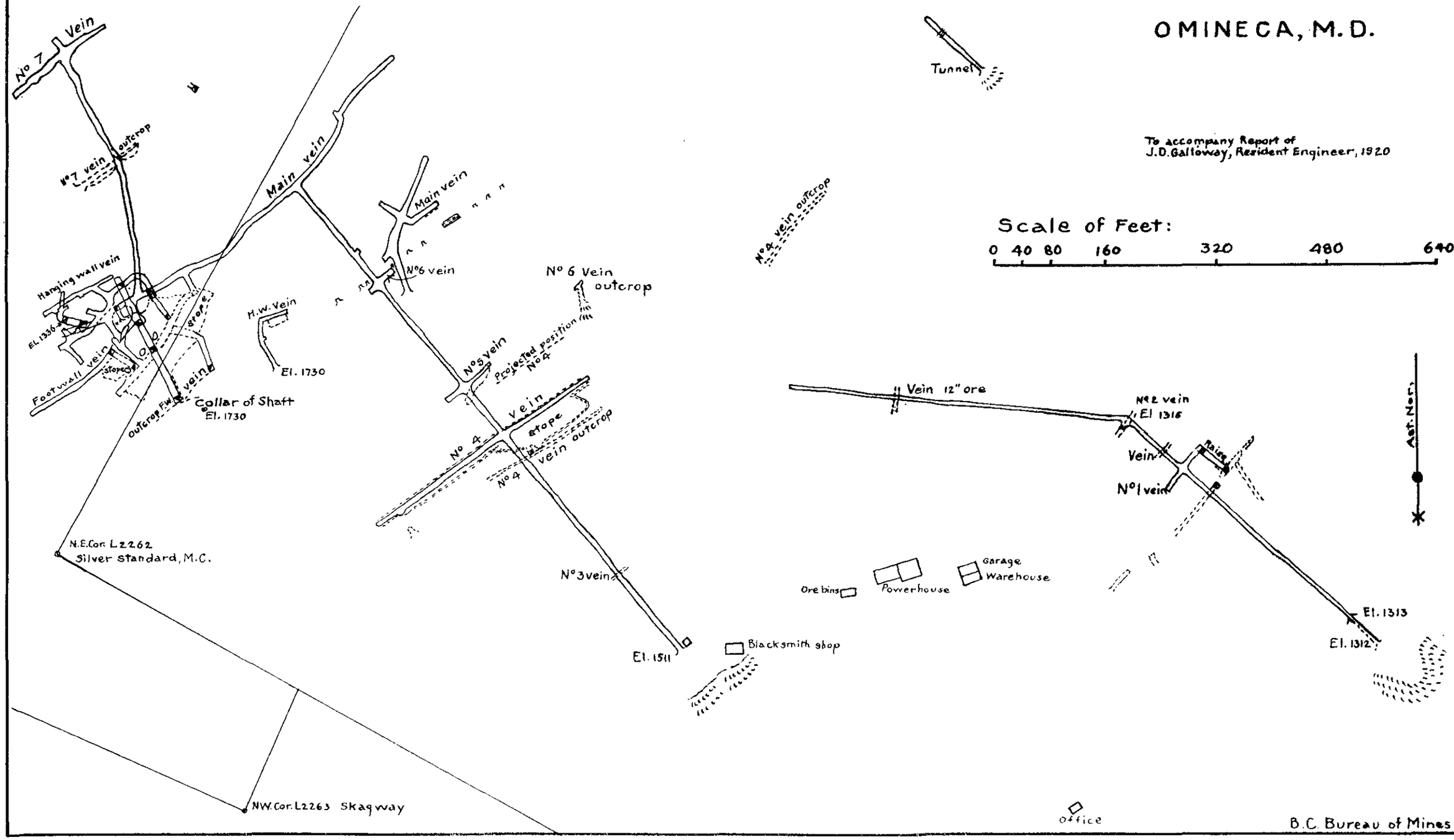
PLAN OF WORKINGS

SILVER STANDARD MINE

OMINECA, M.D.

To accompany Report of
J.D. Galloway, Resident Engineer, 1920

Scale of Feet:
0 40 80 160 320 480 640



B.C. Bureau of Mines

mixture of galena and zinc-blende occurring in a quartzose gangue and carries from 1½ to 2 oz. of silver to the unit of lead. The last part of the tunnel is a drift on the ore-body, showing it to be continuous for 200 feet or more.

Work was stopped for the winter about the end of the year, but next spring the question of equipping the property with a power plant, tramway, and concentrating-mill will be considered, as Mr. Cronin now considers that the mine has passed the prospect stage.

Detail descriptions of this property can be found in the 1914, 1917, and 1918 Annual Reports. The property is situated some 30 miles from the town of Telkwa, to which it is connected by a good sleigh-road. This road goes through a low pass in the Babine range at the head of Canyon creek, and has practically a level grade all the way to a point within 3 miles of the mine. From this point a series of switchbacks on a 14-per-cent. grade carry the road to the mine. Eventually the concentrating-mill will be situated some distance below the mine, to which it will be connected by aerial tramway, and from the mill an approximately level road will be obtained to Telkwa, the shipping-point on the railway.

Accompanying this report is a plan showing the important workings of the property. Tunnel No. 1 was first driven as a drift-tunnel, developing a 4-foot quartz vein which in places carried good shoots of galena and zinc-blende. Later the contact ore-body which outcrops on the surface was partially developed by tunnels A and B. Crosscuts were then run from tunnel No. 1 to explore the contact ore-body, and finally tunnel C, which is on the same level as No. 1, was driven.

These workings demonstrated that there was a considerable ore-body lying either in or near the plunging contact of the intrusive igneous rock with the black schist. This igneous rock is a rhyolite, in places being sufficiently coarse-grained to become a granodiorite. As a rule the ore is developed in the rhyolite rather than in the schist. The No. 2 crosscut tunnel was commenced in 1919, and during the present year, 1920, work on it was carried on nearly continually.

Silver King Group.

This group of eight claims is situated at the head of Driftwood creek and distant some 19 miles from Smithers. The first 12 miles is wagon-road and the remainder is good pack-trail. The group extends easterly from the head of the creek to where it adjoins claims of the *Babine-Bonanza* group. The property is owned by Patrick J. Higgins and partner. In November, 1919, a Seattle syndicate secured an option on the property and commenced work in a small way, which was continued until May, 1920. During the summer a reorganization of the syndicate was effected and the Steamship Mining Company was formed to take over the rights of the original syndicate. It was expected that work would then be resumed on the property, but up to the end of the year nothing was done. Unless further development is soon commenced the option on the property will expire. S. A. D. Davis was in charge of the work and had an interest in the original syndicate.

The main showing on the property is a quartz vein occurring in a rhyolite porphyry, and striking N. 70° E. (mag.) and dipping northerly at 60°. The vein is exposed in the rocky walls of a small canyon on both sides of Driftwood creek, which at this point is quite small. The width of quartz varies from a few inches up to 3 feet. It is mineralized with galena, zinc-blende, and grey-copper. Occasional specimens are obtained carrying native silver and silver sulphides. The quartz as a whole is fairly well mineralized with metallic minerals.

The original development by the owners consisted of a drift-tunnel on the east side of the creek 30 feet in length and one on the west side 10 feet long. The work done by the syndicate consisted of driving ahead the east tunnel to a total distance of 100 feet.

A sample taken across 15 inches of the vein at a point 10 feet from the face of the tunnel assayed: Gold, 0.12 oz.; silver, 81.6 oz.; lead, 7 per cent.; copper, 2.2 per cent. Another sample across 18 inches at a point 30 feet from the face of the tunnel gave: Gold, 0.22 oz.; silver, 168 oz.; lead, 10 per cent.; copper, 5.5 per cent.

Other Properties.—During the last two years several groups of claims have been staked in this locality. Most of them show ore carrying values in silver and copper. Little development has been done on any of these properties, but the high-grade ore occurring on them should make them worth investigating. The Kelly & Carson properties are typical of these new locations.

Hudson Bay Mountain.

There was not a great deal of mining activity on Hudson Bay mountain this year, but it seems possible that certain propositions that were under negotiation this year will go ahead in 1921. Among these are the *Aldrich*, *Carroll*, and *McLean* properties, on which deals are pending.

Empire Group. This group, consisting of the *Empire*, *Highgrade*, and *Timber* claims, is situated 6 miles from Smithers in a basin at the head of the South fork of Simpson creek, on the easterly side of Hudson Bay mountain. The owner of the property is Donald Simpson, of Smithers. The main showing is a small but well-defined vein striking N. 75° W. (mag.) and dipping north-easterly at about 60°. The country-rock is mainly andesitic breccia, both purple and green-coloured varieties being noted.

The metallic minerals present in the vein are galena, zinc-blende, and iron pyrite. The gangue consists of altered wall-rock together with some quartz. The vein varies in width from 6 to 12 inches, and there are subsidiary parallel quartz stringers in the hanging-wall. Assays show the ore to carry about 1 oz. silver to the unit of lead. A grab sample of roughly hand-sorted ore assayed: Gold, 0.04 oz.; silver, 39 oz.; lead, 41.5 per cent.; zinc, 20 per cent.

Schufer Property.—Further development of this property was carried out by the owners during the year, with satisfactory results, but no ore was shipped. The completion of a good wide trail to this property this year should enable the owners to make ore shipments in 1921.

Cassiar Crown Copper Company.

Small-scale operations were carried on by this company for eight months in the year, the work being stopped in November. The property is situated on Grouse mountain, 18 miles south-easterly from Telkwa. This company has done a considerable amount of development-work on its property since acquiring it in 1914. The details of this work can be found in the Annual Reports for 1914 and the following years. One hundred feet of drifting was done this year on the *Ruby* claim. No ore was shipped.

Telkwa River.

There are a number of claims situated near the headwaters of the Telkwa river which have been held for some years; some of these claims are Crown-granted, while others are held by annual assessment. Two properties were developed to some extent during the summer—namely, the *Big Four* group and the *Surprise* group.

These claims are situated about 35 miles from the town of Telkwa; the first 15 miles is by wagon-road to the forks of the Telkwa river and the remainder by pack-trail. The properties lie short distances beyond the junction of Milk creek and the main stream. The main trail up the Telkwa river is in fair condition, but some of the old corduroying needs renewing, as these places are now bad mud-holes.

Big Four Group. This property is situated about 2 miles by trail from the junction of Milk creek and the Telkwa river (at this point the main stream is quite small), on Goodwill mountain, at an elevation of 3,500 feet. The owners are the Chisholm Bros. and partners. A new trail was built to the property this year from the main Telkwa River trail, which owing to a better grade makes the climb from the valley to the showings much easier. The showings are situated below timber-line and overlook the main valley of the Telkwa. The present owners acquired the property last year and since then have erected a good cabin, sunk a 60-foot incline shaft, and made a number of open-cuts and surface-stripping.

The formation as exposed on the property consists of a light-coloured, fine-grained granitic rock, in places approaching a felsite and in others being a granodiorite. In this formation one or more quartz veins outcrop. The various quartz-croppings which occur at different points within a radius of 500 feet may be parts of the same vein which are disconnected by faulting, or there may be more than one vein. There are several showings of quartz, more or less mineralized and of considerable size, exposed in shallow cuts. If the ore-body is a definite vein, as would seem apparent, then it is faulted and probably cut by several dykes.

The metallic minerals which occur in the quartz are galena, chalcopyrite, and pyrite. Assays show that the galena is low in silver content and that the iron and copper sulphides only contain small amounts of gold. The unmineralized quartz contains no gold or silver values.

An incline shaft has been sunk 60 feet on a quartz-outcrop which at the surface is from 3 to 4 feet wide. At the time of examination there was water in this shaft, so that the working

could not be examined. The dump from the shaft does not show as much quartz as would be expected, so that apparently the shaft does not follow the vein closely or else the vein pinches somewhat. The quartz from this vein is rather sparingly mineralized with pyrite and chalcopyrite. A grab sample from the dump on assay only showed small amounts of gold and silver.

One hundred feet above the shaft there are several outcroppings of quartz which look considerably more promising than the shaft-workings. On one of these a large open-cut has been made which shows a width of 6 to 8 feet of well-mineralized quartz. A grab sample of the ore from this cut assayed: Gold, 0.20 oz.; silver, 3.6 oz.; lead, 18 per cent.; copper, 1.6 per cent. This ore, in addition to galena and pyrite, carries some chalcopyrite.

Another cut a short distance below the one last mentioned shows a 4-foot vein, an average sample of which assayed: Gold, trace; silver, 4 oz.; lead, 24 per cent.; copper, 9.7 per cent.

The indications are that this property may have an ore-body of considerable size of milling grade.

Surprise Group.

This group, consisting of the *Morning Star*, *New York*, *Surprise*, and *Maple Leaf* claims, is owned by Sam Bush and Louis Schorn. It is situated on a mountain lying on the north side of Milk creek and the showings are all above timber-line. The formation as exposed on these claims consists of volcanic rocks, the prevailing types being red and green andesites. Outcropping on these claims are a number of quartz veins which are irregularly mineralized with galena, grey-copper, chalcopyrite, pyrite, arsenopyrite, and copper carbonates.

On the *Morning Star* claim one vein is developed by a 12-foot shaft and some open-cuts. The width of quartz is from 6 inches to 2 feet and in places it is well mineralized with sulphides. From the quartz taken out of the workings twenty-eight sacks of ore had been hand-sorted; a grab sample of this assayed: Gold, 0.42 oz.; silver, 322.6 oz.; lead, 26 per cent.; copper, 12 per cent.

On the *New York* claim there are three quartz veins which are roughly parallel, striking east and west along the mountain-side and separated by 700 to 800 feet. The lowest vein is from 2 to 4 feet wide and somewhat broken by faulting. The quartz is not particularly well mineralized, but in places carries bands of galena and arsenopyrite. A sample across 2 feet of the vein assayed: Gold, trace; silver, 12 oz.; lead, 12 per cent. Another sample of selected galena returned on assay: Gold, trace; silver, 28.4 oz.; lead, 48 per cent. A sample taken across 3 feet, which showed a little arsenopyrite, assayed: Gold, 0.22 oz.; silver, 10.5 oz. to the ton.

The main showing on the *New York* claim lies about 500 feet up the mountain from the last-mentioned vein. It consists of a very well-defined quartz-filled fissure which crops out along the hillside for several hundred feet. This vein has a general east-and-west strike (mag.) and dips northerly into the hill at an angle of about 33°. The width of quartz between walls varies from 1 to 3 feet. The metallic minerals present in the quartz are galena, arsenopyrite, grey-copper, chalcopyrite, and small amounts of native silver. These minerals occur as a rule in a pay-streak a few inches wide on the footwall side of the vein. The country-rock enclosing the vein is a dark-coloured volcanic rock of the nature of a diabase. During the summer an incline shaft was sunk on this vein to a depth of 45 feet and some surface cuts were made along the outcrop.

A sample taken across 2 feet near the top of the incline returned on assay: Gold, 0.16 oz.; silver, 24 oz.; lead, trace; copper, 0.3 per cent. Selected ore from the vein assayed: Gold, 0.14 oz.; silver, 67.8 oz.; lead, 21 per cent.; copper, 0.6 per cent. A grab sample of the ore-dump gave: Gold, 0.16 oz.; silver, 15 oz.; lead, 4 per cent.; copper, 0.3 per cent.

Telkwa Collieries.

The coal-mine of the Telkwa Collieries was worked with a small force of men during most of the year, the shipments of coal amounting to about 1,400 tons. During the year the company leased the property to J. M. Gillespie, who has been manager for the company for the past two years.

The method of handling this coal has been by wagon-haulage from the mine to a bunker on the railway at Telkwa, a distance of 4½ miles. During the summer the Grand Trunk Pacific Railway put a steam-shovel at work extending the yard at Telkwa, and in the course of this

work the coal-shipping bunker was taken down, and up to the end of the year had not been replaced. This prevented shipments of coal to Prince Rupert or other points on the railway. It is expected that when the bunker is replaced regular shipments will be commenced again. Detail descriptions of the coal-measures in this locality and the workings of the Telkwa Collieries can be found in the 1918 and other Annual Reports.

Mr. Gillespie also has a lease on the Aveling coal property, which is situated about 6 miles up the Telkwa river from the town of Telkwa and about 2 miles distant from the property of the Telkwa Collieries. Arrangements have been made to open up a seam of coal on the Aveling property and mining was commenced about the end of the year. Part of this seam contains a band of high-grade blacksmith-coal, and it is the intention to mine and ship this. By submitting samples to Vancouver, orders have already been received for car-load shipments of this blacksmith-coal, and it is hoped that a considerable market for this class of coal can be secured. Analyses of this coal show it to be low in ash and high in fixed carbon.

Zymoetz River Coalfield.

In 1914 the writer examined the coalfield lying on Chettleburgh creek, a tributary of the Zymoetz river, and distant about 40 miles from Telkwa. There are two good seams of coal exposed at this place, respectively 9 and 6 feet in thickness, which are slightly developed by short prospect-tunnels. The coal-measures are exposed up and down Chettleburgh creek for 2 miles, but owing to concealment of the rock formation by surface wash the other dimensions of the basin are not known.

The property, consisting of some twenty sections, is owned by the Copper River Coal Company. The National Finance Company, now in liquidation, handled the property as fiscal agents until 1914. The property is now being handled by the Yorkshire and Canadian Trust, Limited, Vancouver, liquidators of the National Finance Company. In the 1914 Annual Report the writer gave a complete description of this field, with sections, analyses, etc.; to this report the reader is referred, as there is nothing further to record since that time.

A diamond-drill was taken in to the property during the winter of 1913, but has never been used, all work having been stopped since 1914.

Diamond-drilling on this property is the easiest and cheapest way in which this coalfield can be prospected and tested. The present showings are of sufficient promise and importance to warrant the expenditure necessary for drilling, as a reasonable speculation for anybody desirous of securing a supply of coal. It must, of course, be remembered that a railway 35 to 40 miles long is a necessity for opening up this coalfield, and it is obvious that the existence of a large tonnage of coal of commercial grade must first be proven before the construction of such a railway can be considered.

About the end of the year an option on this property was obtained by A. C. Garde from the liquidators. It is known that one condition of the option is that diamond-drilling of the property is to be started in the spring of 1921. If this work is carried out the value of this coalfield should be definitely determined.

SIBOLA SECTION.

There was no mining activity in this section during 1920, but a number of prospectors were busy in the hills and some new finds have been reported. The *Emerald* group on Sweeney mountain and the *Silver Tip* group on Whitesail lake, which were under development in 1919, were not worked during the present year. These properties have promising showings of silver-lead ore and undoubtedly will attract attention in the future. The question of transportation is difficult but not insurmountable.

A geologic reconnaissance of the country around Whitesail and Eutsuk lakes was made during the season by a party of the Geological Survey of Canada, the party being under the guidance of R. W. Brock.

TALTAPIN MINING COMPANY.

Introductory.—The Taltapin Mining Company is a company organized in 1919 for the purpose of developing and operating certain mineral property situated north of Burns Lake, a town on the Grand Trunk Pacific Railway. Vancouver capital was interested in the project and the

head office of the company is in Vancouver. A. Wallace is President of the company and A. Wood is managing director.

Development-work and necessary construction-work was started late in 1919 and carried on until May, 1920, when operations were suspended until the fall. Mr. Wood has been actively in charge of the work at the property and a small force of men was put to work in November, with the intention of continuing development all winter.

Location.—The mineral property which is being developed by the Taltapin Mining Company consists of the *Silver Fox* claim and six other adjoining claims. The *Silver Fox* claim is held under option of purchase from the owner, Charles S. Anderson, and is a Crown-granted mineral claim. The six other claims were staked for the company last fall.

The property is distant from Burns Lake about 25 miles in a northerly direction. The rough wagon-road from Burns Lake to Babine lake is followed for 12 miles to a point known as the Half-way. From this point a sleigh-road was built last fall to the property, a further distance of about 13 miles. The whole road can be classed as a sleigh-road, although light loads can be taken in by wagon in the summer-time when the road is dry. The spring of the year is the bad time, as the conditions are not suitable either for sleighing or wheeling. The principal showings are on the *Silver Fox* claim and they outcrop along the walls of a canyon formed by Anderson creek. All work by the company has been confined to the development of these showings. The elevation of the property is about 2,600 feet, or only slightly higher than Burns Lake, which is 2,300 feet. Anderson creek is a good-sized stream and in the spring of the year is a raging torrent.

Geology.—The rock formations on this property are well exposed in the canyon of Anderson creek, and this is the only point at which they were examined. The prevailing rock is a light-coloured greyish-green andesite which has been considerably altered by metamorphic action. The original hornblende has been very largely altered to chlorite; the feldspars, however, show but little alteration. This andesitic rock is not homogeneous throughout, but shows variations in texture and basicity, and it would appear that the formation is made up of successive flows which, while differing somewhat in composition, are of the same rock type.

A wide band of white siliceous rock occurs near the centre of the canyon, which is locally called quartzite. While in places this rock bears a strong resemblance to quartzite, it will probably be found to be a highly siliceous volcanic rock of the nature of an aplite or felsite. It is apparently contemporaneous in origin with the andesite formation. The andesitic formation has a general strike of north-east and south-west, with a flat dip to the north-west.

There are a number of fairly well-defined quartz veins, which crop out on the walls of the canyon of Anderson creek and usually strike and dip with the formation.

Description of Veins.—Anderson creek where it forms a canyon on the *Silver Fox* claim runs roughly north and south. The canyon is about 75 feet deep, with steep walls, which in many places are perpendicular. East of the creek the country gradually rises, but to the west the country is rolling, with no appreciable gain in elevation. The quartz veins which are exposed by the canyon cut across Anderson creek at varying angles from 45° to 90°. In a distance of 800 feet up and down the canyon there are half a dozen or more stringers and veins of quartz which vary in width from a few inches up to 6 feet. These veins have a general strike of north-east and dip at angles of 30° to 60° to the north-west. They are broken up somewhat by small faults and slips. The metallic minerals noted in the veins are galena, sphalerite, chalcopyrite, arsenopyrite, pyrite, and tetrahedrite. In most places these minerals only occur in small amounts, the total percentage of metallic minerals to quartz being quite low. Surface oxidation is apparent in places, but is an unimportant feature.

The most important showing in the property is what is known as the "High-grade vein." This vein, where it is exposed on the east side of the canyon, has a strike of N. 30° E. and dips at 60° to the north-west. It also crops out in the bed of the creek and at the foot of a vertical bluff on the west side of the creek. It is at this latter place that there is said to be a considerable showing of high-grade ore, but unfortunately it was quite impossible to examine this showing when the property was visited. Work was done on this showing last winter, when the creek was at low water and frozen over, a hole 6 feet deep being sunk. At the present time this hole is nearly filled with rock which has fallen in and it is covered by the water of the creek. The original owner had a ladder down the bluff on the west side, but this was blown away in the work done last winter, so that it is impossible to even get near the showing.

On the east bank of the creek the "High-grade vein" shows from 6 inches to 2 feet of quartz which is very sparingly mineralized with galena and pyrite. The lead is not sufficiently exposed at this point to admit of proper sampling. There it was observed this "High-grade vein" does not differ markedly from any of the others, but Mr. Wood says that in the hole in the bed of the creek this vein shows from 4 to 5 feet in width of good-grade ore.

At a point about 200 feet down the creek from the outcrop of the "High-grade vein" there are three bands of quartz or veins which strike north-easterly and dip at an angle of 30° to 45° to the north-west. These three bands are separated from one another by from 10 to 20 feet of rock-matter and vary in width from 1 to 4 feet. They are very sparingly mineralized with galena, sphalerite, and arsenopyrite, and some oxidation products therefrom.

On the west side of the canyon a tunnel had been driven in on the central band by Anderson. Last winter a tunnel was driven by Wood, which starts 40 feet north of the Anderson tunnel and goes in at right angles to the creek. The Anderson tunnel curves to the north and is now connected through to the Wood tunnel, which latter is about 100 feet long. Both these tunnels crosscut the vein obliquely and pass into the foot-wall. The central quartz-band as exposed by this work is from 2 to 3 feet wide and sparingly mineralized. Mr. Wood considers that the "High-grade vein" and the "Tunnel vein" intersect, and from their apparent strikes they may. He therefore plans to sink from the end of the tunnel and then crosscut for this intersection, where he anticipates finding good ore. He considers that it is quite impracticable to develop the "High-grade vein" from the point where the good showing of ore occurs. By his method he will develop both the "High-grade vein" and the three bands forming the "Tunnel vein."

Values.—High values are said to be obtained from the main showing in the "High-grade vein," Mr. Wood having assays showing up to about 1,000 oz. in silver to the ton, besides lesser values in gold, lead, and copper. Presumably these are from specially selected specimens. From the hole sunk on the "High-grade vein" near the bed of the creek last winter 3 tons of ore were hand-sorted, hauled out to Burns Lake, and shipped to the Trail smelter. The returns from this shipment have not yet been received, but Mr. Wood expects the shipment to run about $300 a ton.

No systematic sampling of the other veins has been done and the random samples taken would indicate the ore to be of low grade, but possibly with sufficient values for milling.

Work done.—The work done by the Taltapin Mining Company last winter and spring was as follows: Repairs to the Babine Lake road and the construction of 13 miles of sleigh-road from the Half-way to the camp at the property and to the showings, which are situated about 800 feet from the camp; erection of substantial bunk-house, cook-house, stable, blacksmith-shop, powder-house, and stable at the Half-way; two good wagon-bridges were put across Anderson creek, one at the camp and the other at the tunnel; 150 feet of cribbing was put in along Anderson creek where the tunnel was commenced; 100 feet of tunnelling and large open-cut at water-level on "High-grade vein." All work was done in a thorough manner and all construction-work was well done.

A gasolene-driven hoist was taken into the property last spring and will be erected at the end of the tunnel for sinking a winze to a depth of 100 feet. Machinery for an air-compressor plant has been purchased and was at Burns Lake ready for hauling in by sleighs in the winter.

Summary and Conclusions.—The *Silver Fox* claim, which is under option to the Taltapin Mining Company, is as yet an undeveloped and unproven prospect. There are on it a number of quartz veins which are more or less mineralized with silver-lead minerals, and one showing, which unfortunately could not be examined, which is reported to be a very promising one. This showing is so situated that it is rather difficult to attack it directly and the method which is planned may prove rather expensive.

The work which is now planned, if carried through, should test out pretty thoroughly the three bands of quartz forming the "Tunnel vein."

A careful plat of all the quartz-outcrops would be useful, and if, as well, all such outcrops were systematically sampled and assay plan made up a fair idea could be obtained whether or not these showings would stand up to milling grade.

CARIBOO MINING DIVISION.

TETE JAUNE SECTION.

The Mica Syndicate.

Introductory.—The Mica Syndicate is a mining partnership formed in Calgary for the purpose of acquiring and developing certain mica claims situated near Tete Jaune: the members of the syndicate are Albert Johnson, I. Nollet, A. Allen, S. E. Beveridge, T. Wilson, and four others.

The *Reliance* claim, which has been owned by T. Wilson for some years, has been obtained by the syndicate and five other claims have been staked. The main showings are on the *Reliance* claim. Some adjoining Crown-granted claims are held by New York interests.

Work was commenced by the syndicate on May 25th, 1920, and for the most of the summer consisted of road and trail construction and the building of camps. It was hoped that actual development of the property would be commenced in September, but with the arrival of snow at that time the work was stopped for the winter.

S. E. Beveridge is in charge of the work for the syndicate, and during the summer from five to eight men have been employed.

Location.—The mineral claims comprising this property are situated on the northern slope of that portion of Mica mountain locally called "Nigger's Nob" and are distant from Tete Jaune, a station on the Grand Trunk Pacific Railway, about 7 miles. Tete Jaune is 184 miles east of Prince George.

A wagon-road which was built this summer by the Mica Syndicate leaves the railway a short distance east of the Sand Creek bridge, which is 2 miles east of Tete Jaune Station, and extends 4 miles towards the base of Mica mountain. This road connects with a road running from Tete Jaune to Swift Creek, on the Canadian National Railway. At the end of this road two large and well-constructed log buildings have been erected, which form a good headquarters camp.

From this point a good trail on an even grade has been built up the mountain to the showings on the *Reliance* claim, a distance of about 3 miles. The elevation of the showings is about 6,000 feet, with timber-line at about 5,000 feet.

Geologic Features.—The dominating rock of Mica mountain is a coarse-grained garnetiferous mica-schist which has been classified by the Geological Survey as highly metamorphosed sedimentary material and provisionally placed in the Shuswap group of the Pre-Cambrian.

These schists have been intruded by granitic rocks which vary from normal granodiorite to pegmatite. The pegmatite dykes, of which there are a number cutting through the mountain, are important, as they are the source of the mica that is obtained. These dykes vary in width from a few feet up to 100 feet. They are approximately parallel in strike, having a trend of north-west and south-east. The dip is to the south-west at from 30° to 40°.

The essential minerals in these pegmatite dykes are quartz, feldspar, and muscovite mica, and in addition small quantities of accessory minerals such as garnet, tourmaline, cyanite, beryl, and apatite. The dykes vary greatly in texture, and only in certain bands, generally only a few feet wide, are the essential minerals segregated into large crystals or masses. It is in these bands that mica "books" are large enough to be of commercial value. Other parts of the dykes generally consist of a coarse-grained intergrowth of quartz, feldspar, and mica. As a rule the dykes seem to have a relatively small feldspar content, but have an excess of quartz.

The mica found in these pegmatite dykes is the variety known as muscovite. It is transparent and, in thin flakes, is almost white in colour with a slight greenish tint. It is generally twinned, very few single crystals being noted. Only surface samples of the mica can be obtained at present and these as a rule are somewhat rusty in appearance. This is probably due to surface oxidation and weathering, and it is expected that much cleaner mica will be obtained at a little depth, where the surface weathering would not have affected it.

The Mica Syndicate has submitted samples of this mica to many experts and mica-buyers, and claim to have had favourable reports, and that several concerns are prepared to purchase this mica in a rough dressed condition when shipments can be made.

In the bands of the dykes where the essential minerals are well segregated the mica crystals are well developed and often attain considerable size. Crystals or "books" ranging from

4 by 4 to 12 by 12 inches occur abundantly, and still larger are found. These crystals have a thickness of ½ inch up to 2 inches. These crystals have an excellent basal cleavage and are easily split into as fine flakes as is desired.

Development.—Very little development-work has been done on these claims. On the *Reliance* claim there is one large open-cut and a few small holes which expose a pegmatite dyke, but the greatest depth attained is not more than 5 feet. This dyke carries considerable mica and the open-cut shows a band from 3 to 4 feet wide in which large "books" of mica occur. On either side of this band there is finer-grained material in which the crystals of mica are about 1 square inch in size.

When the property was visited at the end of August the syndicate planned to commence development of this showing in a short time, but shortly after the work was stopped on account of snow. Operations will be resumed in the spring of 1921.

FORT GEORGE SECTION.

At the present time there is practically no actual mining going on in this section, but there is some prospecting and small amounts of development on some properties are carried on each year. Some claims in the neighbourhood of Prince George were described in the 1914 and 1918 Annual Reports, but no further work had been done on them.

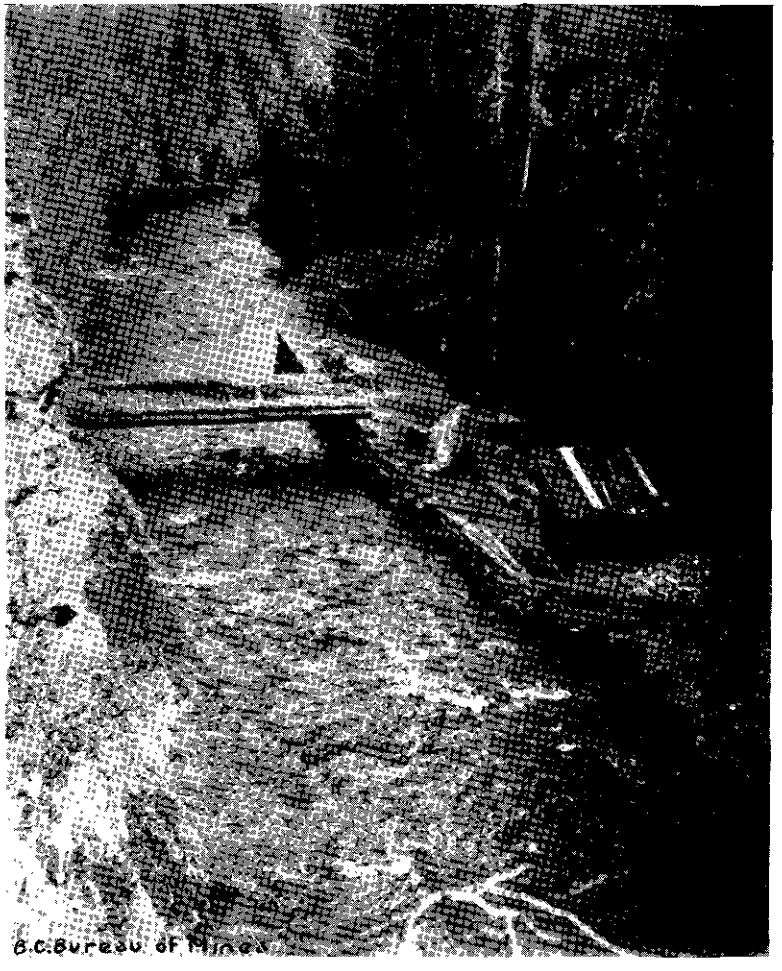
A silver-lead property owned by Oscar Eden, of Prince George, and partners, and situated some 50 miles to the north-east of Prince George, has been partially developed. This property was not examined by the writer, but was examined by L. Reinecke, of the Geological Survey of Canada, his report being issued in Memoir No. 118 of the Geological Survey. Mr. Reinecke's report is as follows:—

"A prospect owned by Oscar Eden, of Prince George, and others, situated just north of the most northerly bend of Fraser river, carries values in silver, lead, and gold. The property is connected by steamer-channel up the Fraser with Hudson Spur, near Hansard, about 24 miles east, on the Grand Trunk Pacific Railway, and to Prince George, about 50 miles down the river to the south-west. The route to Hudson Spur is in quiet water all the way, but there are several long rapids down the river toward Prince George. Developments on this property include a tunnel and shallow shaft. The tunnel, within 100 feet of the north bank of the river, is about 95 feet long, trending about north 40° west. The country-rock is a quartz muscovite chlorite schist carrying some carbonate. A sheared zone about 3 feet wide and dipping east carries quartz with pyrite. In places in the tunnel it lies between fairly solid walls, the easterly wall being apparently more schistose, but otherwise of the same character as the wall on the west side. There has been much faulting and silicification of the country-rock. The shaft lies 300 feet in elevation over the river, about 1,800 feet north of it, and about 750 feet east by south of the north-east corner of Eden's homestead lot. Galena occurs in quartz that is from 5 to 6 feet in width lying between well-defined walls of schist. The walls strike 285° magnetic north (46° true north) and dip 60° to 65° to the north-east. Faulting on the foot-wall is represented by 8 inches of black and red gouge. About 20 feet of the length of the ore-body has been exposed. If the strike of the ore-zone be followed in an easterly direction for 550 feet along the side-hill a gulch is crossed running S. 67° W. toward the Fraser. Two hundred feet down the gulch from where the strike of the ore-zone would cross the gulch are boulders of quartz, some of them 2 feet across, with much galena. They must have moved downhill from their outcrop and are a very excellent indication that the ore-zone has a length of from 500 to 600 feet at least.

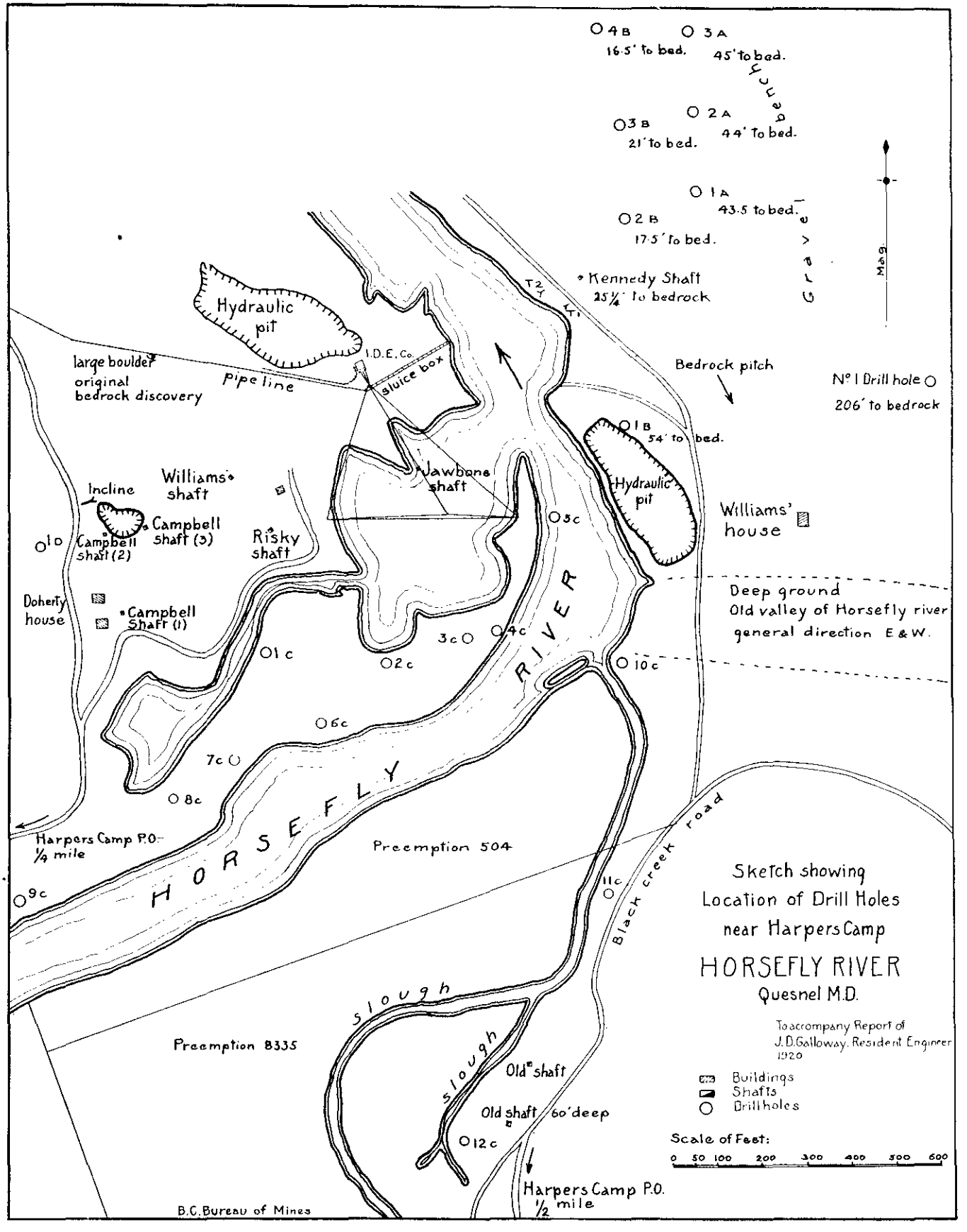
"Samples taken from various places in the tunnel and in the foot-wall of the ore-zone at the shaft are said to have carried radium. The writer took samples from the gouge in the shaft and from points in the tunnel, as near as possible to the points from which the original samples are said to have come from, but a test on these samples by H. V. Ellsworth, of the Geological Survey, did not indicate any trace of radium. According to Mr. Eden, samples taken by him across the outcrop near the top of the shaft gave 13 oz. of silver and 15 per cent. of lead to the ton, whereas a sample across the ore at the bottom of the shaft yielded 25.8 oz. of silver, 42 per cent. of lead, and a trace of gold. The writer did not sample this ore-body, but galena is plentiful through the quartz.

"Assays made from samples 30 and 60 feet from the mouth of the tunnel are said to have yielded respectively 3 oz. silver, 50 cents in gold, with some lead, and $4.80 in gold.

Placer-prospect Drilling, Horsefly River.



Taltapin Mining Co.'s Camp, Omineca M.D.


4B
16.5' to bed.
3A
45' to bed.
Gravel
3B
21' to bed.
2A
44' to bed.
1A
43.5 to bed.
2B
17.5' to bed.
Mag
Gravel
* Kennedy Shaft
25¼' to bedrock
T2
T1
Hydraulic pit
I.D.E.Co.
sluice box
large boulder
original
bedrock discovery
pipe line
Bedrock pitch
No 1 Drill hole
206' to bedrock
1B
54' to bed.
Hydraulic pit
Williams' house
Jawbone shaft
5c
Incline
Williams shaft
Campbell shaft (3)
Campbell shaft (2)
Risky shaft
1c
Doherty house
Campbell Shaft (1)
Deep ground
Old valley of Horsefly river
general direction E & W.
RIVER
3c
4c
2c
10c
1c
6c
7c
8c
HORSEFLY
Harpers Camp P.O.
¼ mile
Preemption 504
9c
11c
Black creek road
slough
slough
Preemption 8335
Old shaft
Old shaft 60' deep
12c
Harpers Camp P.O.
½ mile
B.C. Bureau of Mines
Sketch showing
Location of Drill Holes
near Harpers Camp
HORSEFLY RIVER
Quesnel M.D.
To accompany Report of
J.D. Galloway. Resident Engineer
1920
Buildings
Shafts
Drill holes
Scale of Feet:
0 50 100 200 300 400 500 600

"A company known as the North Point Mining Company, of which Oscar Eden is president, has been formed to develop this property. Surface-trenching should be done to prove the outcrop over as long a distance as possible, so as to determine its dip and strike and whether it has been faulted. With this information it should be possible to drive a crosscut to meet the lead from a point on the steep side-hill south of and below its outcrop. This would give adequate drainage. There are plenty of good landing-places for scows along the north bank of the river. The company owns a large motor-boat and the ore can be conveniently transported to the railway at Hudson Spur. This is the most promising looking of the prospects dealt with in this chapter."

AHBAU LAKE SECTION.

In August a trip was made into Ahbau lake to examine some quartz-showings in that section. From Cottonwood Post-office, which is on the Barkerville road 20 miles from Quesnel, a pack-trail runs to the southern end of Ahbau lake, a distance of 16 miles. From the end of the lake a rough trail continues up the western side of the lake and on to the headquarters camp of Guthrie & Gray, which is situated on Ahbau creek, a short small stream flowing from Hay lake to Ahbau lake. The headquarters camp is distant about 25 miles from Cottonwood and Ahbau lake is about 6 miles long.

Guthrie & Gray also have a cabin camp on the shore of Ahbau lake near the northern end. Their quartz claims are situated on the eastern side of, and about half a mile away from, the Willow river, and are distant about 5 miles from their Lake camp.

Ahbau creek was worked some years ago by Chinamen for placer gold, but none of the workings were on a very extended scale. During recent years Guthrie & Gray have worked portions of the creek-bed and have taken out some gold. The creek ground is shallow, from 2 to 10 feet in depth, and there is not sufficient grade for hydraulic operations. So far as tested the bench-gravels do not carry appreciable gold. These placer operations have been on a small scale.

Moosehorn Group.

This group of mineral claims, owned by Guthrie & Gray, consists of the *Willow*, *Buster*, and one other claim. The showings on the claims are at an elevation of about 3,000 feet and are situated on Moosehorn creek about half a mile from the Willow river. There are several quartz-croppings on the hillside and in the bed of the creek which represent two or more veins. The main vein is exposed along the hillside for a distance of about 150 feet and has a general east-and-west strike (mag.). It has a width of from 4 to 6 feet of quartz and is developed by a tunnel 15 feet long and some surface cuts. The vein exposed in the bed of the creek is similar in character and has a width of from 2 to 4 feet.

Both veins are sparingly mineralized with galena, zinc-blende, pyrite, and arsenopyrite. The surface is somewhat oxidized, giving a rusty appearance to the quartz. The percentage of metallic sulphides in the quartz gangue is as a rule low. The country-rock in which the veins occur is a dark schistose rock which on examination is seen to be mainly dark-blue quartzite and argillite. The formation is cut in places by narrow feldspathic dykes. The quartz gangue has in places a certain amount of sericite mica developed in it. Selected samples of the ore are said by the owners to have returned good values in gold and silver as well as a lead content.

The following samples were taken from the property for assay:—

Description.	Gold.	Silver.	Lead.	Zinc.
		Oz.	Per Cent.	Per Cent.
Average from dump from cut on lower vein.....	Trace	1.8	4.5	2.0
Selected ore from same dump	„	15.8	32.5	2.0
Across 4½ feet quartz from face of upper vein tunnel	„	1.6	1.0	..

The property is not as yet developed to any extent, and if these veins were opened up more, or in other places, a higher mineral content might be found in them. Surface-cutting of the veins along their line of strike might be useful.

Silver Knife. This claim, which is owned by William Harper, is situated 5 miles to the north-east of the south end of Ahbau lake. Irregular and broken lenses of quartz occur here in a schist formation. A tunnel has been driven in 90 feet and some crosscuts run from it. The quartz shows but little mineralization and assays of representative samples show only traces of gold and silver.

BARKERVILLE SECTION.

Hopp Placer Mines. Of the placer properties controlled and operated by John Hopp in the vicinity of Barkerville, only two were operated this year, these being *Lowhee* and *Stouts Gulch*. Operations were in no way different from former years and about the same yardage and grade of ground was handled as last year, so that the returns were about the same. The early part of the season was unsatisfactory on account of adverse water conditions. An unusually late spring made it late in the season before hydraulicking could be started, and then the available water went off with a rush and in a short time operations had to be curtailed on account of a shortage of water. This was compensated, however, by better water conditions in the last half of the season, as an unusually heavy rainfall extending from late summer right through the fall supplied an abundance of water.

Waverly. This hydraulic mine, situated on Grouse creek, was operated throughout the season under the management of E. Moore. A large amount of dead-work was done this year in opening up a pit to gain access to the pay-channel, but it is believed that this will be reached now in a short time. This is an old property taken up two years ago by Moore and associates, and it was realized that the opening-up of the property in a new place would take considerable preliminary work.

Other Placer Properties.—The *Point* mine on Slough creek was operated as usual throughout the season under the management of Joseph Wendle. A satisfactory clean-up is reported.

The Lightning Creek Hydraulic Mining Company's property, situated 2 miles up Lightning creek from the town of Stanley, was operated during the season under the management of Lester Bonner. It is not known what success was attained.

On the property of the Lightning Creek Gold Gravels and Drainage Company on Lightning creek, at Wingdam, work was continued during the winter on the new shaft started in the fall of 1919. Owing to the heavy pressure of water the shaft was lost and the attempt to reach bed-rock at this point had to be abandoned. A manager and some workmen have been on the property all year, but no further plan of development has as yet been inaugurated.

A successful season is reported by Sparks & Felker, who operate a small-scale hydraulic plant on Perkins gulch D. D. Fraser joined the partnership this season and the plant was extended to give a better water-supply.

Small-scale work by individuals on several creeks and on bars of the Fraser river were carried on as usual during the season.

Proserpine Mountain.

The bonding of two groups of quartz claims on Proserpine mountain last fall by a Toronto syndicate led to the hope that productive quartz-mining would soon be inaugurated in this section, but unfortunately these hopes have not yet materialized. The properties bonded were those owned by E. E. Armstrong and Tregillus and partners. R. A. Bryce, of Toronto, was in charge of the work, and from October, 1919, until February of this year from forty to sixty men were kept at work. A considerable amount of surface crosscutting and stripping of the veins was done and a number of shallow tunnels were run. Hundreds of samples of the quartz and associated schist were taken, and apparently the syndicate considered that a pretty thorough examination of the properties had been made. The decision arrived at was that the properties did not give promise of yielding a large tonnage of low-grade gold ore which could be mined and milled at a profit. As a payment on the bonds was coming due in March, the option was therefore allowed to lapse. The owners were negotiating with other parties during the year to take up the properties, and are quite confident that they will be able to arrange another deal.

Some further work was done during the summer by individuals on quartz veins on the mountain.

QUESNEL MINING DIVISION.

QUESNEL SECTION.

Cottonwood River.

Some promising dredging-ground has been located on the Cottonwood river and a number of leases changed hands this year. It is expected that testing of the ground will be commenced next year, with the possibility of one dredge being installed in the near future.

Quesnel River.

The Cariboo Gold-Platinum Extracting Company commenced operations this spring on its leases on the Quesnel river, some 15 miles up the river from the town of Quesnel. The necessary machinery for a drag-line scraper type of dredge was taken in and erected on the ground. The equipment at the plant consists of a 1-yard Sauerman cableway excavator, double-drum donkey engine, 32-horse-power boiler, 8 by 10 centrifugal steam-pump, amalgamator and concentrator (Marsh patents), cables, etc. The necessary buildings, towers, etc., have been erected.

A test run of about two weeks was made late in the fall before closing down for the winter season, and it is said that satisfactory results were obtained.

The primary object of this company is to engage in the business of extracting gold and platinum values from the black sand occurring in the placer-gravels. S. J. Marsh, promoter of the company, has experimented with this matter for some years past and now has a patented process for extracting these metals. Furthermore, as a result of his investigations, Mr. Marsh claims that at many places on the Quesnel and Fraser rivers and their tributaries the gravels do contain black sand containing appreciable platinum values. These values, together with a certain amount of flour gold, are not recovered in the ordinary process of hydraulic mining or dredging, and Mr. Marsh therefore believes that his process will open up a new field of activity in mining in the district.

The company plans to erect next year a plant on 2-Mile flat at Quesnel, which will treat the black-sand concentrates from any placer-mining enterprise in the district. In order to have something to start on and also to demonstrate the possibilities, the company has erected the drag-line scraper plant previously referred to, and will mine the gravels for the black-sand content as well as any coarse gold that may be recovered.

It is known that the black sand of the Quesnel river and some of its tributaries do contain varying and irregular amounts of black sand, especially where a natural concentration of the gravels has taken place. It is therefore encouraging to have an attempt made to mine some of these gravels for the platinum content.

After organizing the company Mr. Marsh succeeded in interesting Minneapolis capital in his project. Herbert E. Crosby, of Minneapolis, who is vice-president of the company, visited the property this fall while the test run of the scraper plant was being made, and expressed himself as being well satisfied with the progress so far made. It is planned to continue operations on a larger scale next season.

Hydraulic.

The big hydraulic plant of the Quesnel Hydraulic Gold Mining Company at Hydraulic, on 20-Mile creek, was operated throughout the season. As in the last three years, the work was mainly the testing on a large scale of certain parts of the gravel-deposits with the hope of finding a pay-channel. It is reported that the season's operations were more successful than in former years and that a fair clean-up of gold was made.

KEITHLEY SECTION.

The *Kitchener* placer mine on Keithley creek, owned by Harrison & Worth, was acquired this year by a syndicate formed by some of the directors of the Quesnel Hydraulic Gold Mining Company. K. C. Laylander, manager of this company, was also in charge of the work at the *Kitchener* mine.

Harrison & Worth had worked this property since 1914 as a drift-digging and were mining in an old high channel of Keithley creek. In 1919 they were particularly successful, as, having reached a rich part of the old channel, they took out good pay and made a good clean-up for the season.

On acquiring the property the new owners decided to work it as an hydraulic mine, as the conditions are nearly ideal for this method of working. The overburden is not excessive, there

is ample fall for a dump, and Keithley creek can be utilized to supply an abundance of water for hydraulicking for a long season.

During the summer the necessary equipment for an hydraulic plant was taken in, including a portable sawmill to saw lumber for the flume. The pipe-line, flume, and all necessary plant was erected and a short run was made before closing down for the winter. It is expected that this property will be an important producer next year.

HORSEFLY SECTION.

Keystone-drilling at Harpers Camp.

Introductory.—The prospecting by Keystone-drilling of certain placer-gravels in the vicinity of Harpers Camp was commenced in December, 1919, by the British Columbia Department of Mines. The drilling was continued until April of this year, when it was stopped pending the arrival of new casing and other equipment. Drilling was recommenced early in August and was continued until December, when the work was again stopped.

Harpers Camp is situated on the Horsefly river, 35 miles in an easterly direction from 150-Mile House on the Cariboo road. A weekly stage from 150-Mile House gives access to the place.

The history of placer-mining in this section is much the same as in other parts of the Cariboo District—namely, vigorous mining in the early sixties by hand-work in the easily available rich ground, followed later by the working of the ground on a larger scale with the aid of modern machinery.

The important productive ground near Harpers Camp was a small area lying in and along a bend of the Horsefly river, the original location being known as Harpers bar. The estimates of the amount of gold taken from this area vary considerably, ranging up to $500,000 or more. 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 and others did not, but the average result of the whole is unknown. It must be remembered, though, that the Ward ground had had the best of the gold taken out by the old-timers.

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.

It has been supposed that the present Horsefly river at this point cuts across an old (pre-glacial) channel rich in gold-bearing gravel, and that the pay-ground was thereby exposed. Assuming this theory to be correct, the conclusion was reached by many that the old channel, if explored further, would yield similar rich gold-bearing gravel.

Considerable work has been done at different times in the past in an endeavour to explore this supposed old channel at points not far distant from the Ward ground.

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 boulder-clay, after which about 400 feet of gravel was passed through containing in places small amounts of 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 only low values were obtained, not sufficient to pay by drifting operations. It is to be regretted that when so much capital was expended in this enterprise the testing of the channel was not carried further.

A number of shallow shafts were put down by hand-work in the vicinity of Ward's pit, but owing to the amount of water to be handled none of these were sunk to any great depth and practically none of them reached bed-rock.

Some Keystone-drilling was done in the area by an Eastern syndicate some years ago.

Physical Features.—Attached to this report is a map showing that portion of the Horsefly which includes Ward's Horsefly pit and adjacent territory and the location of drill-holes put down by the Government. The country is rolling and the actual channel of the Horsefly is cut down from 20 to 30 feet below the general level. The grade of the river is slight, not being 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.

The original discovery at "Harpers bar" (Ward's Horsefly) was at a point in the river-channel where bed-rock was naturally exposed. From this high point the bed-rock apparently pitches off in all directions. To the north-east, east, and south the ground has been worked with the bed-rock pitching gradually, and consequently the workings getting deeper. The limiting depth with Ward's hydraulic elevator was reached at between 50 and 60 feet.

Before mining operations commenced in this area the Horsefly river flowed to the west of the present course. Wing-damming of the stream and the piling-up of hydraulic tailings deflected the course of the river locally.

There is a considerable depression or old valley crossing the Horsefly river, running in a general east-and-west direction at this point. Beaver valley may be a continuation of this old valley in the westerly direction, while to the east the old valley connects with the present Horsefly river.

A topographic map of the Harpers Camp area was made in the season of 1919 by a party of the Geological Survey of Canada under the direction of Dr. B. R. MacKay. This map has not been issued yet.

Drilling.—The main object in the Government drilling at Harpers camp was to find if possible some extension of the rich area and to obtain information as to whether or not there was a rich gold-bearing channel feeding this area.

The drilling operations may be divided into two parts, that done from December, 1919, to April, 1920, and that done from August to December, 1920.

To begin with, a hole was started a short distance from Williams House on what was believed might be the rim of the old channel of the Horsefly. This was sunk about 100 feet, at which point it had to be stopped until more casing and cable was secured.

A number of shallow holes were then put down on the ground controlled by the International Dredging Company. This company's plant consists of a drag-line scraper system capable of digging and elevating gravel to a height of about 30 to 40 feet. This plant was erected with the idea of reworking the ground in the vicinity of Ward's pit, and where it was hoped some extension of the rich area, previously unworked, would be found. The plant was operated during parts of the summers of 1918 and 1919, but very little gold was recovered. Apparently the ground handled consisted mainly of old hydraulic tailings.

As will be seen from the accompanying plan, twelve holes were drilled at different points ahead of the International plant. These holes ranged up to 50 feet in depth, but in no case reached bed-rock. The drilling results were mainly negative, but proved that there was no important area of ground in this vicinity carrying sufficient gold to pay to work with the plant

of the International Dredging Company. The company has therefore ceased operations entirely. When the drilling was recommenced in August with an adequate equipment of casing, etc., the No. 1 hole (near Williams House) was continued and sunk down to bed-rock, a total depth of 216 feet. This depth was greater than had been expected and showed there was a deep channel at this point. It was obvious that to continue a cross-section of holes south-easterly from this point across the old channel of the Horsefly would involve very deep drilling, as the indications showed that the ground would be progressively deeper to the south-east.

The drilling was therefore continued to the north-west, where shallower ground was believed to exist. Seven holes were put down ranging from 17½ to 55 feet, all being sunk to a bed-rock and some holes a short distance into bed-rock. Some values were disclosed by this drilling, but not sufficient to make pay-ground. This completed the drilling on the eastern side of the river, as it was believed that sufficient information had been obtained.

The last hole put down was on the western side of the river near an old drill-hole put down some years ago. In this vicinity R. H. Campbell and partners had sunk three shafts during the summer by hand-work, without getting definite results. It had been reported that good values had been disclosed by the old drill-hole, and so at the request of Campbell a hole was put down to check this and thereby assist the work of exploring this area.

The following table shows the holes drilled, total depths, and depths to bed-rock.

Hole No.	Depth.	Depth to Bed-rock.	Remarks.
	Feet.	Feet.	
1	211	206	Norma lease.
1c	25	Unknown	Lease 1360.
2c	28	,,	,,
3c	28	,,	,,
4c	38	,,	,,
5c	36	,,	,,
6c	42	,,	,,
7c	46	,,	,,
8c	41	,,	,,
9c	37	,,	,,
10c	52	,,	,,
11c	39	,,	,,
12c	37	,,	,,
1A	49	43½	Kahm group.
2A	44½	44	,,
3A	53	45	,,
1B	55	54	,,
2B	21¾	17½	,,
3B	22	21	,,
4B	17½	16½	,,
1D	51	50	Campbell group.

Values.—No. 1 hole showed no value whatever throughout the length of the hole. Of the holes, Nos. 1c to 12c only one showed important values; that one being No. 4c. The following table shows the distribution of the values in this hole:—

Footage.	Mg. of Gold.	Value per Cubic Yard.
0 to 10	.....	*Nil.*
10 to 21	.....	*Nil.*
21 to 24	60.0	$1.20
24 to 26	.....	*Nil.*
26 to 28	Some fine colours.	Practically *nil.*
28 to 30	590.0	$17.70
30 to 32	613.5	18.40
32 to 33	270.0	16.20
33 to 34	110.0	6.60
34 to 38	40.0	0.60

Average value for the total depth of 38 feet of hole, $2.66 a yard.

It will be seen that the main values are contained in a strata lying from 28 to 33 feet in depth, about 87 per cent. of the total gold occurring in this 5 feet. This section of the hole has a value of $17.68 a yard.

From the log of the hole as turned in by the foreman, the first 12 feet of the hole was in surface river-wash gravel; then came 9 feet of slum; from 21 to 32 feet the drill passed through a fine blue gravel with some streaks of clay; from 32 to 38 feet the material was a coarse blue gravel with some streaks of heavy sticky clay. This blue gravel from 21 to 38 feet was cemented sufficiently to render it unworkable by a scraper or dredge. Apparently the only feasible way to work this ground would be by drifting operations, and in that case the water might prove difficult to handle.

The series of holes 1A to 4B showed certain values in places, but in none of them are the values sufficient to make it profitable to work the ground. The following table shows the results:—

Hole. No.	Value per Cubic Yard.
1A	Practically *nil.*
2A	12 cents.
3A	Practically *nil.*
1B	" "
2B	14 cents.
3B	1 cent.
4B	4 cents.

Hole No. 1D showed little or no values.

Tests were made on a number of samples from the drill-cores to determine if the concentrates carried any combined gold. The samples were panned down and the colours of free gold removed from the concentrates. These concentrates, consisting of black and ruby sand, were separated into magnetic and non-magnetic samples, and these samples assayed for gold and platinum.

The assay results showed that where the concentrates had had the free gold entirely removed there was practically no contained gold content in them. A low platinum content was obtained in one sample, but too slight to have any commercial importance.

Conclusions regarding Origin of Deposit.—There is now available a certain amount of information regarding the deposit of rich auriferous gravel situated at Ward's Horsefly. This information may be divided into: (*a*) Facts deducible from surface topographic features; (*b*) information from old workings, shafts, etc.; (*c*) information from Government drilling.

From the available information different theories as to the origin of the rich deposit might be derived. The following ideas are advanced by the writer, but are subject to modification in the light of fuller information:—

From a consideration of the present topographic features, together with information of the depth of ground from shafts and drilling, it is quite apparent that an old channel of the Horsefly is crossed at this point by the present Horsefly river. This channel flowed in from the east, occupying the flat which stretches easterly from Williams House. Apparently the Miocene shaft explored a continuation of this channel to the west. The available evidence indicates that but little gold was found in the gravels of this old channel as explored by the Miocene shaft. The evidence from other old shafts and Keystone-drilling tends to confirm the conclusion that the gravels of this old channel contain but small amounts of gold.

The rich ground in Ward's pit contained the gold partly in a yellow gravel and partly in a lower strata of blue gravel, the latter perhaps being the most important gold-bearing strata. The blue gravel at this point is nearly identical with the gold-bearing gravel at Hobson's Horsefly, 5 miles down-stream from Ward's pit. At Hobson's Horsefly the gravels worked were part of an old channel of the river lying a short distance from and parallel to the present channel of the Horsefly river.

It is apparent that the gold-bearing gravels at Ward's pit are quite different from the white quartz gravel of the old east-and-west channel of the Horsefly which was partially explored by the Miocene shaft. The blue gold-bearing gravel, which as a rule has been fairly well cemented, has been previously classified as pre-glacial in age,* but complete evidence of this

* B. R. MacKay: Summary Report, G.S.C., 1918, Part B.

is lacking. It at least is older than the present stream-gravels, but is apparently younger than the gravels of the east-and-west ancient channel.

The occurrence of gold in the yellow gravel, which is a modern stream-gravel, would appear to have originated by erosion and concentration of the blue gravel. The problem is therefore reduced to the origin of the blue gravel and its gold content. It would seem to be fairly well established that this blue gravel has been deposited by the Horsefly river while occupying more or less its present channel. This blue gravel as originally coming down the river probably carried a small gold content, and at certain favourable points, depending on local conditions, this gold would be concentrated to a greater or less degree. Where the Horsefly river crossed the old east-and-west channel local conditions were such as to cause a considerable concentration of gold in the blue gravel deposited at that point. Here the river crossed a wide, deep, gravel-filled channel with a high rim of bed-rock on the northerly side, over which rim the river necessarily had to carry its burden of sand, clay, and gravel. This high rim-rock acted as a natural riffle to prevent the free flow of gold down the river, with the result that a concentration of gold was made at this point, a sufficient concentration to make the rich diggings at Harpers bar.

After the deposition and partial cementation of the blue gravel, which may have occurred during an interglacial period, the course of the Horsefly was slightly but not materially altered, as is shown at Hobson's Horsefly. At Harpers bar the river continued to occupy approximately the same channel. Partial reworking of the blue gravel resulted in the formation of the gold-bearing yellow gravel, with the rich ground again concentrated at and near the high bed-rock or old rim-rock exposed in the river-channel. It is significant that phenomenally rich ground was found around a large boulder lying on bed-rock near the point where the bed-rock was originally exposed in the channel.

The bed-rock, as previously stated, dips away in all directions from the high point originally exposed, and as the workings went deeper the gold values as a rule decreased.

The evidence from drilling and shafts is that the blue gravel carries slight amounts of gold wherever it is explored, but that only in the original workings of Ward's pit does it carry pay values. The drilling done along the A and B lines prospected the rim of the ancient east-and-west channel, and the logs of the holes show that after going through modern river gravel or clay the drill penetrated blue gravel down to bed-rock. While these holes were on the rim of the old channel, they were also along the rim of the present channel, which may account for the blue gravel having but little or no gold in at that point. The gold-bearing blue gravel was carried along in the centre of the stream with but little gold distributed to the rims.

Hole No. 4c yields interesting results, in that it shows that the pay-streak of Ward's pit extends at least that far to the south. It must be remembered, though, that this hole is only about 150 feet south of old workings. At the time that the series of C holes were put down the drilling equipment only permitted the sinking of shallow holes. It is unfortunate that some of these holes were not put down to bed-rock, as they might have yielded useful information.

The nearest holes to hole No. 4c are Nos. 3c, 5c, and 10c. The logs of these holes show that blue gravel was penetrated in each case, but that no appreciable gold was found. The holes were shallow, however, and the blue gravel at greater depths might contain some gold.

Conclusions.—The following tentative conclusions have been arrived at regarding this deposit of auriferous gravel, which, however, may have to be modified when fuller information is obtained:—

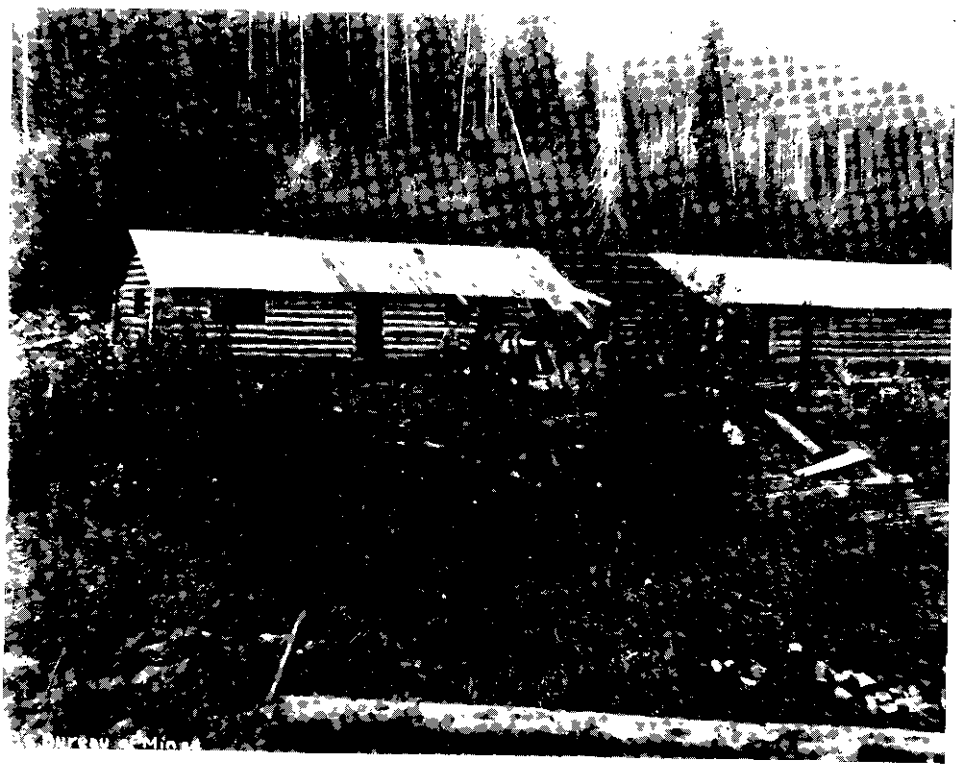
(1.) The physical character of the gold found at Ward's Horsefly is such that it must have been transported a considerable distance; it therefore probably had its origin near the head-waters of the Horsefly river.

(2.) The gravels coming down the Horsefly river, either in the present or older channels, carried small amounts of gold, but only in workable quantities where a very considerable natural concentration of the gravels took place. It follows therefore, that a long continuous channel of rich gold-bearing gravel feeding the Ward's Horsefly area will not be found.

(3.) The high gold content of the auriferous gravels at Ward's Horsefly was due to the local physical conditions at that point causing an extreme concentration of the gold in a small area.

(4.) Some extensions of the present known and worked-out area of rich gravels may yet be found. This extension is most likely to exist in a direction up-stream from the old workings. The ground will probably be deep and may prove difficult to mine owing to water.

Mica Syndicate, Tete Jaune—Mica Claim.



Mica Syndicate, Tete Jaune—Camp.

(5.) The drilling so far carried out by the Government has been of a prospecting nature. If a policy of further drilling is decided upon, the ground in a southerly direction from the old workings should be further prospected. An extension of the pay-ground shown in hole No. 4c might be located by further drilling.

(6.) The pay-ground shown in hole No. 4c warrants further investigation. This ground could probably be mined by a shaft-sinking if some arrangement was made to handle the water.

CARIBOO DISTRICT.

CARIBOO MINING DIVISION.

REPORT BY L. A. DODD, GOLD COMMISSIONER.

I have the honour to submit herewith the office statistics for the year ended December 31st, 1920.

The revenue shows a substantial increase over the last calendar year.

OFFICE STATISTICS—CARIBOO MINING DIVISION.

Free miners' certificates issued (Barkerville, 190; South Fort George, 181; Quesnel, 132)	503
Mineral claims recorded	52
Certificates of work ("Mineral Act")	143
Conveyances and agreements recorded	86
Powers of attorney recorded	49
Placer claims recorded and rerecorded	17
Leaves of absence (placer)	14
Applications for placer-mining leases	70
Placer-mining leases issued	67
Certificates of work ("Placer Act")	5
Placer-mining leases in force	335

Revenue.

Free miners' certificates (Barkerville, $1,691.25; South Fort George, $807.50; Quesnel, $513.75)	$ 3,012 50
Mining receipts, general	22,233 28
Other sources	1,039 50
Total	$26,285 28

OMINECA MINING DIVISION.

REPORT OF STEPHEN H. HOSKINS, GOLD COMMISSIONER.

I have the honour to forward herewith the office statistics for the Omineca Mining Division for the year ending December 31st, 1920.

The District Resident Mining Engineer will undoubtedly, as in the past, furnish your Department with a full report on mining conditions in this Division.

Although there has been considerable activity in prospecting on placer-mining leases along the Finlay river and certain portions of the Peace river, no definite information regarding results have so far been received at this office.

When the amendments to the "Placer-mining Act" of 1920 become fully understood and are working smoothly, we should come in closer touch with any development that may be taking place.

It will be undoubtedly noted with satisfaction that the revenue received in 1920 exceeds the amount taken for the same period of 1919 by over $7,000.

OFFICE STATISTICS—OMINECA MINING DIVISION.

Free miners' certificates (ordinary)	577
Free miners' certificates (company)	10
Free miners' certificates (special)	1
Mineral claims recorded and issued	222

Certificates of work issued	588
Placer claims recorded and issued	6
Bills of sale and mining agreements, etc.	259
Powers of attorney recorded	53
Mining documents filed	82
Certificates of improvements recorded and issued	31
Crown grants of mineral claims issued	31
Applications for placer-mining leases (Omineca Division)	24
Applications for placer-mining leases (Peace River Division)	42
Placer-mining Leases issued (Omineca Division)	13
Placer-mining Leases issued (Peace River)	31

Revenue.

Free miners' certificates	$ 3,466 00
Mining receipts	15,912 20
Total	$19,378 20

QUESNEL MINING DIVISION.

REPORT BY R. M. MCGUSTY, MINING RECORDER.

I have the honour to submit herewith my report on mining operations in the Quesnel Mining Division of the Cariboo District for the year ending December 31st, 1920.

As in the past, the Resident Mining Engineer will furnish you with reports on actual mining development during the past season and the result of the operations of the Keystone-drilling near Harpers camp.

During the season under review there has been little change in conditions in this division; the *Kitchener* mine on Keithley creek and the Quesnel Hydraulic Gold Mining Company at 20-Mile being the only two mining concerns employing crews.

In regard to the *Bullion* property there is no change to report.

The result of the work in connection with the Keystone drill operating in the Harpers Camp section under the Department of Mines will be watched with interest, such work being of undoubted assistance to the miners in that locality, and if the report is favourable a fresh impetus to mining in that section will result.

During the past season the demand for mining leases has been active, due in no small measure to the reduction in lease fees and amendments to the lease laws.

OFFICE STATISTICS—QUESNEL MINING DIVISION.

Free miners' certificates issued	149
Mineral claims recorded	24
Certificates of work recorded	10
Placer-mining records	12
Placer mining rerecords	9
Powers of attorney recorded	20
Bills of sale and mining documents	5

EASTERN DISTRICT (No 5).

REPORT BY A. G. LANGLEY, RESIDENT ENGINEER.

(Reports marked * are by B. T. O'Grady, Assistant.)

INTRODUCTORY REMARKS.

The mineral industry of the district has suffered during the year from the scarcity of labour, which in some cases has been accentuated by strikes called by the O.B.U. Early in May a strike called by this union in the Slocan Mining Division greatly curtailed the operations of the leading mining companies, with the one exception of the Silversmith Mines, Limited, which company saw fit to accept the terms of this union. Labour is now more plentiful and the Slocan is getting back into its stride once more. It is reported that from about November 15th the various mines have had full crews working and that the strike has been definitely broken.

The outstanding feature governing this year's production of lead and zinc has been the continuous operation of the great *Sullivan* mine by the Consolidated Mining and Smelting Company. Under adverse conditions this mine has greatly exceeded last year's output, and has been able to supply the smelter with a steady stream of ore, thus offsetting the decrease in tonnage from other sources.

In view of the high cost of labour and supplies, conditions cannot be considered ideal for the mining of gold ores; it is therefore encouraging to note that there have been new and important developments in this direction during the year, which leads to the conclusion that as soon as conditions become more normal, and the ounce of gold represents a greater purchasing power than at present, event greater activity will be witnessed among the gold properties.

Mining operations on a small scale have not been seriously affected by the labour situation, and it is safe to say that the past season has been an exceptionally busy one in the hills for the small operator, leaser, and prospector. To my knowledge, many results obtained among the prospects have been very encouraging, and it is fully anticipated that next season will see a number of new names on the shipping-list, providing market conditions are favourable.

The production of coal from the Crowsnest fields shows a substantial increase over that of last year, the total output being over 800,000 tons.

In this district during the season three soldier prospecting parties were assisted by the Government. Two of these chose the Big Bend district north of Revelstoke, and a third the Golden Mining Division.

B. T. O'Grady was appointed assistant to the Resident Engineer on June 1st. His time was mostly employed in the Slocan, Nelson, and Ainsworth Divisions, and many applications for assistance on road and trail construction received attention which otherwise would necessarily have been neglected through lack of time.

The season was a busy one both in the East and West Kootenay; numerous applications were received for examinations and assistance on road and trail construction, and altogether about eighty-five properties were visited.

EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

The shortness of the open season greatly curtailed the field-work in this Division, and time did not allow as many examinations as was anticipated. Prospecting has shown signs of revival, though not commensurate with the scope that this large and well-mineralized area affords.

The principal producer is the *Monarch-Couvcrapee* property at Field, which, under the management of Mr. Adkins, has shipped between 500 and 600 tons of lead ore and concentrates during the year.

Rose and Daisy. Situated on the ridge between the Columbia and Spillimacheen rivers at a point almost opposite Castledale. The property was bonded to C. H. Rowley last fall, and 100 feet of tunnelling was done in an effort to develop some small

surface showings. The results did not come up to expectations and the work was abandoned. Elsewhere on the property there is a strong surface showing of low-grade lead ore, on which work recently done by the owners is reported to have given excellent results. R. W. McKeeman, of Castledale, is the principal owner.

Castledale. Consisting of two claims owned by W. Logan. Considerable tunnelling was done on this property by C. H. Rowley. In these workings the vein does not show continuity and only a few small pockets of quartz mineralized with chalcopyrite were encountered. It is now reported that the owner has found more ore at another showing, on which he has confined his attention during the season.

Prospecting was energetically carried out by F. P. Armstrong and his partner, J. G. Webster, under the returned soldier prospecting scheme put into effect this year by the Provincial Government. The areas prospected included the ridge between the Spillimacheen and the Columbia rivers and Vermont creek. Three claims were staked.

Captain Armstrong is also interested in the *Giant* mine near Spillimacheen, where there is a large deposit of barytes and low-grade lead ore. It is reported that Eastern capitalists have taken an option on the property and intend to mine the barytes on a large scale.

Marie Group.—Situated near Palliser. Preliminary prospecting-work done by the owner, O. W. Wiedman, consists of an open-cut on the vein, in which several quartz stringers carrying galena have been exposed. Some of the sorted ore ran: Silver, 2.4 oz.; lead, 66 per cent.; zinc, trace.

Eclipse Group.* This group, consisting of the *Eclipse* and *Eclipse "A"* claims, is owned by A. F. Macaulay, of Spillimacheen. The property is situated on the south-eastern side of Warren creek, which flows north-easterly into the South fork of the Spillimacheen river. The altitude of the upper workings is about 6,350 feet. In a direct line from the Columbia river the distance to the claims would be about 11 or 12 miles, but the present route is by sleigh-road 18 miles from Spillimacheen; thence by pack-trail about 5 miles, making a total of 23 miles from transportation. The more direct route, however, would involve crossing the low divide which separates the North and South forks of the Spillimacheen river, necessitating a circuitous route to obtain a favourable grade.

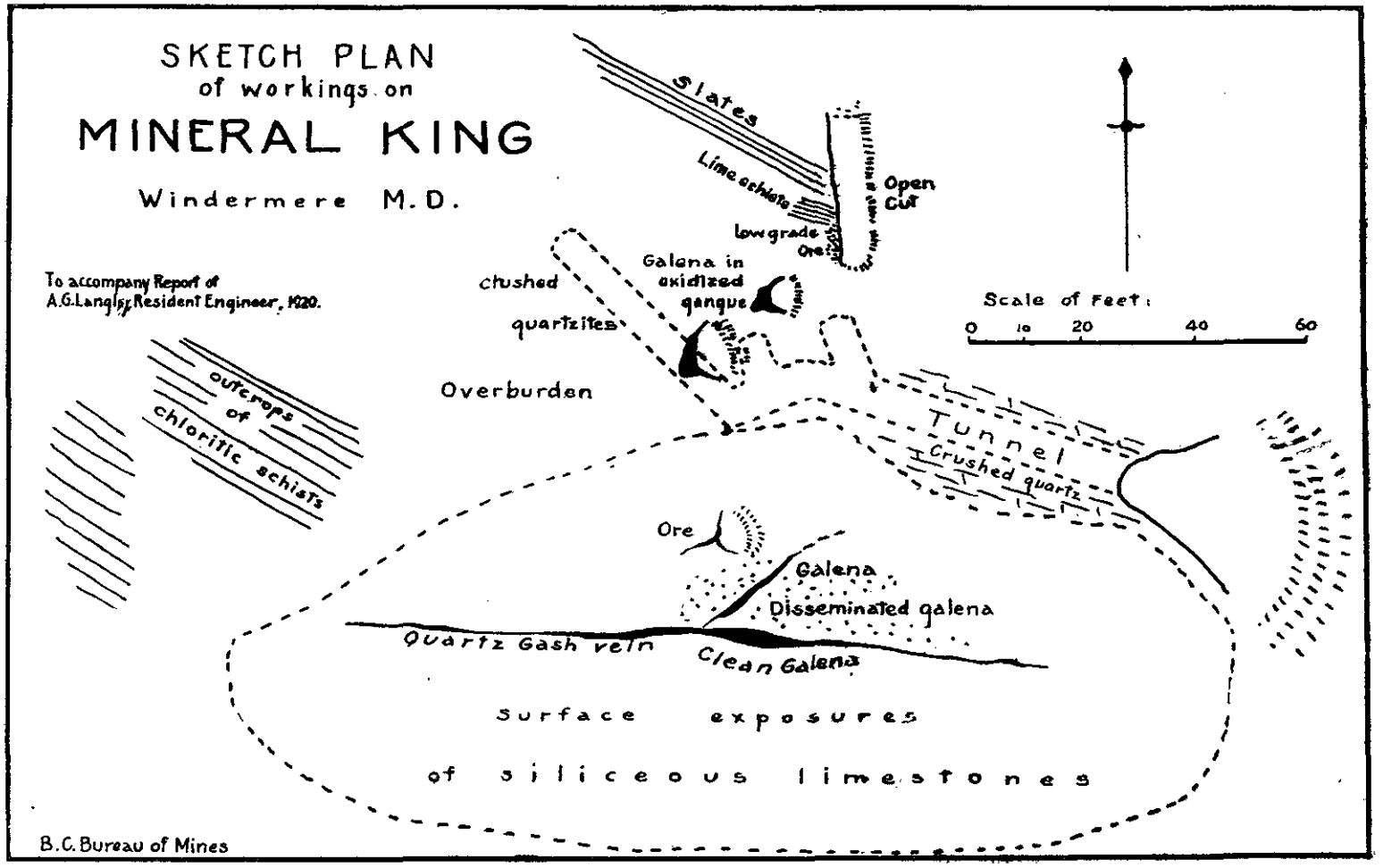
A quartz vein carrying chalcopyrite occurs in a fissured zone about 12 to 16 feet in width. The shattered material of this zone forms the ledge material in which the ore is deposited, chiefly on the foot-wall side. The country-rocks are schists and siliceous limestones.

The best showings are at the upper workings, where a band of solid ore from 16 to 18 inches in width is exposed in open-cuts about 50 feet apart. Samples taken at these places show 19.2 and 14.5 per cent. copper respectively. Between these showings there is a tunnel 35 feet in; this tunnel appears to have turned too far into the foot-wall, having failed to develop any ore. Farther down the mountain and about 300 feet vertically below this tunnel there is a showing of 12 inches of solid ore on the foot-wall side of the ledge, the adjoining 11 feet of quartz to the hanging-wall side being more or less impregnated with mineral. Just below this showing a tunnel has been driven 20 feet in the quartz. The mountain-side below the workings is strewn with boulders containing ore and ledge material amounting to a considerable tonnage.

The upper workings were roughly estimated by the writer to be about 1,000 feet above and 1,500 feet from Warren creek. If sufficient ore is developed to justify the erection of a concentrator a good site for it could be obtained on the creek below the claims.

Paradise. Work was greatly hampered by lack of men during the season, and the production was necessarily less than the average. Mining and development has principally been confined to the No. 4 level, from which a raise is being driven to tap the ore-shoot exposed below the No. 2 level. New ore-bodies have been developed between the No. 4 and the upper level, at a distance of 175 feet from the portal. These lower workings are still in the zone of oxidation, and the ledge-matter is composed of the same soft decomposed material as in the upper levels, though the ore carries a higher percentage of galena. A 5-ton White motor-truck was used for hauling the ore from the mine to the railway.

Bald Eagle. Situated on Slade creek to the north-west of the *Paradise*. John Burman, the principal owner, put in a season's work at the property. A width of from 2 to 3 feet of ore was encountered in a short crosscut from the main tunnel. It shows up strongly in the bottom, and in order to get under it an adit-tunnel is being driven 45 feet lower down.


SKETCH PLAN
of workings on
MINERAL KING
Windermere M.D.
To accompany Report of
A.G. Langley, Resident Engineer, 1920.
Slates
Lime schists
Low grade Ore
Open Cut
Galena in oxidized gangue
Crushed quartzites
Overburden
Outcrops of chloritic schists
Scale of Feet:
0 10 20 40 60
Tunnel
Crushed quartz
Ore
Galena
Disseminated galena
Quartz Gash vein
Clean Galena
Surface exposures
of siliceous limestones
B.C. Bureau of Mines

The ore is a massive galena with which is associated zinc-blende and iron pyrites. A sample taken across a width of 2 feet assayed as follows: Gold, 0.02 oz.; silver, 11.4 oz.; lead, 33.5 per cent.; zinc, 20 per cent. A grab sample from a 10-ton pile extracted from the tunnel ran: Gold, trace; silver, 23.2 oz.; lead, 42.5 per cent.; zinc, 24 per cent.

The first attempt to develop the ore exposed in the upper tunnel was the driving of a 192-foot crosscut at a vertical depth of 80 feet below the showing; this proved futile, as it was not driven in the right direction to develop the projection of the ore. This tunnel has been abandoned, but may be of use at some future time.

Silver Belt. Situated in the basin to the south-west of the *Paradise* mine and at the head of Spring creek. The property was visited, but there was little to be seen, as the workings from which ore has been extracted, consisting of a long open-cut and several shallow shafts, had caved in, and there were no surface indications which could be taken as a useful guide to form an opinion of the character of the deposit.

Mineral King. During the season exploratory and development work were carried on by the Toby Creek Mining Company, of Vancouver, which recently acquired the property under option. The property was examined on May 28th, at which time not much work had been done by the Company. The claims are located on the southerly slope of the ridge which forms the divide between Toby and Jumbo creeks at a distance of approximately 26 miles from the railway at Athalmer. The elevation of the workings is 5,500 feet, or 1,200 feet above the level of Toby creek. The hillside, which has a fairly uniform slope of about 30°, is devoid of timber in the vicinity of the workings; below this few rock-exposures are visible on account of the heavy covering of the detritus from the bluffs which form the summit. Ample water power is available for mining or milling purposes on a large scale from the near-by creeks. Mining-timbers can also be obtained within a short distance.

To reach the property a motor-car can be taken for the first 18 miles from Athalmer and horses for the remaining distance. An old road used by a lumber company still exists on the southerly side of Toby creek, but at present is impassable for vehicular traffic on account of the bridges being washed out. However, this road could be put into first-class condition at a moderate expense in proportion to its length, and an excellent grade for haulage purposes could be obtained.

The formation of the hill consists of vertical bedded schists, quartzites, slates, narrow bands of limestone, and squeezed conglomerates having a north-westerly strike. Judging by the highly metamorphosed and contorted nature of the rocks in the vicinity of the deposit, there has been a shearing and crushing movement on a large scale. An examination of the surface exposures shows the ore to consist principally of galena, with which is associated zinc-blende and iron pyrites in varying quantities, and to have been deposited in quartz-filled gash-fissures in a highly silicified limestone, some of which carry lenses of clean galena, while in places the country-rock has been impregnated with disseminated galena. Small pockets and bunches of galena are also found in the adjoining crushed and decomposed ledge-matter. Altogether, across a width of about 60 feet there are a number of nice surface showings, but the entire width could not be considered of high enough grade for mill-feed. The writer would classify the deposit as being of the replacement type, formed along a sheared contact of limestone and slate.

The continuity of the limestone, which forms an isolated knoll on the hillside and probably the hanging-wall of the deposit, could not be traced on the surface of the hillside either above or below its occurrence. The surface exposures as described above are confined to a limited area, including and adjoining the knoll of limestone.

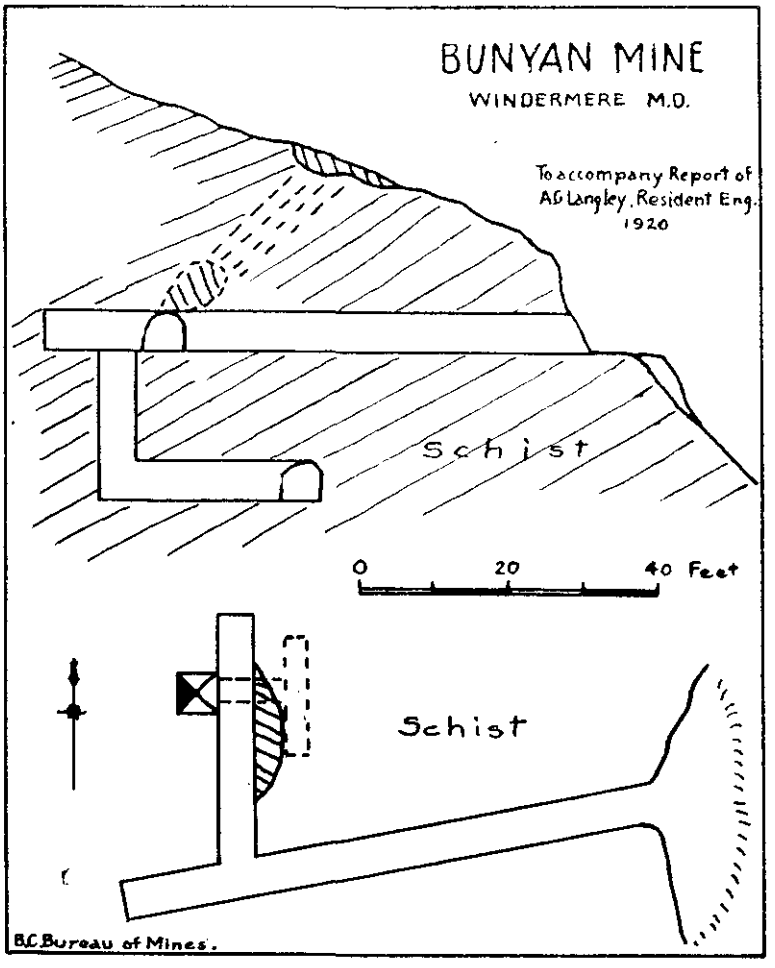
The old tunnel driven into the hillside for a distance of 120 feet, and vertically about 50 feet below the surface showings, did not develop the ore-showing exposed on the surface, and further crosscutting was recommended, which, according to recent reports, opened up a good width of clean galena. Other work done on the surface is reported to have met with very satisfactory results.

Samples taken of the best grade of ore, as exposed in various open-cuts across the apparent strike of the ore-body, ran as follows: Gold, trace; silver, 33.4 oz.; lead, 57.4 per cent.; zinc, 4.8 per cent. A grab sample from a small pile of iron pyrites from the tunnel ran: Gold, trace; silver, 0.8 oz.; zinc, 4.8 per cent.

Work on the property was suspended for the winter months, but it is understood that the company is very well satisfied with the results obtained by the work done during the year, and that operations will be continued in the spring.

Bunyan Group.

This property is situated at a distance of 7 miles from Invermere, at the head of Goldie creek, and is easily accessible by a good wagon-road. During the year it was bonded by the original owners, W. W. Taynton, J. H. Taynton, and associates, to E. J. Fader, and work was started in the fall. On the shoulder of a bluff which rises some 300 feet above the upper bench-lands of the Columbia several outcrops of copper-stained schist and barytes are exposed in shallow open-cuts. In order to develop this surface showing a 60-foot tunnel was driven into the face of the bluff, gaining barely 30 feet in depth. The tunnel crosscuts a schist formation, shot with stringers and lens-like inclusions of barytes; at 60 feet in a drift was run under the surface showing and an irregular-shaped body of ore was struck. This has been stoped to a height of 15 feet above the floor of the drift.



The roof of the stope represented approximately an area of 6 by 14 feet, and from this a sample was chipped at random from a number of different places, the result being as follows: Gold, trace; silver, 2.8 oz.; copper, 3.58 per cent. The ore here consists of disseminated grey-copper in a finely brecciated ground-mass, consisting of small fragments of country-rock cemented together with silica and barytes. The formation has a strike of N. 25° W. and dips into the hill at an angle of 45° to the south-west.

Captain Fader conceived the rather unique idea that the most economical way in which to mine the ore would be to blow off the shoulder of the bluff with one big blast. The blast had the effect of badly mixing up the ore and waste, so that sorting was made extremely difficult and the resulting product was very low grade.

Paradise Mine, Windermere M.D.

Millie Mack Mine, Arrow Lake M.D.

Surface improvements include additions to the bunk-house, a 600-foot 2-bucket tramway, and ore-bins. Two car-loads of ore was hauled to the railway by 6-ton Packard motor-trucks.

It is reported that shipments have been suspended and that future development will be principally confined to the driving of a lower crosscut at a point 100 feet below the present workings.

Nip & Tuck.

This property, comprising two claims—the *Nip & Tuck* and the *Silver Tip*—is situated at an altitude of 8,900 feet above sea-level. The mine cabin, having accommodation for four men, stands on a barren hillside at a short distance from the workings. A road formerly built to the *Ptarmigan* mine camp ends within about a mile of the workings, and for this latter distance there is a good rawhide trail. The total distance from the railway is approximately 28 miles. Operations are being carried on by a syndicate under the terms of a lease and bond. R. H. Perry had charge of the work.

The formation, consisting principally of limestone, has apparently been tilted vertical, forming a rugged and jagged peak, the easterly shoulder of which joins the glacier-covered summit of the divide between Slade and Law creeks. The workings are situated on the westerly side of this peak in the face of a precipitous bluff.

Snow prevented an examination of the surface showings, but the vein is said to be traceable to the glacier, near which good ore is exposed on the surface. Ore also outcrops near the summit of the peak, where 140 sackfuls had been extracted from shallow surface diggings. In order to handle this a wire had been strung to the portal of the lower tunnel, from whence it was planned to string another wire to the main trail in the basin below.

Work was being confined to driving an adit on the lead, which had previously been prospected by two short tunnels, 20 and 30 feet respectively higher up the hill. Snow and ice prevented an examination of these workings, so all that could be seen was the lowest tunnel then being driven. It was in 68 feet and had a direction of S. 35° E. The ground was frozen within a few feet of the face and the sides and roof were covered with frost crystals.

At the face ore was beginning to make its appearance, and a sample taken across 12 inches gave the following results: Gold, 0.02 oz.; silver, 25.8 oz.; lead, 8.8 per cent.; zinc, 0.7 per cent. A grab sample from a few sacks of ore taken from one of the upper tunnels ran: Gold, 0.02 oz.; silver, 74.1 oz.; lead, 44.7 per cent.; zinc, 1 per cent.

The group is located on the continuation of a well-mineralized zone extending from the *Ptarmigan* in a south-easterly direction. There are many difficulties to contend with, to say nothing of the hardships to be endured in mining at this altitude, and it is to be hoped the efforts will be fully justified by the results of the work now being done.

Iron Cap.

This property, situated at an elevation of 9,000 feet, lies between the *Ptarmigan* and the *Nip & Tuck*. Many years ago a considerable amount of tunnelling was done, presumably to develop ore exposed near the portal of the upper tunnel and the ground underlying an iron-stained capping. This work principally consisted of three tunnels driven from the surface at vertical intervals of 100 feet. The lowest is in about 350 feet, the next about 200 feet, and the uppermost 400 feet. Near the portal of this latter tunnel a small lens of ore was encountered having a north-westerly trend and a dip apparently to the south-west. At a distance of a few feet in a 60-foot winze was sunk, from which ore is said to have been extracted. This is now full of ice. Past the winze there is no evidence of a vein and no ore has been developed.

The ore is galena, with which is associated a large percentage of iron oxide and a little zinc-blende. A sample over a width of 3 feet ran: Gold, trace; silver, 24.3 oz.; lead, 17.3 per cent.; zinc, 0.6 per cent. The ore probably owes its occurrence to the replacement of limestone in a sheared zone along a line of faulting.

It is doubtful from the development whether those who previously operated the property ever understood the nature of the deposits encountered in this formation, for the exploratory work does not seem to have been guided by good judgment.

During the season J. L. McKay and G. Larrabee did some work at the upper tunnel under a lease, and also extracted some ore from a near-by claim called the *Hell Diver*.

Ptarmigan.

This property, which was visited in 1903 by W. Fleet Robertson, the Provincial Mineralogist, is fully described in his report for that year. Information regarding the workings and the value of the ore mined might be obtained from E. J. Scovil, of Golden, who is agent for the owner. The property was visited by the writer, but could not be properly examined, as the tunnels were nearly filled with ice; access

was, however, gained to the lower level by crawling over 150 feet of ice, which almost completely filled the tunnel. When once inside the workings were found to be dry and in first-class condition; even the equipment, consisting of mine-track, air-pipe line, ventilating-pipe, ore-car, and small air-hoist, was in a good state of repair.

A lot of tunnelling has been done, which conveys the impression that there was a lack of systematic development. It would appear that the mountain has been cut transversely by a fault having a south-easterly trend, along which shearing has taken place; in this sheared zone ore has been deposited in small fissures and as irregular-shaped bodies replacing the limestone. The logical way to explore this ground would seemingly be to drift in the direction of the fault-strike and crosscut at intervals. The dump from this level is large, but by far the greater bulk is of waste material, although there may be 700 to 1,000 tons which might be worth careful sampling should the property be reopened. A grab sample from the surface of this portion of the dump ran: Gold, 0.02 oz.; silver, 15.3 oz.

Early in the year about 250 tons was hauled from the lower terminal of the tramway and shipped to Trail. The principal values were in silver, which averaged about 25 oz. a ton. This was second-grade ore sent over the tram and dumped outside the bin. There is about one car-load remaining. The bunk-house at the mine and the buildings at the compressor plant were in a good state of repair.

Tatler Group. This group, owned by R. S. Gallop, comprises twelve claims and is situated at the head of the South fork of Horsethief creek at a distance of approximately 40 miles from the railway at Athalmer. To reach the property the Horsethief road is followed from Wilmer and for the first 20 miles is in good condition; past this point the remaining 4 miles of road is only just passable for a wagon. The remaining 12 miles is covered by a trail, and the mine cabin is finally reached at an elevation of 7,200 feet. In spite of the distance the trip is an easy one, for there is no hard climbing, the valley-grades being gradual.

It is difficult to imagine more beautiful scenic surroundings than those passed through on the way to this property. The magnificent waterfalls, high rugged peaks, glaciers, and the park-like valleys are most impressive. In places on the main creek wide areas of the valley-floor have been covered with alluvial soil. The land so formed appears to be very fertile, judging by the crop of grass in evidence. It is free from timber and a large percentage of it would appear to be arable.

Rock-exposures noted on the way indicated the formation to be composed largely of argillites, limestones, quartzites, and schists. A quartz agglomerate similar to that on Slade creek near the *Trojan* was noticed exposed on the Horsethief Creek road.

One of the most striking geological features is the occurrence of a large mass of intrusive granite, which forms a high mountain on the north side of the creek at a point about opposite the confluence of McDonald creek. A dyke from this batholith invades the sedimentary rocks on the south side of the creek, but does not appear to extend for any great distance. The country around the marginal contact of this intrusive mass should receive close attention from the prospector.

For many years R. S. Gallop has been doing exploratory work on a number of copper-showings exposed on the higher altitudes of the mountain which forms the divide between the headwaters of the south fork of Horsethief and Jumbo creeks. His efforts have largely been confined to surface diggings, with the ultimate object in view of being able to show up enough ore to justify the development of the property on an extensive scale by some large company. Having only limited capital, and being further handicapped by the shortness of the season at the high altitude, the work has necessarily been slow and laborious; still, a considerable amount of open-cutting, trenching, and tunnelling has been accomplished.

The formation of the mountain consists of beds of limestone, slate, sandy shales, and quartzites; the structure is anticlinal, the top of the arch forming the summit of the mountain. The action of erosion, due to frost and glacial ice, has left the summit and the upper slopes covered with a thick layer of slabs of shale, limestone, and angular fragments of quartzite, which have greatly added to the difficulties of tracing the continuity of the various showings.

The folding of the strata has apparently been responsible for the formation of small vertical fissures, the more pronounced of which are quartz-filled and mineralized with chalcopyrite, iron pyrites, and a little grey-copper. Although these fissures, which have been prospected

on the lower slope of the mountain, can be traced for a considerable distance, they are narrow and, taken individually, do not give promise of any large tonnage. Higher up the mountain numerous surface diggings have uncovered ore of varying grades and quantity.

At an altitude of 8,900 feet a strong showing of ore has been uncovered. Here a deep open-cut exposes a face 8 feet wide and about 20 feet long. Although it is difficult to arrive at the exact nature of this deposit on account of the adjacent rock-surfaces being completely covered with loose material, it appeared to be in the form of a bedded fissure, having a north-westerly strike and a dip of 25° to the north-east. Other exposures around the contour of the hill would sustain this theory.

From this cut some 20 tons of ore has been extracted. A grab sample from the ore pile assayed as follows: Gold, trace; silver, 10.2 oz.; copper, 4.5 per cent. The ore carries the bright-blue stain of azurite along the fractured surfaces. This was the strongest showing seen by the writer, and at this point further work seemed advisable in order to uncover the vein and to demonstrate the extent and character of the deposit.

Farther up the mountain, approaching the summit, a number of scattered diggings expose copper indications and a little ore, but enough work has not been done here to prove the existence of any well-defined ore-body or to enable one to establish a connection between the various workings. A sample of ore from one of these showings ran: Gold, trace; silver, 6.8 oz.; copper, 3 per cent. From the summit, which is covered with glacial ice, an excellent panorama can be obtained of the surrounding country, the elevation being 9,300 feet.

At present work is being confined to driving a tunnel into the face of a bluff situated a short distance from the cabin and at an elevation of about 7,500 feet. This tunnel is being driven to develop a vertical quartz-filled fissure which is distinctly outlined in the bluff. At a short distance above the tunnel this vein has a width of 15 inches and is mineralized with chalcopyrite and iron pyrites. A sample of this ore ran: Gold, a trace; silver, a trace; copper, 2.3 per cent. While a sample across a streak in the tunnel ran: Gold, trace; silver, 13.8 oz.; copper, 3.6 per cent.

In order to mine ore of this character at so great a distance from transportation a large tonnage is essential, and in the writer's opinion future efforts should be concentrated on the development of the largest and strongest showings. In the event of extensive mining operations being carried on, there are no serious obstacles to prevent the construction of a road at a suitable grade. There is plenty of mine-timber handy, while water-power is available at no great distance.

Lead Queen.—During the year the lower crosscut was continued and the vein tapped at an additional depth of 75 feet. The drift along the vein at this level is reported to have a nice showing of ore in either face. Work has been suspended for the winter, but, according to the manager's statement, will be continued next spring.

Isaac.—This property was acquired by Paul Denhart last year from H. E. Forster, of Wilmer. A shipment of 62 tons of silver-lead ore was made to Trail. It is recently reported that parties interested in the *Nip & Tuck* have acquired this property.

FORT STEELE MINING DIVISION.

This Division easily leads all others in tonnage produced for the year, and yet it has only three or four properties on the shipping-list. One of these properties—namely, the *Sullivan*—is responsible for the bulk of the production and is one of the greatest deposits of zinc-lead ore on the continent. It is interesting to note that previous to the operation of this property one of the largest producers of silver-lead ore the district has ever had was the *St. Eugene* at Moyie, which is situated at a distance of 32 miles in a south-easterly direction from the *Sullivan*.

The *North Star*, situated close by the *Sullivan*, is the only other large shipper at the present time.

The fact that such large deposits have been found to exist upon the development of ordinary surface showings tends to enhance the possibilities of prospects in adjoining areas where geological conditions are similar.

There are a great many prospects scattered throughout this Division, but in the majority of cases not enough work has been done to prove the persistency of the veins or the definite boundaries of the ore. It is gratifying to note that this year has witnessed increased outside interest in the Division, and general activity among the prospects has been more pronounced.

The Prospectors' Association, under the secretaryship of J. F. Hutchcroft, has been active in giving useful information and advice regarding various properties and best way to reach them.

Sullivan. Good progress has been made by the Consolidated Mining and Smelting Company, of Canada, Limited, in development and mining operations. The lower tunnel is now in over 8,000 feet, and is still being continued to strike the ore proved by the diamond-drilling done from the upper workings. A raise connecting the upper and lower workings has been completed. Labour was scarce during the summer and early fall. Shipments were curtailed during the first four months of the year owing to a strike called by the O.B.U. Shipments for the year 1920 were as follows: Zinc ore, 242,229 tons; lead ore, 13,214 tons; iron pyrites, 4,300 tons.

North Star.—This property, which is the second largest producer in the East Kootenay, has been operated steadily during the year and made shipments of about 6,600 tons of silver-lead ore, consisting principally of carbonates.

St. Eugene.—Situated at Moyie. This property has been operated since May 1st by the Consolidated Mining and Smelting Company, of Canada, Limited. The approximate tonnage produced is 700 tons of lead ore and 300 tons of zinc ore.

Society Girl.—Situated near Moyie. After many years of unproductive activity it is now reported that a nice shoot of silver-lead ore has been struck and a car-load shipped to Trail. It is to be hoped that this will mark the beginning of a period of prosperity for the owners, who have been so persistent in their endeavours to make a mine of the property.

Victor.—Situated on Maus creek near Fort Steele. Development has been actively pushed on this property and a 50-ton concentrator is now nearing completion. The ore is galena, with which is associated zinc-blende.

Placer-mining.—Placer-mining has been fairly active throughout this Division. On Wildhorse creek the Gamble Mining Company, which was operating a monitor on some virgin ground, had a successful run, which unfortunately was limited to a very short period owing to a break in the pipe-line and shortage of water. Improvements now made should allow them a full season's run next year.

The Wildhorse Dredging Company, which has also been operating on this creek, ceased operation for some time pending a reorganization of the company. It is reported that his has been accomplished and it is expected that the company will be operating next season.

On Perry creek A. J. Palmquist has completed the flume and installed monitors. A preliminary test is said to have yielded a nice return of fine gold.

Coal.—Robert Strachan, the Senior Inspector of Mines, reports that work has been steady throughout the Crowsnest coalfields, with the exception of a two-week strike in October at Coal Creek and Michel.

At Coal Creek and Michel the mines are all in good condition and no new developments have been made.

At Corbin work has been continued fairly steadily, the large portion of the coal coming from the Nos. 3 and 4 mines, while some preliminary work has been carried out at Nos. 5 and 6, which are new mines. During the greater part of the year labour has been scarce.

Indications of fresh developments in the Upper Elk coalfield have been in evidence during the past few months, a party having started to reopen the holdings of the Northern Coal Company, but owing to lack of labour the work was discontinued until next spring.

Federal Group. Located within a short distance of the Kootenay Central Railway and on Skookumchuck creek. When visited in May the group of claims were as follows: *Rob Roy*, *Eureka*, *Federal*, and *Victory*. The property is being operated by the Globe Mining Company, of Vancouver, which is capitalized at $250,000. D. A. McIntosh is president and W. H. Wooley secretary-treasurer.

The formation in which the deposit occurs is of sedimentary origin and schistose in character, due to a crushing and shearing produced by a thrust along a fault-plane, which latter is well defined at a short distance to the west of the tunnel-site. Copper was first found associated with oxide of iron in this sheared zone near the edge of the creek, and though the steep rocky bluff rises to a height of about 100 feet above this point, there is no apparent evidence of the continuation of the deposit in a vertical direction. At a short distance down the creek the stain of cobalt bloom is noticeable in the calcareous talus accumulated at the foot of the bluff.

A few feet above the creek a tunnel 75 feet in length has been driven into the bluff in a direction of S. 20° E. This tunnel does not reveal any ore of economic importance, except that of the original discovery near the portal. At a distance of 15 feet from the face a 2-compartment shaft had been sunk at some previous time to a depth of 22 feet. This shaft was full of water. At 10 feet from the portal the present company has sunk an incline winze, which at the time of examination was down 30 feet, the bottom being almost vertically below the edge of the creek-bed.

As far as could be ascertained, this winze followed a shoot or chimney of soft talcose material stained with limonite, the iron probably originating from an adjacent body of pyrrhotite. In this soft material native copper has been deposited in thin layers and groups of arborescent crystals, from which some beautiful specimens have been obtained. The copper thus formed is probably of secondary origin, having been precipitated from solution in percolating waters by the action of the iron oxide. The primary source of the ore possibly is not far distant. Near the bottom of the winze the ore shows a width of about 4 feet, but its extent can only be defined by further work.

The sheared zone apparently extends across the creek, where the opposite bank exhibits decomposed and iron-stained material. A sample taken across a width of 4 feet assayed as follows: Gold, trace; silver, trace; copper, 11 per cent. A grab sample from small dump ran: Gold, 0.04 oz.; silver 0.4 oz.; copper, 6.7 per cent.

Since the examination was made a short stretch of road has been built connecting the workings with the main road, and a compressor and pump have been installed.

Bull River Iron-Deposits.

Situated near the summit of Mount Fenwick at an elevation of 6,500 feet. The property comprises a group of seven Crown-granted claims and fractions covering an area of 375 acres. Access can be gained from the town of Bull River, on the Kootenay Central Railway, by wagon-road for 6 miles to the base of Mount Fenwick, and thence by trail which follows a fairly steep and uniform grade to the old cabin situated at an elevation of about 6,000 feet, or 4,000 feet above the railway. The circumstances under which the examination was made were not favourable. The trip was arranged to be taken with Mr. Fenwick, who is thoroughly familiar with the ground and the work which has been done. Unfortunately he was unable to accompany me at the last minute, and Archie Douglas, who acted as a guide to the property, did not have any knowledge of the extent or location of the various workings. So the following report will be confined to the general impressions gained by the writer and will not include a detailed description of the various workings and exposures.

Making an early start from the Douglas ranch, situated at about 2 miles from the base of the mountain, the old cabin was reached by noon, which only allowed a short time on the claims. The base of the mountain consists of sedimentary rocks of Cambrian age, including slates, shales, and quartzites; the upper portion of the mountain, including the summit, is capped with arcenaceous shales and dolomitic limestones, in which latter the ore-deposits occur.

This formation has a strike of N. 20° W. and a dip of about 30° to the east. Along the ridge of the summit at an elevation of 7,000 feet the exposed rock-surfaces are cracked and shattered, due to the action of erosion, conditions which are generally found at these altitudes. On the north-easterly side the mountain falls off abruptly, forming a series of steep jagged bluffs, down some 600 feet to a basin in which several small lakes can be seen.

The workings are mostly confined to the south-westerly side and are scattered over a large area, from the summit to 900 feet below. The hillside, covered with grass and underbrush, is sparsely timbered with small balsam and jack-pine, which would provide ample fuel for camp requirements.

Traversing the face of the bluff in a vertical direction, hæmatite-filled fissures can be distinctly seen. The fissuring has probably taken place along the line of fault-fractures. These fissures have a strike almost normal to that of the formation, and theoretically it would seem reasonable to assume that they formed the main channels for the mineral-bearing solutions which have replaced porous and more easily soluble bands of the country-rock. Hence, if this theory is correct, where the zone of fissuring crosses bands of easily replacable rocks the ore may be expected to spread out in the form of a bedded deposit, and as far as the writer was able to ascertain this is what has happened.

The old trails have become obliterated, and although travelling is easy, it is difficult for a stranger to locate all the numerous diggings, and the time available only allowed a cursory examination of those on the *Hematite* claim.

Varying thicknesses and grades of ore can be seen at nearly all the open-cuts which have been driven into the face of the hill, and by means of which the ore has been traced for a considerable distance. At one of the most easterly workings, there is exposed in the face of a cut a width of 10 feet of ore, which was the strongest and most promising-looking showing seen by the writer. A grab sample from a dump of about 30 tons ran as follows: Iron, 51.6 per cent.; phosphorus, trace; silica, 22.2 per cent.; sulphur, 0.68 per cent. The best grade of ore is a massive blue hæmatite, running about 68 per cent. metallic iron and 3 per cent. silica.

Further exploratory work would appear advisable, but just where and how this should be carried out can only be determined by an extensive examination and careful study of the geological conditions. This work should be done with the view of proving the existence of a sufficient body of ore of suitable grade to warrant the large expenditure which would be necessary to provide power and transportation facilities in order to carry on mining operations on a large scale. Abundant power is available at Bull River falls, at a distance of 3 miles, while the property is within a reasonable distance of the railway.

The development of a large body of hæmatite ore within a short distance of the Crowsnest coalfields would certainly prove a most valuable asset to British Columbia.

Achilles Group. Sometimes known as the *Evans* group owing to the fact that C. and W. Evans, of Marysville, have been actively engaged on the property for a number of years. It was reported on by J. D. Galloway in 1915 in the Minister of Mines' Report for that year. At the time that it was visited by the writer during the past season weather conditions unfortunately only allowed a hurried examination of the claims in Pollen basin, and prevented an examination of the showings on the other side of the ridge in what is known as the Kelly basin. Hence no further report will be made until the claims have been thoroughly examined. The following remarks regarding the accessibility to the property may be of use to those wishing to make the trip.

The claims are situated at a distance of approximately 22 miles from Marysville. Starting from Cranbrook, the camp can easily be reached in a day, as a good road follows up St. Mary river as far as Meacham's ranch at the west end of St. Mary lake; from here the river can be crossed on a log-jam, from which point a good trail leads to the cabin near Fiddler creek, a distance of about 6 miles. An alternative route is by trail for 10 miles from the easterly end of St. Mary lake. The elevation of the property ranges from about 6,000 to 7,000 feet, and on account of its altitude can be seen to best adantage from the latter part of July to about the middle of September.

Whitefish Group. This group, consisting of three claims, is owned by C. Hungerford Pollen. It is situated at a short distance above Whitefish creek and close to the trail leading to the *Achilles* group, at an elevation of 5,400 feet. The surface exposure consists of a strong outcrop of quartz mineralized with iron and copper sulphides and occurring in the face of a bluff composed of gabbro. A tunnel driven for 163 feet developed the vein for the first 35 feet in, at which point a 20-foot winze was sunk. In the side of this winze the ore shows a width of about 3 feet. It is authoritatively stated that ore shipped from here yielded about 6 per cent. copper and 6 oz. in silver.

Blue Peter Group. This group, consisting of four claims and a fraction, is owned by C. Hungerford Pollen and is situated near the head of Alki or John creek, at a distance of about 3 miles from the wagon-road. The cabin, which is in a good state of repair, is conveniently situated to the workings. At a short distance above the creek a 100-foot tunnel has been driven to develop a strong surface showing of iron-stained ledge-matter. In the tunnel the mineralization occurs as bunches and disseminations of iron and copper sulphides. The ore consists of chalcopyrite associated with pyrrhotite and iron pyrites in a siliceous gangue. The vein occurs in a diorite sill and has probably been formed along a fault-fracture, through which highly siliceous mineral-bearing solutions have circulated, filling the interstices and replacing the country-rock.

A grab sample from the surface of a small dump ran: Gold, trace; silver, trace; copper, 2 per cent. No doubt much higher values could be obtained by careful sorting. A lower tunnel was started, but abandoned before it penetrated the surface wash.

Mystery. This property was visited on the way down the creek, but, as it was beginning to get dark, time only allowed a hurried inspection of the tunnel, which has been driven into the hillside for a distance of about 180 feet. From what could be seen the ore occurrence is similar to that at the last-mentioned property. Iron and copper sulphides occur associated with quartz and filling the interstices of the country-rock adjacent to the vein.

A grab sample from the surface of the dump, roughly estimated to contain 250 tons, ran: Gold, trace; silver, trace; copper, 6.8 per cent. There is said to be a series of veins which have been prospected by other workings.

WEST KOOTENAY DISTRICT.

AINSWORTH MINING DIVISION.

NEAR AINSWORTH.

Florence.—Under the management of H. Hewer, this mine has been worked continuously during the year, although, in common with other properties, operations were somewhat curtailed owing to scarcity of labour. An average crew of forty-five men was employed.

No. 1.—Operated by the Consolidated Mining and Smelting Company of Canada, Limited. Shipments for the year amount to 700 tons. The property has recently been leased to Thos. Hawes and associates.

Highland.—Operated by the Consolidated Mining and Smelting Company. The mine was closed down in March. Some 200 tons of silver-lead ore was shipped to Trail.

Spokane-Trinket was steadily operated during the year under the management of J. McDougal. Approximate tonnage shipped, 450 tons.

Krao.—Some exceptionally high-grade silver ore was shipped from this property. The total production for the year was approximately 125 tons.

Ruth.—Work was continued by W. A. Smith and associates on the old tailings-dump, from which they have shipped about 250 tons.

Other properties which have made small shipments are *Twin* lease, *Tariff*, *Maestro*, *Little Phil*, and *United*.

Skyline. This well-known property, belonging to A. W. McCune, comprises the following claims: *Skyline*, *Perhaps*, and *Morning Star*. It is situated at an elevation of 5,000 feet and at a distance of 6 miles from Ainsworth. It was worked in the early nineties, the ore being shipped partly to the Pilot Bay smelter and partly to American smelters.

An extract from the Provincial Mineralogist's report of 1896 is as follows: "The smelter returns from seventy-four lots or over 2,000 tons in 1895-96 assayed from 35 to 149 oz. in silver, or an average of 54 oz. a ton, and less than 5 per cent. lead, and of the large amount shipped during 1896 the silver varied from 51.5 to 74.5 oz. of silver a ton, or an average of 58 oz. a ton." The mine is reported to have been closed down in 1896. The report further states that the workings then included an incline 87 feet deep, sunk on the lead, and a shaft farther to the west 200 feet deep, from the bottom of which a drift 120 feet in length and an upraise 40 feet led to the incline and the stopes. The writer has not been able to find any record of more work being done until 1917, when A. W. McCune decided to drive a long crosscut to tap the vein about 450 feet below the surface at the old workings. Up-to-date buildings were erected, including a roomy bunk-house, cook-house, stables, and blacksmith-shop.

The crosscut was driven and the vein was encountered at a distance of approximately 1,200 feet from the portal. The formation in the tunnel consists of bands of siliceous limestones and crushed slates of the Slocan series. The vein, or what is taken for the vertical extension of the vein, is a fractured zone consisting of crushed country-rock, being more or less cemented with calcite and silica. This has been drifted on for some distance, but only small values have so far been encountered. The crosscut extends past this zone, but there are no further indications of vein-matter. The work was abandoned in 1918, when pipe-lines, track, ties, and, in fact, everything that was movable was taken away.

The upper workings are mostly caved in and it was only possible to get a little way down the old incline shaft. Here small sections of the ground which had not been stoped showed a similar structure to that in the low tunnel, except that the rock was more decomposed owing

to processes of oxidation, and in places it was well mineralized with impregnations of the ore-minerals. The richest ore, being disseminated galena and grey-copper in a quartz gangue, is characterized by bright blue and green stains on the fractured surfaces. A sample across a 1-foot streak of ore of this character taken in the incline shaft ran: Gold, 0.01 oz.; silver, 364.2 oz.; lead, 12.5 per cent.; zinc, 3.5 per cent.

The following is an extract from the report of R. G. McConnell, of the Geological Survey, made in 1895: "The deposits appear to occupy fractured zones of considerable but unknown width, traversing the limestones and slates in nearly a north-and-south direction and dipping to the west. The zones have been silicified and impregnated with ore in a selective manner by ascending solutions. The ore occurs in flattened ore-bodies, occasionally 10 or 12 feet in thickness, which, in the case of the *Skyline*, according to Scott MacDonald, the manager, often cross nearly horizontally from the foot-wall to the hanging-wall." From the above it is reasonable to conclude that further ore-bodies may be expected in the fractured zone, and that exploration from the lower tunnel in a vertical direction is advisable.

The property is now being worked under lease and bond by R. Sheridan, E. Mathews, M. Hamilton, and J. Sime, who during the season have confined their attention to mining ore from the surface and from the upper part of the old workings, from which they have shipped about 150 tons.

During the winter, work is being pushed on a 2-compartment upraise from the lower tunnel to connect with the old workings. This was started on October 12th, and on January 8th it was reported to be up 160 feet.

RIONDEL CAMP.

Bluebell. Mining operations during the summer months were largely confined to mining ore from the glory-hole and surface of the hillside. In this connection it is peculiar that in the early history of the property much oxidized ore lying at and near the surface was overlooked, when it could have been used to good advantage at the old Pilot Bay smelter. S. S. Fowler has been able to ship large tonnages of this material at a time when the ore from the lower levels was unobtainable on account of water. In order to cope with the water in the lower levels additional pumping plant has been installed, and it is reported that satisfactory progress has been made towards unwatering this part of the mine. This year's output exceeds considerably that of 1919.

Tam O'Shanter.—A little work has been done on this property and a shipment of 56 tons made to Trail.

Kirby Group. This property, consisting of a group of six claims, was staked by A. J. Curle, of Kaslo, in the spring of 1919. It is situated within a quarter of a mile from Kootenay lake and at a short distance in a north-easterly direction from the old *Bluebell* mine. The surface of the hillside, which has a gentle slope towards the lake, is well covered with overburden and a growth of small timber, conditions which add to the difficulties of prospecting.

The formation, consisting of dark schists, quartzites, and highly metamorphosed limestones, has been intruded by dykes of rocks. In the immediate vicinity of the outcrop few rock-exposures are visible, while the topographical features do not allow any appreciable depth in the prospecting-tunnels, although good backs could be obtained should conditions warrant the driving of a long crosscut. The vein as exposed in a 55-foot crosscut shows a width of 10 feet of sparsely mineralized quartz, with a narrow band of ore on the hanging-wall side and small bunches and stringers of galena on the foot-wall. It has a strike of north and south, a dip of 35° to the west, and occurs as a bedded fissure. On the foot-wall side the vein has been drifted on for about 70 feet, while farther up the hillside ground-sluicing has uncovered several stringers of ore and indications of mineralization.

The ore is galena, with which is associated zinc-blende and spathic iron in varying quantities. Some very high silver values have been obtained from small seams carrying ruby-silver. The general run of the ore carries good average values in silver and lead, but on account of its high zinc-tenure would have to be carefully sorted before shipment.

The preliminary work done by A. J. Curle and his partner, R. Guthrie, has of necessity been confined to shallow workings, and the property has now reached the stage where expenditure on a somewhat larger scale will be necessary to carry on further exploitation.

Gwennie and Phyllis. These claims were staked by B. L. Eastman and R. D. Hearn, of Riondel, in 1919. They are situated on the hillside to the east of the *Bluebell* mine and at an altitude of 500 feet above Kootenay lake. Many years ago prospecting-work had been done on them, consisting of a shallow shaft sunk on the vein and some open-cutting. This shaft is now full of water, but an open-cut 30 feet long which exposes the vein for this distance shows it to have a width of about 3 feet and to be mineralized with bunches and streaks of galena and zinc-blende in a quartz gangue. A tunnel has been driven at 55 feet below this showing, but at the time of examination it still had some 30 feet to go in order to get under the surface exposure.

The vein, which has a strike of east and west and a dip of 60° to the north, occurs along the contact of a dark fine-grained dyke-rock and quartzite. The ore is a mixture of galena, zinc-blende, and iron pyrites; the clean galena carries up to 60 oz. in silver, but unfortunately careful sorting and cobbing of the ore would be necessary to obtain a shipping product.

DUNCAN RIVER DISTRICT.*

Bonaventure Group.—Situated near Howser lake. This property has been worked during the year by the owners, LeBlanc & Senff, who have been busily engaged in driving a crosscut to tap the vein at depth.

Dary Group. This group consists of the *Dary* and *Dismuth* claims, owned by Mrs. I. Tapanila, of Kaslo. The workings are situated at an altitude of about 5,100 feet (aneroid) on the northern side of Bear creek, which flows westerly into the Duncan river at a point about three-quarters of a mile north of Healy Landing. In a direct line the workings are about 1 mile from the river, but the existing trail is probably about 3 miles in length.

The geological formation of this area embraces quartzites, limestones, argillites, and grey schists, classified as the Duncan series. Galena occurs in small shoots in a quartz vein the strike and dip of which appear to conform to that of the enclosing schists.

The old workings consist of an incline shaft on the *Dary* claim about 70 feet down on the dip of the vein (43° to N. 50° E.), near the bottom of which there is a 12-foot crosscut, and an incline shaft about 30 feet down on the vein on the *Dismuth* claim.

The vein varies in width from 10 inches to 4 feet, is well defined, and can be traced down and between the shafts, which are about 300 feet apart horizontally. A sample across 10 inches in the *Dary* shaft gave: Gold, a trace; silver, 40.6 oz.; lead, 14 per cent.; zinc, 4.4. per cent. A sample across 4 feet in the *Dismuth* shaft gave: Gold, a trace; silver, 14 oz.; lead, 7 per cent.; zinc, 1 per cent.

At the time of the writer's visit in June the *Dary* shaft was being unwatered and preparations were being made to continue development by H. Tapanila and two men employed by him. A windlass, Sibley ventilating outfit, and blacksmith-shop had been installed, and a new cabin had been erected recently to replace the one burned in a forest fire some years ago.

Bannockburn Group.—Situated on Hall creek. Alex. Smith, the owner, has had a few men employed at development-work.

Old Gold.—Situated at the head of a tributary to the West fork of the Duncan river. This property has been worked in a small way for many years, and some high-grade silver-lead ore has been packed out over the divide to Ferguson, a distance of 13 miles. During the present season a few men were employed.

RETALLACK.

Whitewater.—Mining operations were carried on principally by leasers, and a number of men were employed at winning ore from the old workings. Reports on hand show that 600 tons of ore was shipped, averaging: Silver, 80 oz.; lead, 27 per cent.; and 164 tons averaging: Silver, 15 oz.; zinc, 50 per cent.

Charleston Group.—This group was acquired by the Keystone Development Company from the original owner, A. J. Harris, who is in charge of the development. The claims are located near the *Whitewater* mine.

Meacher Group.—Situated at the head of Whitewater creek. The owner, Michael Wargo, put in a season's work at the property.

Wellington.—The Standard Silver Lead Mining Company put a crew of men to work at cleaning out the old workings, preparatory to making a thorough examination of the mine with a view to doing further development-work.

Mitford Group.—Situated on Goat creek. Recently bonded by A. J. Harris to the Mitford Mine Units Company, of Spokane. A few men have been employed at drifting on the vein below the old workings.

Fletcher Group.—Situated on Lyle creek and owned by A. H. Watkins. The old *Ibex* trail was reopened in view of proposed development. According to recent reports, a consolidation of the *Phoenix* and *Fletcher* groups has been effected and the properties bonded to Spokane interests.

Lincoln.—The development of this property has been continued by J. H. Thompson, of New Denver.

Helen Group.—Further work has been done on the property by the English Bros. and a new trail to Blaylock is being constructed.

Utica.—During the early part of the year this property was worked under lease by A. J. Poyntz and associates. A very rich shoot of ore was encountered in the old workings, the high silver values being in grey-copper and native silver. The leasers are said to have done exceedingly well.

South Fork of Kaslo Creek.

Silver Bell.—Mining and development work has been steadily carried on during the year and some 220 tons of high-grade silver ore shipped to Trail.

Silver Bear.—This property adjoins the *Silver Bell.* It was acquired during the year by M. S. Davys and associates. The season's work is reported to have been satisfactory and a small tonnage of high-grade ore has been shipped.

Index.—The long crosscut has been continued and other development-work carried on. A small shipment was made to Trail.

Revenue.

This property was recently bonded by E. J. Edwards, O. McDougal, and S. A. Williams from L. McLean and associates, of Kaslo. To reach the claims the wagon-road up the South fork of Kaslo creek is followed for a distance of about 10 miles from Zwicky. From a point near the end of the road a trail leads up the mountain-side for about 2 miles, and the mine cabin is reached after a climb of about 2,000 feet, making a total elevation above sea-level of 6,375 feet.

The formation is of granite and the vein occurs as quartz-filling in a fault-fissure, along which there is evidence of much movement; some of the wall-rock having a beautiful natural polish. The vein, which has a width of about 3 feet, shows marked persistency. It has a dip of 80° to the west and strikes in a northerly direction into the hillside, the slope of which, being about 40°, affords good depth with little drifting. The metallic contents are principally galena, zinc-blende, and iron pyrites, the gangue being quartz. A fairly clean shipping product can be obtained by sorting.

The vein has been developed by three tunnels. Time did not allow a survey of the workings, but the following measurements are sufficiently accurate to give an idea of what has been accomplished:—

No. 1 level has been driven for 180 feet on the vein and ore was underhand-stoped from a point near the portal. A sample across a width of 26 inches near the floor of the drift assayed as follows: Gold, 0.02 oz.; silver, 61.8 oz.; lead, 23.5 per cent.; zinc, 9 per cent.

The No. 2 level has been driven for a distance of 220 feet and gains an additional depth of 60 feet on the vein. Ore was also encountered in this level and a raise was driven to the No. 1.

The No. 3 level has been driven at a vertical depth of 200 feet below the No. 2 and is in 150 feet. Ore was encountered at about 100 feet from the portal and was raised on for 20 feet. Across the roof it shows a width of 8 to 12 inches. A sample across 8 inches ran: Gold, 0.02 oz.; silver, 61.8 oz.; lead, 12 per cent.; zinc, 14.5 per cent. The average value of 50.9 tons shipped during 1913 and 1916 was: Silver, 74.6 oz.; lead, 49.8 per cent.; zinc, 7.97 per cent.

At a distance of about 300 feet in a westerly direction there is evidence of another vein, but as yet very little exploratory work has been done on it. A sample taken across 6 inches at the face of an open-cut gave the following returns: Gold, 0.02 oz.; silver, 25 oz.; lead, 17.5 per cent.; zinc, 3.5 per cent.

The trail to the property was improved and a small crew of men was put to work during the summer.

Gold Cure Group.—Recently acquired by the Marsh Mines and Development Company, of Kaslo. A small crew was employed at the property this summer.

Black Bear.* This mineral claim is owned by Charles Sampson, of Kaslo, and O. B. Gerard, of Toronto, and was recently bonded by A. H. and T. H. Hansen, of Kaslo. The property is situated at an altitude of about 3,650 feet on the northern side of the South fork of Kaslo creek, about 400 feet vertically above the creek, and is easily accessible by a short trail from a point on the South Fork wagon-road about 8½ miles from Kaslo.

The ore is found in shoots in a quartz vein which occurs in the rocks of the Slocan series, the strike and dip of the vein appearing to conform to that of the enclosing schists. The ore consists of galena and iron pyrites in a quartz gangue. The old workings consist of a shaft about 35 feet down on the dip of the vein, which is 67° to N. 65° E., and a short crosscut tunnel below the shaft, which was being driven to intersect the vein and an open-cut about 50 feet north-easterly from the shaft and 20 feet vertically above it.

The width of the vein in the shaft varies from 12 inches at the surface to about 19 inches near the bottom, but water at the bottom of the shaft prevented an inspection of the face. The shaft appears to be in ore for about 30 feet from the surface. There was said to be a showing of ore in the open-cut, but this was inaccessible owing to a cave-in of the bank above. A sample across 19 inches near the bottom of the shaft gave: Gold, 0.08 oz.; silver, 5.3 oz.; lead, 15 per cent.; zinc, 3.6 per cent. A grab sample from a small pile of sorted ore gave: Gold, 0.02 oz.; silver, 25.5 oz.; lead, 56 per cent.; zinc, 2 per cent.

At the time of the writer's visit in June the work done by the Hansen Bros. consisted in putting the old workings in shape to continue development.

POPLAR.

Bullock Group. This property, consisting of three claims and a fraction, is situated at an elevation of 1,200 feet above the railway and at a distance of about 3 miles from Poplar. The claims are easily accessible by trail from the railway-track. The group was acquired by the Bullock Gold Mines, Limited, in 1919. The formation, generally speaking, consists of highly metamorphosed rocks, schistose in character and mineralized in certain zones with pyrite and arsenopyrite. The schists are rich in iron sulphides and evidently carry gold in appreciable quantities, as good results have been obtained in some places by panning the decomposed and oxidized material from the surface, and it is possible that if a big enough body of this material is discovered it could be mined and treated at a profit.

In this formation quartz veins and veinlets are of common occurrence, some cutting the formation and others following the schistosity of the enclosing rocks. The latter type show persistency along the outcrop, but their continuity with depth in this particular locality has not yet been demonstrated. They do not appear to be of the fissure type, but possibly owe their origin to segregation of quartz in the highly siliceous phases of the enclosing schists. The vein-filling is usually milky white quartz, although smoky quartz is sometimes encountered.

A good deal of prospecting and development work has been done on these veins in the vicinity of Poplar since the discovery of some exceptionally rich pockets of gold quartz in 1903. The company's efforts have largely been confined to exploratory work on veins as above described, and small pockets and stringers of galena have been exposed.

The principal underground work consists of a 287-foot crosscut tunnel, driven at a vertical distance of 50 feet below the outcrop of the vein, on which an old shaft had been sunk. The bottom of this could not be examined on account of water, but at the top the quartz vein showed a width of about 28 inches to be heavily mineralized with iron sulphides, which are oxidized at the surface. A general sample of this oxidized material taken from a number of places along the outcrop ran: Gold, 0.40 oz.; silver, 1.2 oz.; copper, trace; lead, *nil;* arsenic, trace. The vein was not encountered in the tunnel, which lies a little to the north-west of the shaft.

Some samples taken near the shaft, which the manager had assayed, ran high in arsenic. As there seemed to be some doubt regarding the value of this, it may be well to mention that

the value of refined arsenic is quoted at from 12 to 15 cents a pound. In October the Tacoma smelter was paying about 2 cents a pound for 80 per cent. of the arsenic content.

During the season two excellent cabins, 16 by 20 feet each, were built and a good trail was constructed. Four or five men were employed at development-work.

Crowned King Group.—Situated near the Bullock Gold Mines' property. It is reported that this property has been purchased by C. Hanson, of Poplar, and W. H. Rhomberg. It is understood that a little work was done and good gold values are reported to have been recovered from some of the schist.

Mobb's Mine.—Situated near Poplar. Recent work has been confined to driving a crosscut to tap the vein at a vertical depth of about 200 feet below a showing of galena in an old shaft. The workings are within a short distance of the railway and less than 700 feet above the track.

Among others who have been mining and prospecting around this district are: J. McDonald, who has a property at Gold Hill; P. Kelly, who owns the *Telluride* group near Poplar; A. Hanson, who is interested in the *Rio Tinto* and other properties; Dick Roberts, who has been interested in claims on Canyon creek for many years; and Osten Foss, who has properties up the Duncan river.

SLOCAN MINING DIVISION.

As previously stated in this report, the strike called by the O.B.U., which took effect on May 1st, greatly curtailed the production and hampered the operations of the various mining companies. The Rosebery-Suprise Mining Company, which has been one of the leading producers during recent years, operated the *Bosun* and *Surprise* mines and the *Ivanhoe* and *Canadian* groups from the first of the year until May 1st, since which time they dropped their options on the two latter properties and have only done a small amount of development at the *Surprise*, where the No. 4 level is being advanced.

At the *Bosun* work was resumed in a small way on June 1st and has been gradually increased, the number of men employed at present being twenty-five. A raise connecting the No. 6 and No. 4 levels has been completed and a No. 5 level started from half-way up the raise. Drifting and stoping from this level have been carried on with good results. This ore will be treated at the company's mill at Rosebery, which has only been run intermittently during the season.

The production in 1920 was as follows: *Surprise*, 2,176 tons; *Bosun*, 2,395 tons; *Ivanhoe*, 45 tons; *Canadian* group, 105 tons.

Clarence Cunningham reports that little progress has been made since May 1st and does not look for any marked increase in activity at the various properties operated by him until the spring of 1921. The production of the *Queen Bess* and his other properties was: Crude ore, 939 tons; lead concentrates, 1,148 tons, zinc concentrates, 1,702 tons.

Silversmith Mines, Ltd. This company operated steadily during the year. The continuity of the large ore-body which was developed last year on the 1,000-foot level has been proven on the 500-foot, 800-foot, and 1,100-foot levels. In places the stope from the 800-foot level is between four and five sets wide. Shipments for the year 1920 exceeded 1,700 tons of silver-lead ore and concentrates.

Noble Five. Under the management of Paul Lincoln, work at this property during recent years has been confined to the development of the vein system at depth, connecting the lower with the upper workings by means of a 1,000-foot raise and establishing intermediate levels. The erection of a 100-ton concentrator was started in 1919 and completed during this summer. Other improvements include the erection of a modern bunk-house and buildings, which provide excellent accommodation for the men. Being short of men in the mine on account of the strike, the mill was started up on ore from one of the old dumps, and the first car-load of silver-lead concentrates was shipped to Trail in the fall.

Rambler-Cariboo.—This property was also hard hit by the strike, and consequently its production shows a marked decrease.

Carnation.—Situated near Sandon. Development-work was carried on under the management of G. W. Clarke, who had a few men employed until the strike closed down operations temporarily. The results so far obtained are said to be of a very satisfactory nature.

Payne.—It is reported that the Pacific Mines Development Company has taken a bond on the property, following an examination made by W. J. Elmendorf. It is understood that the preliminary work will be confined to the lowest level of the mine.

Among the numerous activities of leasers and small operators around Sandon the following have been reported: *Washington* and *Silver Reef* groups, worked by M. Monahan and partner and one car-load of ore shipped; *Last Chance*, worked under lease by R. Cunning and 26 tons of ore shipped; *Victoria*, worked by J. Worgan, the owner; *Cinderella*, worked by G. Dean; *Black Colt*, worked by Geo. Petty. Leasers have also been active in the old workings of the *Payne* and *Hope*.

Molly Hughes.—*Situated on Slocan lake near New Denver and owned by H. Clever.* Thirty-three tons of high-grade ore shipped to Trail.

Mowitch. This property was worked by Joe Beber and associates. It is situated at a distance of 6 miles from New Denver, the tunnel-sites being only a short distance above the new wagon-road to Three Forks. The vein is a small well-defined quartz-filled fissure in a massive slate formation. It has a strike of N. 35° W. and almost a vertical dip. It is developed by two adit-tunnels at a vertical distance of 80 feet apart. The ore is a "dry ore" carrying high values in silver. Thirty-four tons was shipped to Trail in 1920. This was transported by means of a wire cable stretched from the tunnel to bins by the railway.

Rosemarie Group. This group, adjoining the above-mentioned property, was also worked by Joe Beber. *The vein, which has a width of from 3 to 6 feet, cuts a slate formation.* The uppermost tunnel at which work was being done was driven on the vein for a distance of 40 feet. This tunnel gains little backs in this distance. Ore was encountered near the face. The ore is a fine-grained galena, with which is associated zinc-blende. A sample from a pile of several tons assayed as follows: Gold, trace; silver, 44 oz.; lead, 37 per cent.; zinc, 16 per cent. Below this work was also being done in an old tunnel from which a few tons of shipping-grade ore had been extracted. This tunnel could not be examined on account of powder-smoke.

California group, near New Denver, was worked under lease by W. Eccles and George Doyle.

Marion.—Alex. Ferguson, the owner, continued development-work.

LONDON RIDGE.

This ridge, rising to an elevation of 7,000 feet, forms the divide between Seaton creek and Kane creek. The ores from this locality, unlike the characteristic ores of the Slocan, are "dry ores," carrying high silver values and little, if any, lead. Many old locations were made over this area, from which high-grade ore has been extracted from time to time. Among those upon which recent work has been done and which are now being developed are the following:—

McAllister. This property, comprising a group of three Crown-granted claims and a fraction, was acquired by R. A. Grimes in 1919, who formed a company, the Slocan Silver Mines, Limited, with a capitalization of $250,000. Stock was subscribed for by a number of prominent business-men of the Prairie Provinces, and it is understood that ample funds are available for carrying out an extensive programme of development and for the erection of a mill when it is considered that sufficient ore has been blocked out.

The ore is a "dry ore," the principal value being in silver, which occurs as argentiferous grey-copper. The ore is disseminated throughout the white quartz of the vein, and although high-grade ore can be sorted from certain small enriched sections of the vein, the general run of the mine is clearly of milling grade. During the early history of the property the treatment of this class of ore no doubt presented a serious problem on account of the loss by sliming of the grey-copper, which would necessarily accompany crushing, and the concentration by water, but since the advent of the oil-flotation process this loss can be eliminated.

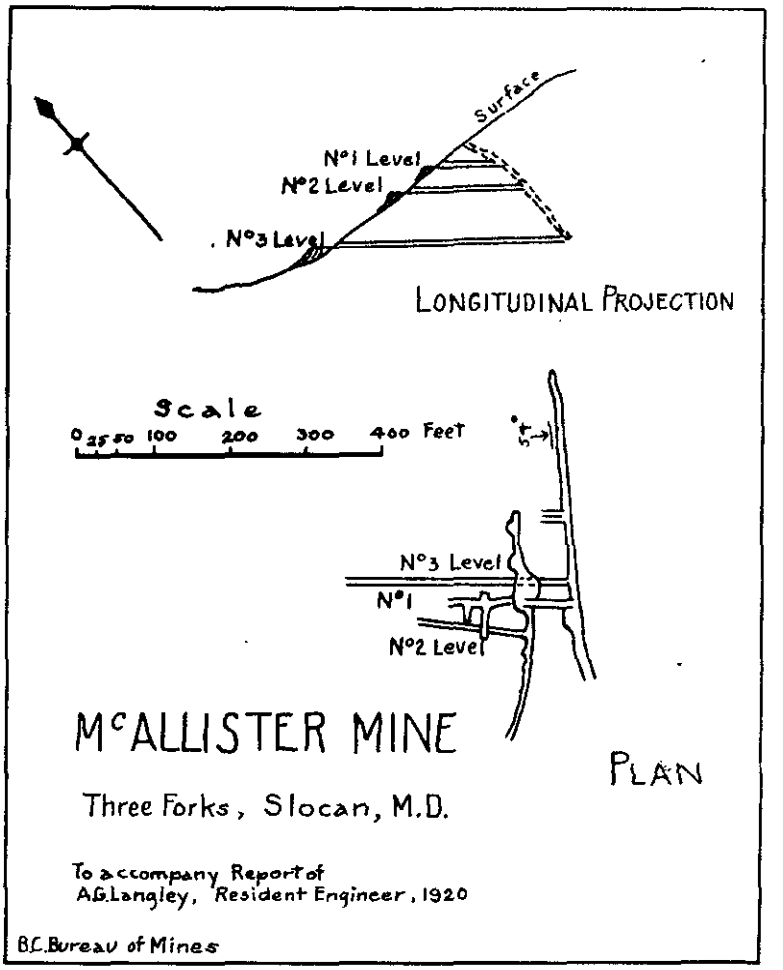
The work done by the present company has been principally confined to exploratory work on the surface and to the development of the vein on the lowest or No. 3 level by means of drifting in either direction and resting on the ore. No power being installed at the mine, all drilling is done by hand, which necessarily makes progress slow. During the year the strike called by the O.B.U. greatly hampered operations. On the No. 3 level the vein is strong and well defined, though at the northerly end of the drift faulted ground was encountered for a distance of about 40 feet, after which the vein was again picked up, and it is now reported that good ore is showing in the face of the drift.

The length of the ore-shoot and the average values of the ore which might be expected between the No. 2 and No. 3 levels can only be determined by systematic sampling, as the

occurrence of the metallic contents is inclined to be spotty and, to the eye, deceptive, for in places where there is little visible evidence of mineralization often good values are obtainable on assay.

Most of the ore has been stoped from the ground so far developed on the No. 2 level, and although the vein varies greatly in width, it apparently has an average of at least 2 feet, while the length of the ore-shoot is about 70 feet.

On the No. 3 level the vein shows a width of from 3 to 5 feet, and as practically no stoping has been done from this level there remains about a depth of about 85 feet of virgin ground on the dip of the vein between the two levels.



The ore-shoot above referred to seemingly has a rake to the north and near its southern extremity a raise connects the two levels. A sample taken near the bottom of the raise across 38 inches ran: Gold, trace; silver, 22.2 oz.; zinc, 1 per cent. A sample taken about half-way up the raise across a width of 40 inches ran: Gold, trace; silver, 37 oz.; and across 16 inches of crushed quartz above the top of the raise on No. 2 level ran: Gold, trace; silver, 14.2 oz. A grab sample of cobbed ore from the sorting-table ran: Gold, 0.04 oz.; silver, 335.2 oz.; zinc, 1.4 per cent.

Additional accommodation has been provided for the men, and it is understood that development-work will be carried on during the winter months.

Good progress was made on the Government wagon-road up Kane creek, which no doubt, will be of great benefit to this property and all others operating in this vicinity.

trips on the west coast of Vancouver island, but was unfortunately unable to do so after the work had been finished; consequently there is no detailed description of this work in the following report.

Dr. Victor Dolmage, of the Geological Survey of Canada, with his assistant, P. C. Emmons, made a reconnaissance of the geology along the coast-line and adjacent islands in the Clayoquot Mining Division during the past summer, the summary report of which will be published in the near future.

CENTRAL WEST COAST SECTION.

Ahousat Subsection.

Flores Island Coal.

On account of rumours of the discovery of a seam of coal on the south-west corner of Flores island near the entrance to Clayoquot sound, an examination of that section was made on August 10th and 11th last. The trip out was made by the Coast trail from the head of Matilda creek and the return trip by a trail crossing the interior of the island. Both of these trails were for the most part in bad condition; the distance by either is about 10 miles. By reason of the exposed coast on the west side of Flores island and the difficulty of landing except in extremely fine weather, when the sea is calm, one of the trail routes is usually taken by travellers.

Fitzpatrick's Land Lot No. 1565.—This land lot was taken up by Edward Fitzpatrick several years ago for ranching purposes and stocked with some cattle, chickens, and hogs. Later he claimed to have discovered a seam of coal and did some open-cut work in the bank of Cow creek, which flows into the sea about a quarter of a mile easterly from Fitzpatrick's cabin, which is situated about 2½ miles east of Raphael point, the extreme south-west corner of Flores island.

Geology.—The rock formation in the vicinity of Land Lot No 1565 is for the most part made up of granodiorite, but at low tide there is a well-defined narrow belt of light-coloured sandstone exposed, which has its line of strike towards the north-west and dips at varying angles towards the south-west, the angles of the dip being from 20° to 50°.

No outcroppings of coal indicating the occurrence of a seam of commercial value could be found by the writer, who was accompanied by Edward Fitzpatrick in his examination. The comparatively narrow belt of sandstone, apparently of the Cretaceous period, was thoroughly examined during extreme low tide, which at the time of the examination happened during the afternoon, thus affording every facility for a thorough examination.

Some very narrow seams of carbonaceous material were noted and sampled. An assay of the sample showed it to contain: Moisture, 0.7 per cent.; ash, 60 per cent.; volatile combustible matter and carbon, 39.3 per cent.

The sandstone-belt was traversed towards the west to a small bay locally known as Siwash bay, where there occurs a fairly extensive body of a dark-coloured sandstone dipping south-west 20° under the sea. This is overlain by a layer of dark-coloured conglomerate rock, much of which has been carried away by erosion. The conglomerate dips and strikes in conformity with the underlying sandstone. No indications of coal-outcroppings could be found, although this dark-coloured belt of sandstone was very thoroughly examined.

Mr. Fitzpatrick informed the writer that the place where he discovered an outcropping of a workable seam was in the bank of Cow creek, where he had done some prospecting-work some years previous, but that as the open-cut had caved there were no exposures of the coal-seam visible. However, Cow creek was examined, with the following results:—

The prevailing rock formation where it is exposed near the mouth of Cow creek is granodiorite, which farther up the creek is hidden by an undetermined thickness of a bluish-coloured glacial clay covered by a layer of gravel several feet thick. A shaft was being sunk in the gravel alongside the westerly bank of the creek for the purpose, as explained by Fitzpatrick, of continuing to sink through the gravel and clay in the expectation of finding coal underlying the clay. As this part of the formation occurs at a lower horizon in the series than the strata of sandstone already referred to, which is exposed about a quarter of a mile westerly from Cow creek, and dipping towards the south-west at an angle of about 55°, it appeared as though the work at the point where it was being done was a useless waste of energy.

Travelling up the creek about a mile, the geologic formation is that of a dark-blue slaty shale, dipping at an angle of 35° towards the south-west and apparently underlying the sandstone

Beatrice.

This property, consisting of the two claims—*Folsom* and *Edmond*—is situated at the head of Mohawk creek at an elevation of 7,000 feet. There is a good trail leading from Camborne to the mine cabins, the distance being 7 miles. Operations were started by the New Era Mines, Limited, of Vancouver, in the fall of 1919 and continued with a small crew of men until late in the present year, when work was suspended.

The formation consists of contorted schists and crushed carbonaceous slates. Except at the outcrop, there is no indication of a vein on the surface, and nothing much to guide one as to the direction of the possible continuity of ore, although the crushed zone extends in a north-easterly direction from the outcrop, which would appear to be the most favourable locality to do further exploratory work.

Ore was first discovered by two inexperienced prospectors. It outcropped as a small chimney of clean galena at the contact of the schists and crushed slate, and gradually lengthened out as depth was obtained. A 30-foot shaft was sunk on this ore, which was further developed by a 200-foot adit-tunnel, known as the No. 1 level.

Altogether some 300 tons of high-grade silver-lead ore was extracted from these workings, which only gained a total depth of 40 feet on the vein. As the topographical features were not favourable for obtaining increased depth by tunnelling from this side, the No. 2 level was driven from the opposite of the butte at a vertical depth of 150 feet below the No. 1 level. Here some 800 feet of tunnelling has been done, comprising a lot of unnecessary and useless work. However, the ore was eventually picked up, and latterly several nice showings have been exposed by H. E. Bodine, who was in charge of the work. In this connection it may be mentioned that the present company has principally confined its attention to cleaning out the old workings and developing the exposed ore-bodies.

The ore is massive, consisting of a finely crystalline mixture of galena and zinc-blende, fairly free from gangue material. It carries high silver values, but unfortunately is very zincky, even some of the most carefully sorted ore running as high as 25 to 30 per cent. zinc, which makes shipment to Trail prohibitive. The following samples were taken:—

Across a width of 2 feet exposed in the face of a 20-foot raise from No. 2 level: Gold, 0.06 oz.; silver, 69.8 oz.; lead, 16.1 per cent.; zinc, 31 per cent.

Sample across a 2-foot width of a small lens of ore exposed in the roof of a drift on No. 2 level: Gold, 0.03 oz.; silver, 29.8 oz.; lead, 7.2 per cent.; zinc, 16 per cent.

Sample across a width of 1 foot exposed along the roof of an intermediate level 50 feet above No. 2 level: Gold, 0.02 oz.; silver, 44.4 oz.; lead, 17 per cent.; zinc, 20 per cent.

Sample of sorted ore for shipment: Gold, 0.075 oz.; silver, 82.5 oz.; lead, 25 per cent.; zinc, 28 per cent.

It will be noticed from the above that in each case the percentage of zinc predominates over that of the lead.

The ore occurs in the crushed slates along and near a schist contact.

During the season a light 2-bucket tramway was installed to connect the No. 2 level with recently constructed bins on the main trail. Improvements were also made to the trail and everything was got in readiness to rawhide ore during the winter, but presumably the high zinc contents prevented satisfactory market arrangements being made.

At the *Berniere* group, which is situated near Camborne, preparations were made to provide accommodation and facilities for a small crew of men by J. A. Darragh, representing Eastern capitalists, who have recently bonded the property from C. Menhinick, the owner.

Geological survey work was done during the season in the Trout Lake and Lardeau Divisions by M. F. Bancroft and party, of the Canadian Geological Survey Department.

In the Trout Lake Division mining activities did not show any marked improvement over those of 1919.

From the *Nettie L.* a small tonnage was shipped by leasers.

S. Cavanaugh was working under a lease at the *Silver Cup*.

At the *Parrsboro*, which is situated near the latter property, the crosscut tunnel started in 1919 by two men, under contract, to tap the vein at depth reached its objective in the fall. There is reported to be a nice showing of ore at the intersection.

At the *Crescent*, which is situated near the head of 8-Mile creek, the development of the vein with depth is reported to have met with satisfactory results. M. Leahy, of Trout Lake, is in charge of the work.

Noble Five Concentrator, Sandon.

St. Mary Lake, Fort Steele M.D.

Mrs. Jowett, of Trout Lake, who, as usual, spent part of the summer prospecting in the hills, claims to have found some sperrylite (platinum arsenide).

NELSON MINING DIVISION.

The activity both by the larger mining companies and the small operators has shown a decided increase as compared with that of 1919. Should the results of the present developments come up to expectations, the output of the district for 1921 should show a decided increase, more especially in gold and silver.

Yankee Girl. Situated at Ymir. This property was acquired in 1911 by the Hobson Silver Lead Company and was operated continuously until 1918. In the spring of the present year the Canada Mining Corporation took it under option after an extensive examination had been made by their consulting engineer, A. W. Newberry. A systematic plan of development was laid out and a crew of men was put to work early in the year.

The record of the mine is good, as it has produced a large tonnage of shipping-ore, while a considerable quantity of milling grade has accumulated. According to figures submitted, the tonnage shipped in past years is as follows: Up to 1911, 8,060 tons; 1911 to 1913, 4,720 tons; 1913 to date, 10,905 tons; the total representing a gross value of $470,000 in gold and silver.

The present work being done by the Mining Corporation of Canada is to prove the continuity of the ore from the lowest level to the upper workings, and at the same time to explore new ground with the ultimate object in view of developing sufficient ore to warrant the erection of a concentrator.

The ore varies in character, though the great bulk of it carries high percentages of pyrite and pyrrhotite, with which are associated galena and zinc-blende in varying amounts. The average values of the above-mentioned shipments of 10,905 tons were submitted to be as follows: Gold, 0.70 oz.; silver, 3.34 oz.; lead, 1.44 per cent.; zinc, 5.50 per cent.

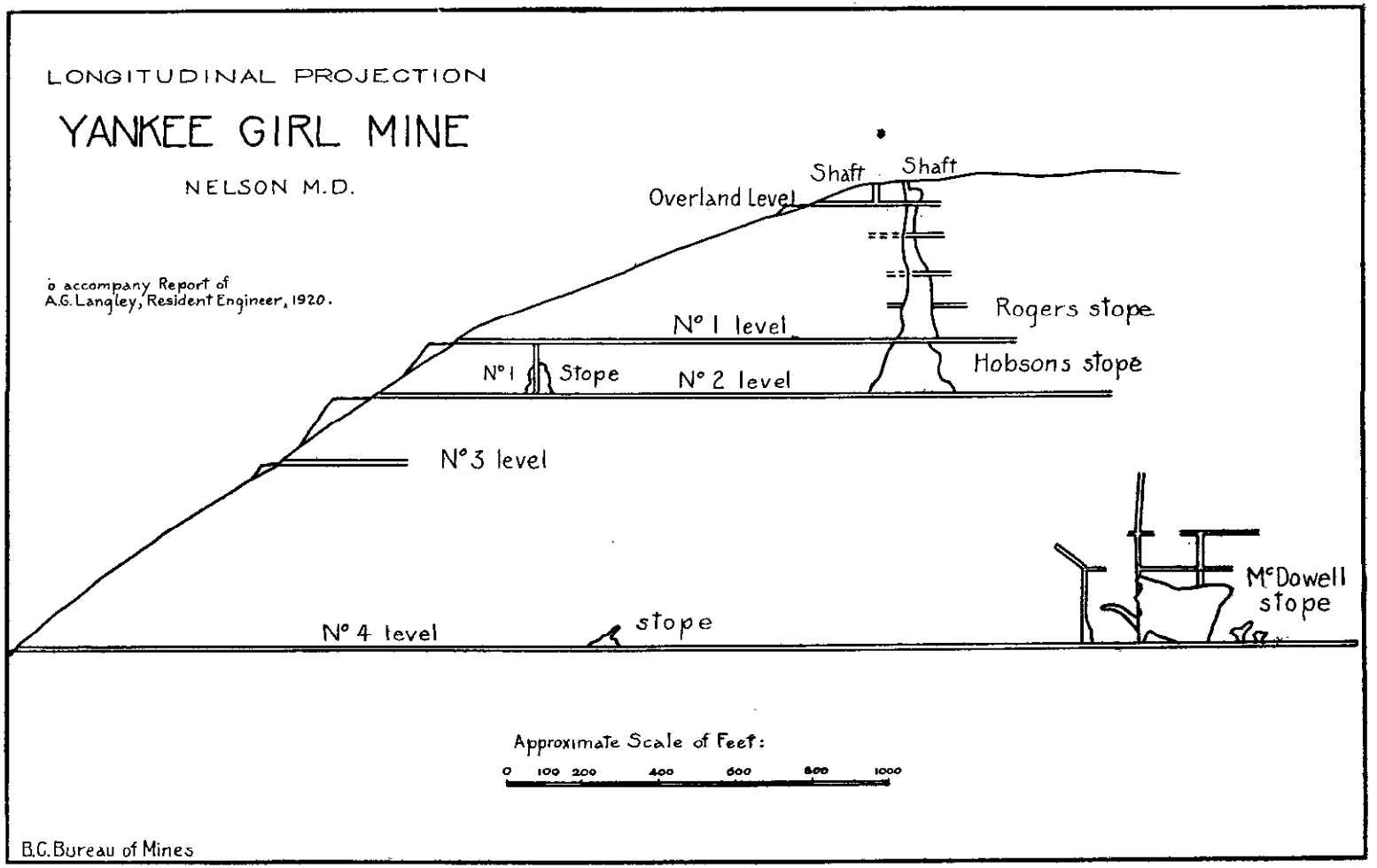
The formation of the mountain-side on which the mine is situated covers an area of marginal contact between the Nelson batholith and the schists and argillites of the Pend d'Oreille group of rocks; the granite forming a series of tongue-like intrusions into the adjoining formation. Ore-deposition has taken place along the line of a fault-fissure, which cuts both the granitic intrusions and the schists. The ore-bodies have been found to occur where the fissure traverses the granite; here highly siliceous mineral-bearing solutions have filled the zone of fissuring and replaced the country-rock to form ore-bodies of considerable extent. The strike of the ore-body on the lowest level is N. 68° E. and dip 65° to the north-west. The schists have a northerly strike and a dip of 60° to the west.

The original owners who staked the claims in 1899 exposed the vein by a series of open-cuts and drove the Overland tunnel, which gained a depth of 50 feet on the vein. Here the ore showed a width of 2 feet and a length of 40 feet. From these workings high-grade gold ore was shipped. The development was continued at depth by other adit levels as illustrated in the sketch accompanying this report. The upper workings are connected by a 2-bucket tram to bins at the upper terminal of the aerial tramway to the railway.

The No. 4 adit-tunnel was commenced in 1914 and is now in 4,050 feet. This develops the vein at a depth of 1,235 feet on the dip or 700 feet below the Hobson stope. The tunnel passes under the vertical projection of this shoot, and no ore-body of importance was encountered until a distance of 3,400 feet from the portal had been gained, where the McDowell stope was started. The length of this stope is about 300 feet and its width 9 feet. The walls of the vein are firm and massive and there is little danger from sloughing or caving.

Over 500 feet of virgin ground between the top of this stope and the ore-body on the next level was probably one of the most important factors which influenced the decision of the present company to take hold of the property. The result of the development-work done by them above this stope is not known at the time of writing. Near the end of the No. 4 level the *Yankee Girl* vein intersects and apparently becomes absorbed by what is known as the Lakeview vein, which has a strike of N. 40° E. and a dip of 55° to the west. It shows up strongly in the roof of the drift at a short distance beyond the McDowell stope.

Since writing the above it is reported that the company has suspended operations, and it is authoritatively stated that during eight months the following work was accomplished: 10 feet of sinking, 2,060 feet of drifting and crosscutting, and 670 feet of raising. This work was


LONGITUDINAL PROJECTION
YANKEE GIRL MINE
NELSON M.D.
to accompany Report of
A.G. Langley, Resident Engineer, 1920.
Shaft
Shaft
Overland Level
Rogers stope
N° 1 level
N°1 Stope
N° 2 level
Hobsons stope
N°3 level
McDowell stope
N° 4 level
stope
Approximate Scale of Feet:
0 100 200 400 600 800 1000
B.C. Bureau of Mines

confined to known ore regions and no new exploration was undertaken. Six cars were shipped from various places to determine the grade of ore that would break down in the vein for bulk shipments. The highest car-load ran about $36 in gold and silver a ton, two cars at about $20, two at about $11, and one at about $14 in gold and silver a ton. The lead content ranged from 2 to 7 per cent.

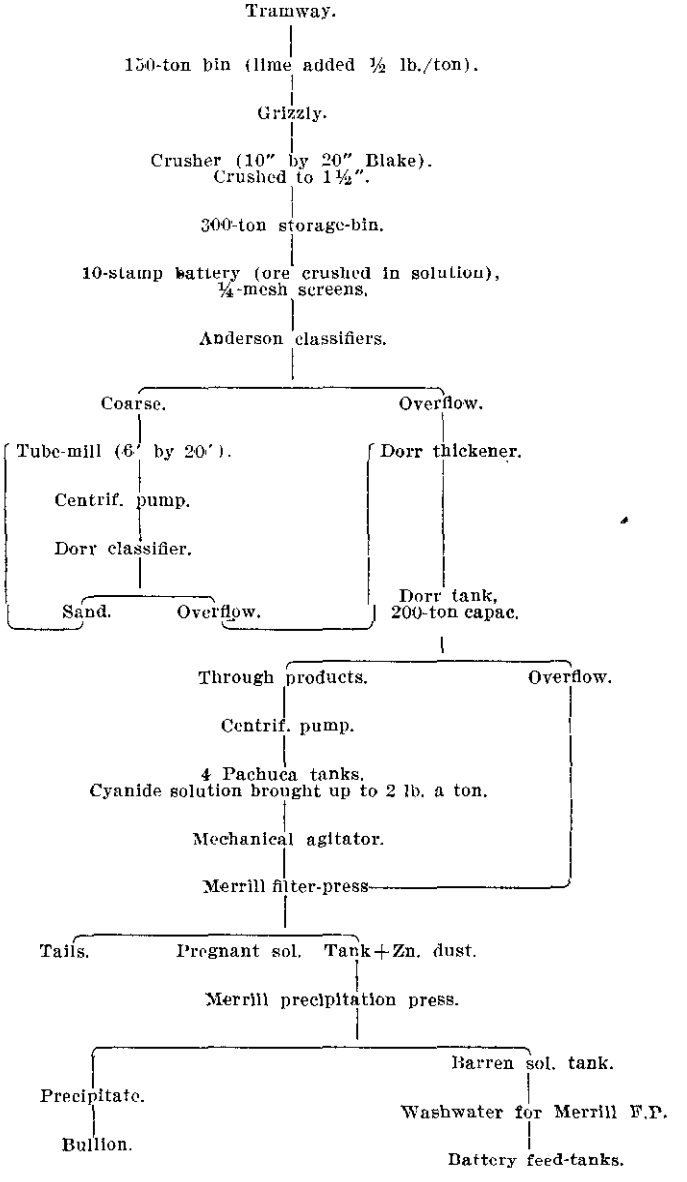
SHEEP CREEK.

Nugget and Motherlode.

These well-known properties have been frequently referred to in past reports of the Minister of Mines; that by J. D. Galloway in 1915 also gives an interesting table showing the production of the various Sheep Creek properties from 1900 to 1915. The *Nugget* and *Motherlode* mines are now being operated by the Nugget Gold Mines, Limited. The long crosscut driven from the lower level of the *Mother-*

Flow-sheet of Motherlode Mill.

(Capacity, 100 tons; extraction, 96–98 per cent.)



lode to tap the *Nugget* vein reached its objective early in the year, after being driven for a distance of 1,165 feet. This gives a depth of 625 feet of virgin ground below the old workings of the *Nugget*, or a total depth of about 1,000 feet below the apex of the vein. Good values were encountered at the point of intersection and a shoot of ore nearly 200 feet long was developed by drifting. The ore is a gold quartz similar in character to that of the *Motherlode* and to that encountered in the old *Nugget* workings. The quartz vein cuts laminated quartzites, which have a strike of N. 20° E. and a dip of 67° to the east.

Through these quartzites there is a heavy flow of water which seeps down between the laminæ and possibly has been an important factor in the enrichment of the vein. The mine is inclined to be wet, but the water has been a blessing in disguise, for, although there is no artificial ventilation in the stope, the air is good and becomes clear soon after blasting. The vein swells and pinches and its average width at any one place is not a safe criterion for what it may be in a few feet distant. The apparent average width of the stope at about 100 feet above the level was about 4 feet. The values are also variable, though the average is fairly consistent. During the season 4,657 tons was milled, yielding 1,584 oz. in gold and 408 oz. in silver.

Mining operations were carried on under somewhat adverse conditions, due to the scarcity of men and the high cost of labour and supplies. The mill was started up in July and closed down in November. During this period only sufficient ore was received to enable it to run for about 25 per cent. of the actual mining-time. The vein is being mined on the shrinkage system; hence, in order to supply the mill with its full capacity of 100 tons a day, it is necessary to mine about 300 tons. It is reported that stoping and development work are being carried on during the winter with a view of having everything in readiness for continual operation this season, when it is fully anticipated better results will be obtained.

Emerald.—The 50-ton concentrator installed at the property in 1919 was remodelled by W. de Witt and is now giving good satisfaction. The mine has been operated steadily, about fifteen men being employed. Ore and concentrates shipped to Trail amount to about 900 tons.

The *Molly Gibson*, owned and operated by the Consolidated Mining and Smelting Company, of Canada, Limited, was closed down on March 1st. Some 300 tons of silver-lead ore was shipped.

California.—Development-work has been steadily continued during the year and extensive improvements made to the *Athabasca* mill, which has been taken over by the California Mining Company. It is reported that the *Athabasca* mine has also been acquired by the company.

Perrier Group. This property, comprising a group of six claims, is situated on the Great Northern Railway at a distance of 3½ miles south of Nelson. It was staked in 1910 and developed by the owners until 1917, when it was decided to close down until the necessary capital could be obtained for development at greater depth and for the installation of a suitable concentrator. Accordingly, this year they formed a company called the Perrier Gold Mines, Limited, to which the title to the property has been transferred in exchange for stock. The capital of the company is $250,000 and stock is now being offered. The directors are all well known locally, the officers being C. E. Crossley, president, R. W. Hinton, vice-president; and W. M. Cunliffe, secretary-treasurer.

The general geological conditions are similar to those encountered in the vicinity of other gold gold-quartz veins which have been developed in the area to the south and west of Nelson. The *Perrier* vein cuts the schists of the Rossland volcanic group at an oblique angle and is a well-defined quartz-filled fissure with gouge on either wall, and has a strike of N. 10° E. and a dip of about 35° to the east or into the hill. It has been traced at intervals by small open-cuts through the overburden which covers the hillside for a considerable distance in a northerly direction from the present workings.

At a point between the railway and Cottonwood creek an incline shaft has been sunk on the vein for a distance of about 100 feet; for this distance the vein is persistent and has an average width of about 17 inches, with a tendency to widen near the bottom of the shaft. The values also show improvement with depth, according to samples taken. Unfortunately the last few feet of the shaft could not be examined on account of water.

The predominant values are in gold, of which about 70 per cent. is said to be free and the remainder associated with the sulphides. The associated minerals are iron pyrites, galena, and zinc-blende; the two latter, though not occurring in sufficient quantity to be considered a factor of economic importance, could be saved in the concentrates and are useful indicators as to the

gold-tenure of the ore, as the best values are generally found to be closely allied with them. This is true of most of the gold-quartz veins of the Nelson district.

At a point some 60 feet below the top of the shaft a small vein mineralized with galena and zinc-blende intersects the main vein. This is probably the same vein which has been drifted on from the surface at a point higher up the hill and at a distance of about 150 feet south-east of the shaft. It has a strike of N. 30° W. and a vertical dip conforming to those of the enclosing schists. The average width of this vein is about 7 inches. A sample taken in the drift showed the ore to be a fine-grained mixture of galena and zinc-blende containing the following values: Gold, trace; silver, 3 oz.; lead, 4 per cent.; zinc, 10 per cent.

From a point 50 feet below the collar of the shaft a drift was run for a distance of 129 feet in a northerly direction on the main vein. This encountered a faulted ground within a few feet of the shaft; the vein was picked up again in a short distance and a little ore was stoped, but not much importance can be attached to this level, which is driven near the surface, where the formation seems to be somewhat shattered and broken over. Extensive sampling of the vein in the shaft and drift gave an average value of $14.75 in gold and silver and an average width of 17.5 inches.

The following are results of a few samples taken across the vein on the south side of the shaft:—

At 20 feet from top of incline across a width of 12.5 inches: Gold, 0.38 oz.; silver, 0.4 oz.

At 30 feet from the top across a width of 14 inches: Gold, 0.40 oz.; silver, 0.4 oz.; lead, 1.5 per cent.; zinc, 0.4 per cent.

At 40 feet from the top across a width of 18 inches: Gold, 0.71 oz.; silver, 0.9 oz.

At 65 feet from the top across a width of 22 inches: Gold, 1.10 oz.; silver, 1.10 oz.; lead, 0.85 per cent.; zinc, 1.75 per cent.

No further sampling could be done at depth on account of water in the bottom of the shaft.

The ore taken from this shaft and the drift was treated in a small mill, and altogether values to the extent of about $3,500 are said to have been recovered. The loss in the tailings probably ran from 20 to 30 per cent. of the total values.

The mill, though limited to small capacity and incomplete in equipment, has served its purpose in helping to get returns on the ore mined and to demonstrate the amenability of the ore for amalgamation and concentration during the initial stages of development. To ensure the successful operation of the property on a more extensive scale it will be necessary to remodel the mill and possibly add a small cyanide plant.

It is understood that as soon as more capital is available the Company proposes to develop the vein at greater depth by sinking the shaft and establishing lower levels, and thus develop sufficient ore to justify a further expenditure on the mill. This would appear to be a good sound policy and fully justified by the existing conditions.

Briefly the present plant consists of: Small friction-clutch hoist; 8 by 10 Blake crusher; Challenge ore-feeder; Huntingdon mill, 3½ feet diameter; copper amalgamating-plate, 4 by 12; two Frue vanners; Rand compressor, 3-drill, or 350 cubic feet capacity.

The water-power to operate this plant is supplied by 2,000 feet of 8-inch pipe from Gold creek under a head of 440 feet. The power plant consists of one 24-inch Tuthill wheel. The mine is unwatered by means of a hydraulic ejector.

Eureka.—After advancing the long crosscut for a distance of 1,200 feet from the portal, the Vincent Development Company dropped their option on this property in the spring.

Aspen.—Situated on Deer creek, near Salmo. P. F. Horton has been busily engaged at the property. A small shipment of a high-grade ore was made to Trail.

Spokane Group.—Situated on Canyon creek, in the Bayonne district, Laib Bros., the owners, who have been doing development-work for some years, spent the latter part of the season in slashing a trail down Canyon creek to Kootenay lake. The property has suffered from lack of transportation facilities, and this in their opinion is the best route over which to take ore.

Among other properties at which there has been some activity are the following:—

Gold Hill.—Situated on 49 creek. Worked under lease by George Gormley. Over a car-load of high-grade gold-copper ore has been extracted ready for shipment.

Arnold Group.—Situated on the North fork of Salmon river. Worked by W. Connolly, the owner.

Mayblossom Group.—Situated near Ymir. J. F. Harbottle, the owner, has been employing seven men and expects to ship ore this winter.

Monarch Group.—Situated near Hall. Further prospecting and development has been done by J. Fisher, the owner.

Reno Group.—Situated on Fawn creek. W. B. Pool, the owner, put in a season's work at the property.

Ore Hill.—It is understood that a couple of men are being employed driving a crosscut, under contract, to tap the vein at greater depth.

Second Relief.—Situated near Erie. Two car-loads of concentrates were shipped to Trail. These came from the mill which was burnt last year.

A little prospecting was done on several groups of claims up the North fork of Salmon river. It is also reported that further work was done on the *Southern Belle* on Wilson creek.

Birdseye Group.* This group of eight Crown-granted claims—the *Birdseye, Lady Aberdeen, Minto, Haddo, Inverness, Lily Fraction, Princeton,* and *Ash*—is situated at an altitude of about 6,000 feet on Morning mountain, about 5 miles south-westerly from Nelson in a direct line. By wagon-road and by trail the distance from Nelson is nearly 8 miles. The present owners are an English syndicate, represented by H. J. Wilson, of Nelson, which acquired the property from the Nelson Copper Fields Company.

Free gold occurs in parallel elongated lenses of quartz in the schist-belt of the Rossland volcanic group. The strike and dip of the ore-bodies approximately conform to that of the enclosing schists. The quartz in places is stained and pitted from the leaching-out of the iron pyrites. Development-work amounting to about 300 feet of underground workings, in addition to numerous trenches and open-cuts on the surface, was mostly done about twenty years ago. A little work is said to have been done in 1915.

Most of the underground work was done on an outcropping lens of quartz on the *Birdseye* claim, having a width of from 15 to 20 feet on the surface. Here a 50-foot tunnel was driven into the quartz, and from near the extremity of this tunnel a winze was sunk about 75 feet from which short drifts were made. The quartz pinches out at the bottom of the winze. Seventy-five feet vertically below the upper tunnel a crosscut has been driven 80 feet in, but without exposing any ore.

On the *Lady Aberdeen* claim an open-cut has been made in another outcropping lens of quartz which has a width of approximately 20 feet on the surface. Values are said to have averaged about $40 in gold to the ton. Two grab samples from the dumps at the *Birdseye* and *Aberdeen* workings gave: Gold, a trace and 0.14 oz. respectively. The irregular nature of the deposits, however, makes accurate sampling very difficult and the highest values are probably confined to narrow pay-streaks and small shoots.

Noonday Group.* This group consists of four claims—*Noonday, Burnett, Marguerite,* and *Pearl Fraction*—owned by J. Radcliffe and J. S. Johnson, of Nelson, and bonded by O. W. Talley and associates, of Seattle, Wash., who were working the property this summer. The *Noonday* workings are situated at an altitude of 7,000 feet at the head of Sitkum creek, about 10 miles by trail from Kootenay lake.

A quartz vein occurs in the Nelson granite formation. The ore is partly free-milling gold quartz and partly concentrating-ore consisting of galena and iron pyrites carrying values in gold and silver. The ore is being mined from an open-cut and a drift 20 feet is on the vein, which is about 18 inches wide in the face. Gold is also panned from oxidized material from the outcrop of the vein. A sample of the panningss of this material gave: Gold, 1.92 oz. A sample across 18 inches in the drift gave: Gold, 0.84 oz.; silver, 0.6 oz.

Three men were employed at the mine at the time of the writer's visit in August. Ore was being packed on burros from the workings to the mill, a distance of approximately a quarter of a mile. The equipment consists of a Gibson prospector's mill, a No. 2 Denver rock-crusher, and an Ogden concentrator.

ARROW LAKES MINING DIVISION.

Millie Mack. Situated near Burton. A new adit-tunnel was driven and about 12 tons of ore extracted. The ore runs high in silver and often carries good gold value. The light tramway by which the ore is taken from the mine to the

trail some distance down the steep mountain-side has proved very satisfactory. H. E. Forster spent the the best part of the season at the mine. Two or three men were employed.

Chieftain Group. Situated on Caribou creek at a distance of 13 miles from Burton and almost opposite the *Millie Mack* mine. The distance is covered by road for 6 miles and then by trail. The group consists of the following claims: *Silver Tip, Mammoth No. 2, Chieftain, Dundas,* and *Duchess.* W. G. Clarke, of Sandon, is the principal owner. The hillside in the vicinity of the workings is covered with underbrush and a network of fallen timber, which rendered an examination of the surface showings impossible. The old cabins are dilapidated, though the underground workings are in good condition.

The geology of the district surrounding this section of Caribou creek is complicated and the structural features of the formation are difficult to follow. The upper portion of the ridge forming the south side of the creek is composed of Valhalla granite, which is a medium-grained light-coloured quartzose rock. From this batholith dykes and stocks have invaded the crystalline and highly metamorphosed rocks of the Shuswap series, which form the lower slopes of the mountain. On the northerly side of the creek remnants of the Slocan series form the upper portions of Grey Wolf mountain, on which the *Millie Mack* mine is situated. This formation has also been intruded by rocks of igneous origin.

It was in the early nineties when prospectors first found their way up this creek and staked a number of claims, among which was the *Chieftain.*

The vein is a quartz-filled fissure cutting the formation and having a dip of about 29° to the south-west. It strikes in an easterly and westerly direction obliquely across the hillside, which latter has a slope of 35°.

The workings consist of two adit-tunnels situated at an elevation of 4,300 feet above sea-level, or about 600 feet above the creek. The upper tunnel has been driven along the vein for 105 feet, at which point a 50-foot winze has been sunk. This is now full of water. In this tunnel the vein shows a width of from 3 to 5 feet and consists of shattered and crushed quartz, from which the metallic sulphides have been largely leached and oxidized by surface waters. Some high gold values are said to have been extracted from this level. A sample across a width of 3 feet of the vein at a point opposite the winze assayed as follows: Gold, 0.02 oz.; silver, 3.8 oz. While a sample from a small pile of sorted ore from this tunnel gave the following returns: Gold, 1.32 oz.; silver, 8.6 oz.

The vertical distance from the top of the winze to the surface is about 70 feet. The lower tunnel gains an additional vertical depth of 40 feet on the vein. The vein was struck at a distance of 152 feet, at which point 69 feet of drifting has been done. The formation encountered in the crosscut is composed of quartzites and highly metamorphosed slates. On this level the vein does not show such strength as it does in the upper tunnel and is not so well defined. The writer is of the impression that it may be an offshoot of the main vein; hence crosscutting and more drifting might be done with impunity.

A sample taken at 3 feet from the east face across a width of 13 inches ran: Gold, 0.24 oz.; silver, 5 oz.; zinc, 1 per cent.

At a distance of 11 feet from the face and across a width of 14 inches a sample ran: Gold, trace; silver, 296 oz.; lead, 0.5 per cent.; zinc, 2 per cent.

The ore is a "dry ore," the principal values being in silver and gold, the former being associated with grey-copper and a little argentiferous galena and the latter with the iron sulphides.

The property is easily accessible and conveniently situated both for water-power and timber. The present transportation facilities are not all that could be desired, as the trail is poorly located and has many adverse grades. Should the property be reopened and conditions be found to warrant the expense, about 4 miles of new road would connect the mine-workings with the existing one to Burton.

It is reported that J. Prow and J. Rymer cut out the trail to the *Canadensis* group, situated about 3 miles farther up the creek from the *Chieftain,* and put in a season's work on the property.

J. Reveler and J. Rymer did further work on the *Tillicum* group.

Promestora. Starting from the site of Mineral City, which at one time was the scene of quite a little mining excitement, a trail is followed up Mineral creek and the property is reached within a distance of about 4 miles. At an elevation of 4,300 feet and at the side of a small ravine an old tunnel and surface diggings immediately above its portal are all that remain to indicate previous efforts of development undertaken many years

ago. The surface is well covered with soil, supporting a thick growth of underbrush. There is evidence in places of trenching, but all such work has become filled in and grown over; hence tracing the vein on the surface was not possible.

In the face of a deep open-cut there is exposed a section of a quartz vein having a width of 5 feet and a vertical dip. It is heavily mineralized with iron suphides, which have become oxidized near the surface. From this open-cut some 10 or 15 tons of iron-stained quartz and a little pyrrhotite has been extracted and is now lying on the dump. A grab sample of this material ran: Gold, 0.30 oz.; silver, 0.40 oz.

The tunnel, which has been driven in a westerly direction at a vertical distance of 30 feet below the outcrop, has a length of 250 feet. It follows a soft streak of crushed material occupying a fault-fissure between walls of altered slates. For the first 40 feet this band of soft material carries a good deal of crushed and broken quartz; past this there is very little evidence of vein-matter.

The tunnel lies to the south of the outcrop, and a short crosscut from a point 70 feet in from the portal would prove whether the surface quartz is continuous with depth. It is authoritatively reported in the Minister of Mines' Report of 1896 that a 9-ton shipment yielded $60 a ton in gold. In this report it is also stated that the vein can be traced for between 1,000 and 2,000 feet.

TRAIL CREEK MINING DIVISION.

ROSSLAND CAMP.

Shipments from the Consolidated Mining and Smelting Company's mines were greatly curtailed and operations were principally confined to development and permanent improvements; of the latter, the concreting of the *Centre Star* shaft was probably among the most important. No ore was shipped from March 1st to July 15th, as the copper-furnaces at Trail were not in operation during that period. The total shipments for the year were about 50,000 tons.

Le Roi No. 2.—This mine has been operated steadily during the year and about 15,000 tons shipped to Trail.

Velvet.—Worked under lease by E. Nordman and associates. About 300 tons shipped to Trail.

White Bear.—In April the surface plant of this mine was destroyed by fire, with the exception of the transformer-house.

The smelting operations of the Consolidated Mining and Smelting Company of Canada at their large plant at Trail were productive of an output of gold, silver, copper, lead, and zinc, estimated at a total value of over $8,000,000. In view of the curtailed production of the Rossland mines, due to the low price of copper and the high cost of labour and supplies and the general curtailment of the silver-lead production, more especially that of the Slocan, due to the strike called by the O.B.U., the value of the production is remarkable and reflects credit on the management. Only during 1917 and 1918, a time when production was stimulated by the Great War, has the output surpassed that of this year.

During this year of depression in general mining activities the great *Sullivan* mine at Kimberley has been the mainstay of the metalliferous industry of this district, and by careful management of this property the company were able to draw sufficient ore to keep the big plant in operation and at the same time maintain the value of its yearly production.

It is interesting to note that over one-third of the total value of metals produced is represented by the production of zinc. This has been made possible by greatly improved mining and metallurgical treatment of the *Sullivan* ores, which has enabled a larger tonnage to be treated at greatly reduced costs, as compared with those in evidence during the early history of the huge electrolytic zinc-refinery.

During 1920 experiments were being made on a large scale, both by magnetic separation and oil-flotation processes. The former process at one time gave promise of being a very important factor in making a clean zinc concentrate, but improvements in the flotation process have now eliminated the magnetic machines from the flow-sheet. The present plant, which is equipped with Minerals Separation machines, has a capacity of about 900 tons. Briefly, the method is that of selective flotation. The lead is taken off first and then the zinc. The zinc concentrates are passed over a battery of tables, where a large percentage of the remaining lead is removed and the clean zinc concentrates are fed to the Wedge roasters of the electrolytic plant.

A 50-ton copper-rod mill is now nearing completion. A new and interesting feature of the plant is a large concrete ore-thawing shed having a capacity of fourteen cars. Owing to the drop in metal prices the company suspended nearly all construction-work at the end of the year.

Mountain Chief.—Situated at Renata, on the Arrow lakes. The property is temporarily closed down. It is understood that the company is endeavouring to interest more capital in order to carry out its plans of development and exploratory work.

Lord Roberts Group.

This group, comprising three claims—*Lord Roberts*, *Sir Douglas Haig*, and *Baden Powell*—is owned by Malcolm McIver and S. Fortcath, of Rossland. The property is situated on the rounded summit of the divide between Murphy and Sullivan creeks at an altitude of 5,350 feet, or 4,000 feet above the railway. The distance by trail from Rossland is 9 miles, and about 4 miles in a direct line from Birchbank, on the Canadian Pacific Railway. The natural outlet to the property would be to the latter place by way of Sullivan creek.

A number of open-cuts and several shallow shafts have exposed a body of magnetite, which varies in grade and apparently follows the somewhat irregularly defined contact between the Trail granodiorite and the rocks of the Rossland volcanic group. The presence of epidote, garnet, and hornblende would indicate that the ore-deposition is due to contact metamorphism.

The best grade of ore is a bluish massive magnetite and has a width, as exposed in several open-cuts, of from 4 to 8 feet. A sample of this ran: Iron, 54 per cent.; phosphorus, *nil;* sulphur, 2.69 per cent. Other phases of mineralization include higher percentages of pyrites, pyrrhotite, and traces of chalcopyrite.

A sample of magnetite in which a small percentage of iron sulphides was visible was taken from the bottom of a 20-foot shaft at the lower extremity of the property and assayed for copper, but gave negative results.

There is abundant evidence of mineralization over the small area exploited by the shallow surface workings, and a cursory examination gave the impression that there were possibilities of opening up a considerable tonnage of magnetite, but owing to the somewhat complex geological structure, a careful study of the deposit would be necessary to determine the best methods to employ for future development. As the ore is highly magnetic, a magnetic survey with a dip-needle should be of great help in tracing its occurrence.

NORTH-EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

REPORT BY G. E. SANBORN, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the Golden Mining Division of the North-east Kootenay District.

Only sufficient work was done in this district to keep the recorded claims alive, except on the *Monarch* claim, near Field. This property was operated and shipments made to Trail up to about December 1st, 1920, when market conditions for lead forced cessation of work.

OFFICE STATISTICS—GOLDEN MINING DIVISION.

Mineral claims recorded	34
Certificates of work issued	13
Free miners' certificates (ordinary)	107
Free miners' certificates (special)	2

Revenue.

Free miners' certificates	$ 504 00
General mining receipts	835 25
Tax on Crown-granted claims	532 50
Tax on mines and minerals	2,557 16
Total	$3,428 91

WINDERMERE MINING DIVISION.

REPORT BY E. M. SANDILANDS, MINING RECORDER.

I have the honour to submit my report for the Windermere Mining Division for the year ending December 31st, 1920.

Mining generally in this Division has improved a little and several new deals have been made. The sale of free miners' certificates and the location of claims have increased over the previous year. Towards the end of the year, however, owing to the low prices of both silver and lead and the refusal of the Trail smelter to pay for the lead content, some of the smaller properties were unable to operate and consequently had to close down temporarily. Should prices stiffen during the coming year there will be quite a bit of development done.

Paradise. This property is one of the old stand-bys of the district and has been worked continuously during the past year. Two thousand tons of silver-lead ore (sand carbonates) was shipped in 1920 and an average of about twenty-five men employed. A 5-ton White truck has been put on the road this year to haul the ore, and later on a trailer was added. The road on the south side of Spring creek has been widened and improved. Lead being the chief feature in this mine's ore, naturally this property has been hard hit on account of not being able to dispose of its lead.

Lead Queen. This property is situated on Frances creek and ships its ore to Brisco, on the Canadian Pacific Railway. This year no ore has been shipped. One hundred and twenty feet of crosscut tunnel has been driven, 34 feet of drifts, and 16 feet of raise. A building of 12 by 14 feet has been built, also a site graded out for the erection of a new cook-house, etc. I understand that there is a good showing of ore in both the drifts off the main crosscut tunnel. It is expected that next year the property will be worked more extensively.

Isaac. This property is also situated on Frances creek, a few miles below the *Lead Queen*. During the year some 75 tons of galena ore and carbonates has been shipped, averaging $84 a ton. Some 25 feet of tunnel, 8 feet of drifts, and 12 feet of shaft have been performed on the property. The ore is galena and carbonates and was shipped to the Trail smelter. The property, formerly owned by H. E. Forster, is under option to W. D. McMillan, of Seattle, Wash.

Nip and Tuck. This property consists of the *Nip and Tuck* and *Silver Tip* claims, which are situated on McDonald creek, a tributary of Horsethief creek. The owners are W. D. McMillan and V. Sontag, of Seattle, Wash. It has been under option and lease since last August. During the fall about 8 tons of ore has been hauled to Wilmer and 80 feet of tunnel has been run. The ore is good grade and will run to $150 a ton. It is silver-lead. At the time of writing the property is temporarily shut down, but further work will be done in the spring. Several cars of ore have been developed this fall.

Bunyan. This property is situated on the mountain at the back of Invermere and near Goldie creek. During the summer considerable work has been done on the claims and 65 tons of ore shipped, and 30 tons more is at the railway-track awaiting more favourable prices. A 1,000-foot tramway, 200-ton bunker, bunk-houses for twenty men, cook-house and dry-house, stable for 6 horses, blacksmith-shop, and powder-house have been built. A crosscut tunnel to tap the vein at 200 feet depth is being run, and should the ore warrant it a still lower one will be run to tap the vein at 600 feet. The values in the ore are silver, copper, and gold. The approximate value of the ore is $25 a ton. Large quantities are in sight and if prices warrant will be shipped later on. On an average about twelve men were employed during 1920. Four miles of new road has also been built.

Maple Leaf and Silver King. These claims are situated on Toby creek, at about the forks of Jumbo creek, and are under option to purchase from the owners, J. E. Stoddart and partners, to W. L. Smith, representing the Toby Creek Mining Company. During the summer considerable work was done on the claims, and especially on the surface, and a very large showing of both shipping and milling ore was uncovered. The grade of the shipping-ore is good. Owing, unfortunately, to impending litigation, work was discontinued in 1919, but I now understand this trouble has been settled. The claims have been surveyed this summer and Crown grants are being applied for. This property promises to be one of the largest in the district and quite extensive work will be carried on this coming summer.

Ptarmigan. This group of claims is situated at the head of Horsethief creek and was leased to E. Watson and others. During the fall of 1919 and the early part of 1920 quite an amount of ore was shipped from the dumps and brought a fairly good price. In the neighbourhood of 300 tons of ore was shipped to the Trail smelter. At the present time the property is shut down.

Bald Eagle. This group of claims is situated on the divide between Slade creek and Spring creek. Mr. Burman, with others, is the owner and continuous work had been carried on, but on account of lack of capital only about two men were employed on an average. There is a fine showing of good-grade galena ore and a shipment is expected this winter. The property is looking very good.

OFFICE STATISTICS—WINDERMERE DIVISION.

Free miners' certificates sold (ordinary)	103
Free miners' certificates sold (special)	1
Claims recorded (quartz)	108
Certificates of work recorded	75
Certificates of improvements	1
Bills of sale, agreements, etc.	31

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 1920.

The season of 1920 has not added any names to the list of shipping mines, but, on the other hand, a much wider interest has been evinced in the properties of the district; many examinations have been made, and in most, if not all, cases where development is proceeding satisfactory improvements have been reported; in fact, the mining industry in the district is stronger than it has been for years, and it is expected, now that the presidential election is over in the United States, a stable money market will result in steady development as a corollary of the many examinations made this year.

Placer-mining has been fairly active throughout the district, although only one company reports a satisfactory clean-up, the others being still in the development state.

The Seattle company on Wildhorse has reorganized, and the Gamble Company, after a short successful run, had to shut down for repairs, the pipe-line having broken down. On Perry creek the hydraulic plant is completed and a little preliminary test yielded a nice return of fine gold. Other placers on Moyie and Bull rivers and Wildhorse and Weaver creeks are being put in shape for next season.

The progress of quartz-mining is satisfactory; the development of the *Victor* group is being rapidly pushed, new machinery being installed, a 50-ton concentrator erected, ore-bins and other necessary buildings built, and this winter's work should put the property on the shipping-list. The work on the *Rob Roy* group on Skookumchuck is progressing favourably under bond to the Globe Mining Company; a compressor and pump have been installed and work is being pushed; some native copper was found in the crevices of the ledge in the shaft and a fine grade of ore exposed. This vicinity has all been located and one company intends doing extensive diamond-drilling.

The St. Mary country did not come in for the attention that it thoroughly deserves; one or two examinations were made, but the results have not been made known. This section of the district has not as yet good transportation facilities, and this very strongly militates against its exploitation.

The hæmatite-deposits on Bull river and Sand creek were examined and well reported on. It is understood a deal is pending.

The free-milling gold-quartz camp on Perry creek came in for some examination, with indifferent results; apparently this type of ore needs special engineers, as many complaints have been made as to the method of sampling followed by the engineers. One report was very satisfactory, and in consequence a deal is pending whereby a prospecting-mill is to be installed.

The Tracy Creek camp came in for some attention, the *Estella* group being examined and favourably reported on; this property has a wide ledge of lead-zinc, as well as one or two leads of copper-gold ore.

The *North Star* mine has shipped approximately 6,500 tons of silver-lead-zinc ore and has had a very successful year.

The *St. Eugene* at Moyie has sent several hundred tons of galena to the smelter; the discovery of 3 feet of solid galena in this property shows that it is not all worked out yet. The shipments amounted to 650 tons of lead ore and over 250 tons of zinc ore.

The *Society Girl* at Moyie shipped a small car of ore to the Trail smelter; this property is under lease.

The returns from the *Sullivan* mine, the property of the Consolidated Mining and Smelting Company of Canada, Limited, show a marked increase over last year's shipments. Shipments for 1920 were as follows: Zinc ore, 242,229 tons; lead ore, 13,214 tons; iron pyrites, 4,300 tons; which are considerably higher than the total amount of ore shipped during 1919. Considerable improvements have been made, including the erection of twelve workmen's houses, two staff

residences, two bunk-houses, a machine-shop, and warehouse. Underground development was pushed actively; the lower tunnel, now in over 8,000 feet, was extended and an upraise connecting upper and lower workings completed. Among the future developments under advisement is the feasibility of bringing electric power for the mine from Bonnington falls, and when decided the construction of the concentrator will be undertaken.

OFFICE STATISTICS—FORT STEELE MINING DIVISION.

Mineral claims recorded	155
Certificate of work (Form E)	273
Certificates of improvement (Form G)	37
Bills of sale, etc.	39
Gold Commissioner's permits	5
Documents filed	5
Affidavits filed	258
Mining leases issued	3
Free miners' certificates (ordinary)	310
Free miners' certificates (company)	3
Crown grants issued	3

Revenue.

Free miners' certificates	$1,595 25
Mining receipts	4,831 50
Total	$6,426 75

NORTH-WEST KOOTENAY DISTRICT.

REVELSTOKE AND LARDEAU MINING DIVISIONS.

REPORT BY ARTHUR JOHNSON, 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, 1920.

REVELSTOKE MINING DIVISION.

BIG BEND DISTRICT.

This important district was exceptionally quiet during the past year. The only work accomplished was by prospectors, who were content with doing assessment-work on their claims to keep them in good standing.

Two parties of returned soldiers under the direction and by the assistance of the Mines Department of the Government spent two months in the Bend prospecting; one party prospecting in the neighbourhood of French and McCullough creeks, the other party confining their prospecting up Downie creek and at the headwaters of Carnes creek. These parties located and recorded seven mining claims.

Placer-mining in the Big Bend during 1920 was at its lowest for many years, although a good deal of prospecting was undertaken by a number of placer-miners with a view to future operations, results of which it is expected will be seen during the forthcoming season.

ILLECILLEWAET CAMP.

A crew of eighteen men was employed on the old *Lanark* mines under the direction of the manager, W. B. Dornberg, and 60 tons of silver-lead concentrates was shipped to Trail smelter. This ore was extracted during the operation of carrying on definite development of the mine.

R. E. Taylor, of Nelson, took a bond during the summer on the *Crystal* group from Joe McKinnon and associates. The *Crystal* joins the *Lanark* to the north-west and some development-work was done on the lead with good results.

The *Silver Creek* mines on Silver creek were practically closed down during most of the season, and there is nothing to report as to conditions in this camp.

During the summer a few men were employed at the old *Waverley-Tangier* mines, situated about 30 miles north from the main line of the Canadian Pacific Railway at Albert Canyon. G. H. Walters, of Spokane, Wash., who acquired the property two years ago from Thomas Graham and Ole Sandberg, made an effort in the spring to find an outlet for this mine by way of Downie creek and the Columbia river to Revelstoke instead of by way of Albert Canyon. Three men were thus engaged for nearly two months, and their report is that the new route will be of great help to the operations of this property, as a splendid trail on an easy grade from the mine to the Columbia river is possible with the minimum of expense. The *Waverley-Tangier* will likely be in full mining operation during 1921.

OFFICE STATISTICS—REVELSTOKE MINING DIVISION.

(John Lee, Mining Recorder.)

Free miners' certificates	114
Free miners' certificates (company)	3
Certificates of work	55
Locations	53
Bills of sale recorded	3
Transfers recorded	1
Memorandum of agreement	9
Payments in lieu of work	2
Groupings recorded	7
Placer leases recorded	2

LARDEAU MINING DIVISION.

With the exception of the mining operations on the old *Beatrice* mine, where four men under the management of H. E. Bodine, of the New Era Mines, Limited, of Vancouver, were employed during the summer in clearing up the old workings and in developing new ore-bodies, there is nothing to report from this camp.

At the *Berniere* group cabins were constructed with the view to extensive development-work during the season.

The outlook for 1921, however, is more promising than for 1920, as a good deal of interest has been inspired in the camp since the visit of M. F. Bancroft and party, of the Geological Survey of Canada, who spent considerable time in this Division during the early fall.

OFFICE STATISTICS—LARDEAU MINING DIVISION.

(Ernest Roberts, Mining Recorder.)

Free miners' certificates	32
Free miners' certificates (company)	1
Locations recorded	28
Bills of sale recorded	5
Certificates of work recorded	66
Payments in lieu of work	4
Groupings recorded	10

SLOCAN DISTRICT.

AINSWORTH MINING DIVISION.

REPORT BY RONALD HEWAT, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on mining operations in the Ainsworth Mining Division for the year ending December 31st, 1920:—

The mining operations during the year were greatly retarded, first, through the lack of labour in the early part of the year; and, secondly, the discontent which developed later among the miners, finally resulting in a strike called by the One Big Union. This tied up the mining industry, as the operators refused their demands, with one exception—viz., the Silversmith Mines, Limited, operating the old *Slocan Star*, and for months only that property was active. Through the lumber industry falling off there have been plenty of men lately and work on several of the well known properties has been resumed, but the damage as far as the year's production is concerned was done.

Silver Bear. A prospecting tunnel was driven farther into the vein and drifting was done for another 180 feet and raises put in connecting with the surface. This work was done in order to prospect and prove up the vein. Seventy-seven tons of high-grade ore was shipped in the course of carrying out this work. Certain work has been done on surface for the purpose of proving up the extension of the ore-shoots. Additions have been made to the bunk-house and cook-house for further accommodation of more hands. The compressor building has been built and machinery installed. A lower tunnel-site has been located with the object of striking the vein at a depth of 150 feet, from which drifts will be driven. All this work is held up, I have been informed, by the refusal of the Trail smelter to pay for the ores in the ordinary way at time of sampling.

Silver Bell.—Work on the *Silver Bell*, situated on the South fork of Kaslo creek, consisted of 523 feet of drifting, 42 feet of crosscutting, 170 feet of raising, and 52 feet of sinking; an average of eight men was employed and ore shipped amounted to 220 tons.

Whitewater.—Located at Retallack. Mostly worked under lease, although the company had a small crew at work taking out ore. Average total employed during the year about eighteen men; shipped 600 tons of silver-lead ore and 164 tons of silver-zinc ore. The company lost its main bunk-house and dining-room by fire in August, and it is intended to replace these during the coming year.

Washington.—A lease was let in May to three Italian miners, who took out 36.61 tons of silver-lead ore, which was shipped to Trail. Leasers quit when winter came on. Nothing done on company's account.

Cork-Province.—This mine has remained idle all the year on account of the strike called by the One Big Union and high operating costs of the year.

Highland.—Operated by the Consolidated Mining and Smelting Company of Canada, Limited. Work consisted of 117 feet of drifting and 27 feet of raising; 830 tons of ore mined and 189 tons shipped, containing 847 oz. silver and 55,375 lb. lead. Thirty-four men were employed. Mine closed down on February 14th, 1920.

The *No. 1*, operated by the above company, employed an average of eight men and shipped 694 tons, containing 21,746 oz. silver and 12,468 lb. lead. Development-work consisted of 110 feet of drifting, 191 feet of raising, and 14 feet of winze. Mine closed down on October 31st.

The *Panama*, owned by H. Giegerich, near Bear lake, did development-work consisting of 150 feet of tunnel and 300 feet of retimbering.

The *Maestro*, situated in the Ainsworth camp, owned by H. Giegerich, and which was leased for the greater part of the year did a small amount of development-work and shipped a small car of ore.

The *Skyline*, situated at Ainsworth and owned by A. W. McCune, of New York City, did development-work consisting of 300 feet of drifts and upraises and shipped 138 tons of ore.

The *Utica*, owned by the Utica Mines, Limited, shipped 708 tons of ore during the year, containing 75,864 oz. silver and 167,708 lb. lead.

Florence. This property, owned by the Florence Silver Mining Company, Limited, employed on an average about fifty-five men, and shows a production for the year of approximately 16,900 tons gross; concentrates shipped, 1,173.2 tons; dry ore shipped, 132.5 tons, containing 18,695 oz. silver and 1,518,083 lb. lead, at an estimated value of $95,000. The operations of the company were handicapped by a three-months enforced shut-down the first part of the year, due to power shortage resulting from the unusually dry and cold weather, and the mines were shut down on December 1st owing to metal market declines and unsatisfactory smelter arrangements, which continued through to the end of the year.

Bluebell. Operations at this mine began during April and continued until the end of the year, and during that period there was mined and treated 13,223 tons of ore. About 2,200 tons of crude oxidized ore was shipped to the smelter without milling, and the balance was concentrated mechanically. All the ore was of an oxidized nature and came from the surface to the east of old glory-hole workings.

OFFICE STATISTICS—AINSWORTH MINING DIVISION.

Free miners' certificates	161
Mineral claims recorded	118
Certificates of work (Form E)	278
Bills of sale, agreements, etc.	75
Mineral claim leases	24
Certificates of improvement	6

SLOCAN MINING DIVISION.

REPORT BY ANGUS MCINNES, MINING RECORDER.

I have the honour to submit herewith my annual report on the Slocan Mining Division for the year ending December 31st, 1920.

I regret to say that owing to a strike which started early in the year, brought on by the organization known as the O.B.U., there has not been much progress nor development of any kind done; and now that the strike is broken up the slump in the price of metals has caused the mine-owners to seriously consider the situation before starting again on a big scale.

The *Noble Five* at Sandon and the *Bosun* at New Denver are the only two that are now operating to any extent.

The *Silversmith* was operated all year.

The big concentrator at the *Noble Five* has been finished and is now in operation. About seventy-five men are employed in the mill and the mine.

The *Bosun* is working about forty men, doing mostly development-work. Their mill at Rosebery has been closed down for the winter months.

The *McAllister* is working a few men on development-work and will begin the building of a mill in the spring.

The *Rambler* has closed down for the winter.

OFFICE STATISTICS—SLOCAN MINING DIVISION.

Free miners' certificates	177
Free miners' certificates (company)	4
Claims recorded	40
Assessments recorded	82
Revenue collected	$5,998.25

SLOCAN CITY MINING DIVISION.

REPORT BY T. MCNEISH, MINING RECORDER.

I have the honour to submit my report of mining conditions in the Slocan City Mining Division for the year 1920.

Owing to the strike in the Slocan the mines have been nearly all tied up, and no capital has been coming in, so the work done has been very small outside of the usual assessment-work required to keep the claims in good standing. What few properties have been working have given very encouraging results. I beg to submit herewith a memorandum of the principal properties which were in operation.

The *Anna* mine, owned by Kurt Zimmerman, which was under lease and bond to Earl Hyde, shipped 58 tons of very high-grade ore and has a fine showing at present.

The *Little Tim*, owned by D. B. O'Neail and A. S. McAuley, has been doing development-work and has shipped 5 tons of ore, but considerable difficulties have had to be overcome. They now have a fine pay-streak and believe that in the coming year, with the settlement of the labour difficulties, this mine will be a good shipper.

The *Ottawa* mine, under lease and bond to A. L. McPhee and L. H. Biggar, shipped 467 tons of ore during the year. For the last four months the lessees have been engaged in constructing a 75-ton tube-mill, with which they intend to concentrate the dumps, and they also have considerable mill-feed in the mine, but the heavy snows have caused them to cease operations; but a short while in the spring will have this in operation. It is being watched with interest by mining men in this district, as at the present it is in the nature of an experiment, and if successful will possibly mean a big thing for the Slocan, as there are several mines that could be worked at a profit if possible to work them with a mill of this kind on the ground.

The *Republic*, which was under lease and bond to A. W. Evans, of Nelson, shipped 19 tons of very good ore, but has ceased operations. There is a very good showing on the property at present, and it is believed that in the spring it will be operated again.

The *Black Prince*, under bond to J. T. Tipping, has been doing extensive development-work and has not shipped any ore during the year; but two cars are now ready for shipment, and it is expected that in the spring extensive shipments will be made from this mine.

The *Two Friends*, owned by C. E. Cartwright and others, has been considerably developed. A good shoot of high-grade ore has been struck, but the mine had to be closed down on account of the deep snow. The mine will be reopened in the spring.

The above is practically all the work that has been done in the camp during 1920, but I think that during the coming year, with the settlement of the strike and the stabilizing of the silver markets, considerable work will be done on the claims here.

OFFICE STATISTICS—SLOCAN CITY MINING DIVISION.

Free miners' certificates issued	72
Certificates of work recorded	105
Locations recorded	27
Transfers recorded	4
Notices to group	12
Poll-tax receipts issued	18
Firearms licences issued	43
Marriage licences issued	7
Total receipts of office	$1,032.90

TROUT LAKE MINING DIVISION.

REPORT BY OSCAR JACOBSON, MINING RECORDER.

I have the honour to submit herewith my report for the Trout Lake Mining Division for the year ending December 31st, 1920.

No development worth speaking of has been made during the year, but from information received it is possible that some new development will be in progress during the coming season.

The owners of the different and most promising mineral claims in the district have kept up their assessment-work during the year.

Locations of new claims show a substantial increase over 1919.

OFFICE STATISTICS—TROUT LAKE MINING DIVISION.

Free miners' certificates issued (ordinary)	53
Free miners' certificates issued (company)	1
Locations recorded	47
Certificates of work recorded	118
Notices to group filed	31
Transfers recorded	5

NELSON DISTRICT.

NELSON MINING DIVISION.

REPORT BY J. CARTMEL, GOLD COMMISSIONER.

I have the honour to submit herewith the annual report on the Nelson Mining Division for the year ending December 31st, 1920.

Whilst the tonnage mined did not equal that of the previous year, yet the amount of development accomplished was probably greater. In spite of this, however, it cannot be said that 1920 was a satisfactory year for the mining industry in this particular district, and at the close of the year mining was practically at a standstill.

The only redeeming feature would appear to be the fact that this state of affairs is due almost entirely to economic conditions prevailing at the present time, the high cost of labour, material, etc., making it impossible to operate at a profit. This applies particularly to those properties the principal values of which are in gold.

However, as the economic conditions would appear to be at last moving toward the pre-war normal, the coming season is looked forward to with a considerable degree of confidence, and from all accounts a number of the more important gold properties will be commencing operations again in a short time.

NELSON CAMP.

Eureka Group. The Vincent Development Company, which had this property under bond, drove a crosscut tunnel a distance of some 1,200 feet with the object of tapping a vein at greater depth, but apparently it became discouraged and withdrew, allowing its bond to lapse. The general impression appears to be that the company failed to do sufficient careful prospecting in connection with the development of this tunnel, and notwithstanding this set-back a number of mining men hold the opinion that this property has much merit, and with proper development will yet prove a remunerative investment for some one with sufficient capital to carry out a practical and systematic policy of development.

California. The *California*, *Athabasca*, and *Exchequer* groups, which are all under bond to J. R. Cassin and associates, of Spokane, Wash., have received considerable attention in so far as development is concerned. The old *Athabasca* mill was remodelled, there having been added a Hardinge conical ball-mill and a flotation plant. This was run for a short time last fall as a test, and then closed down owing to the present high cost of production and operation. There is said to be sufficient ore blocked out on the property to keep the mill running steadily for years, and with the additional tonnage which may be expected from the *Athabasca* and *Exchequer* it is safe to predict that once the cost of production becomes nearer to normal a vigorous policy of development will be carried out and these properties become among the very largest producers in the district.

Perrier. This mine, situated on Cottonwood creek, quite close to Nelson, has not, I think, received any material attention during the past year, but a local company has been organized with a view to financing the purchase of necessary machinery and the installation of a mill. With proper equipment the mine should become a profit-producer, judging from its showings.

Gold Hill. This property, which is situated on Forty-nine creek and is owned by Alex. McDonald and partners, has late in the fall shown up much larger ore-bodies than ever before encountered, and George Gormley has secured a lease on the mine and is conducting active operations thereon. A car of the ore shipped to the Trail smelter showed up well, yielding $55 a ton in gold, with also a fair percentage of copper, and arrangements have recently been made with the owners of the *Granite-Poorman* mill to treat a quantity of milling-ore, 45 tons of which is already being hauled there.

The *Birdseye* group, situated near Nelson, has received some attention during the year, but work is closed down at present. I believe, however, that its English owners intend to institute a more progressive policy of development in the spring.

Granite-Poorman. Two men, Watson & Wolverton, secured a lease on this property during the latter part of the year and carried out a small amount of development and research work, resulting in the production of a small gold brick, and I understand that recently a syndicate of mining men have become interested in the venture, who are in a position to supply the capital necessary to enable the carrying-out of further development-work with a view to testing the continuity of the worked-out ore-bodies with depth. Should their efforts prove successful, which it is sincerely hoped they will, we may expect to see this well-known property once again a producer.

Monarch Group. This group, which consists of six claims, is situated near Hall Siding, and is owned by Jas. Fisher and partners. Little more than the necessary assessment-work was done during the year. Most of the work done so far consists of open-cuts, in some of which good showings have been secured, the best of which exposes 27 feet of copper-gold ore averaging 1½ per cent. copper and $1.80 in gold. A 92-foot tunnel struck the lead at a depth of 50 feet.

The *Molly Gibson*, operated by the Consolidated Company, employed thirty-one men; 372 tons of ore mined and 272 tons shipped, containing 4,349 oz. silver and 1,501 lb. lead. Development-work consisted of 92 feet of drifting and 31 feet of raising. Mine closed down on February 14th.

OTHER CAMPS.

Emerald. This mine, which is situated on Sheep creek, shipped altogether some 873 tons. The new mill did not at first give expected results, but after receiving attention at the hand of an expert it is stated that results are now fully up to expectations. Owing to the early unsatisfactory working of the plant, shipments were necessarily somewhat curtailed, and, of course, the present low price of lead was also a contributing factor.

Nugget. Considerable development was done on this property following the striking of the vein by the 1,200-foot tunnel driven through the *Motherlode*, and a large body of ore was blocked out for stoping. A quantity of the ore was run through the *Motherlode* mill, but the high cost of production made a discontinuance of this advisable for the time being. Everything is in readiness, however, to commence operations again on the return of conditions more favourable to gold production.

Reno Group. On this group, which is situated on Fawn creek, considerable development was done during the year, and the owners, W. B. Pool and associates, have satisfied themselves that several of the veins go to depth. The ore is free milling and is said to carry excellent values.

Second Relief. Apart from the shipment of about 75 tons of concentrates to Trail, nothing was done on this property during the year, A. D. Westby, the manager, being engaged in an endeavour to raise capital necessary to rehabilitate the mine, which was put out of business by forest fires causing the complete destruction of the plant during the previous year. Mr. Westby informs me that his financial plans are maturing favourably and that he expects to have work under way in the spring.

Spokane Group. On this group, which is situated in the Bayonne camp, the Laib Bros. have not done any great amount of development this year, having devoted their energies to the construction of a trail to Kootenay lake, following Canyon creek, the problem of transportation being the most pressing one at the moment. It is stated that ore to the estimated value of some $100,000 has been blocked out on this property, which it is impossible to ship owing to the lack of a trail over which it could be transported.

Yankee Girl. This well-known mine, situated near Ymir, is owned by the Hobson Silver-Lead Company, but during the past year has been under option to the Mining Corporation of Canada, by whom a large amount of development-work was done, and I understand that while operations were suspended fairly early in the fall upon instructions from headquarters in the East, the original owners are quite satisfied that the property is in a position to renew production with the advent of the better economic conditions which it is earnestly hoped will soon be in evidence.

OFFICE STATISTICS—NELSON MINING DIVISION.

Free miners' certificates (individual)	411
Free miners' certificates (company)	8
Free miners' certificates (special)	1
Claims recorded (mineral)	167
Certificates of work recorded	390
Agreements, transfers, etc.	84

ARROW LAKE MINING DIVISION.

WALTER SCOTT, MINING RECORDER (OFFICE AT NAKUSP).

I have the honour to submit the annual report on the Arrow Lake Mining Division for the year ending December 31st, 1920:—

Millie Mack.—H. E. Forster has 12 tons of ore sacked, waiting sleigh transportation to the smelter.

Hoodo Group.—Prough & Rymer are driving a tunnel upon the *Hoodo* mineral claim this winter.

The *Tillicum* group of mineral claims, owned by Reveler & Robson, has had considerable development this summer and looks promising.

OFFICE STATISTICS—ARROW LAKE MINING DIVISION.

Free miners' certificates issued	46
Special free miners' certificates issued	2
Certificates of work recorded	19
Mineral claims recorded	11

ROSSLAND DISTRICT.

TRAIL CREEK MINING DIVISION.

REPORT BY H. R. TOWNSEND, GOLD COMMISSIONER.

The mining operations in this district have been very slight during the year. The Consolidated Mining and Smelting Company of Canada has continued with some development-work and has shipped a limited amount of ore, shipments being somewhat increased latterly.

The *Le Roi No. 2* shut down before the end of the year.

The *Velvet* mine is being worked by a syndicate of local men who have an option to purchase, and they express themselves as well satisfied with their prospects.

A placer lease was granted to Ruffner, Graham & Symons of 1 mile of the Columbia river northerly from the International Boundary, and they are operating during the low water, but I have not been informed as to the results obtained.

OFFICE STATISTICS—TRAIL CREEK MINING DIVISION.

Free miners' certificates (individual)	124
Free miners' certificates (company)	2
Mineral claims located	28
Certificates of work recorded	60
Certificates of improvements	4
Bills of sale, agreements, etc.	14
Leases of reverted claims	30
Placer lease	1

SOUTHERN DISTRICT (No. 4).

REPORT BY PHILIP B. FREELAND, RESIDENT ENGINEER.

INTRODUCTORY.

The above district includes four Mining Divisions—Grand Forks, Greenwood, Osoyoos, and Similkameen. The mineral production of this district is considerably below its former average, chiefly owing to the closing-down of the Granby mines at Phoenix in June, 1919, which diminished the production of copper and gold, the chief output from the Phoenix mines.

The high price of silver during the first part of the year stimulated the mining of the silver-lead ores, resulting in a larger tonnage, as will be seen below:—

TOTAL TONNAGE AND CONTENTS IN MINING DIVISIONS FOR 1920.

Mining Division.	Ore.	Gold.	Silver.	Copper.	Lead.	Fluorspar.	Arsenic.
	Tons.	Oz.	Oz.	Lb.	Lb.	Tons.	
Grand Forks	41,473	1,019	15,387	571,878	5,278	7,477	.....
Greenwood	1,727	631	298,801	10,482	101,155	.....	.....
Osoyoos	40,925	18,716	71,493	.....	.....	.....	$22,231
Similkameen	18,907	69	3,326	462,047	.....	.....	.....

Practically all the silver and lead ores came from the immediate vicinity of Greenwood and Beaverdell.

It seemed probable that the output from the Canada Copper Corporation's mines on Copper mountain, near Princeton, would offset the loss of the Phoenix tonnage, but, owing to unforeseen difficulties, operations did not commence until late in the autumn, and about the same time the price of copper dropped to 13.5 cents a pound, making impossible profitable mining for the company in its early stages. The mine was closed down pending a rise in copper prices or a decreased cost in supplies and wages.

Satisfactory results were obtained in the mine, the ore breaking easily and in comparatively small pieces. It was found that the 42- by 36-inch Farrel-Bacon jaw-crusher in the primary crushing plant had very little work to do, whilst the No. 6 McCully gyratory crushers were overworked. In the mill the rolls did not crush the small siliceous pieces of rock satisfactorily, and it seems probable that some type of crusher giving a hard blow will have to be used.

The future possibilities in the district lie along the lines of close examination and research with the idea in mind of possible concentration. The good systems of railroads, wagon-roads, and high-power electric lines running through the district are an added attraction to capital and will solve the problem of transportation, so difficult to overcome in outlying districts.

It seems probable that most of the outcrops of self-fluxing copper ore-bodies have been discovered and mined. Other deposits, lower grade and more complex, have not been thoroughly exploited, and it is these varieties of ore that might command attention, as well as possible ore-bodies that do not outcrop.

In the neighbourhood of Deadwood, near Greenwood, there is some attractive surface mineralization; also an area between Beaverdell, on the Westkettle river, and the Kettle river, and in portions of the Granby (North fork of the Kettle) river; also the country lying south of Princeton in the vicinity of the Roche river and Whipsaw creek.

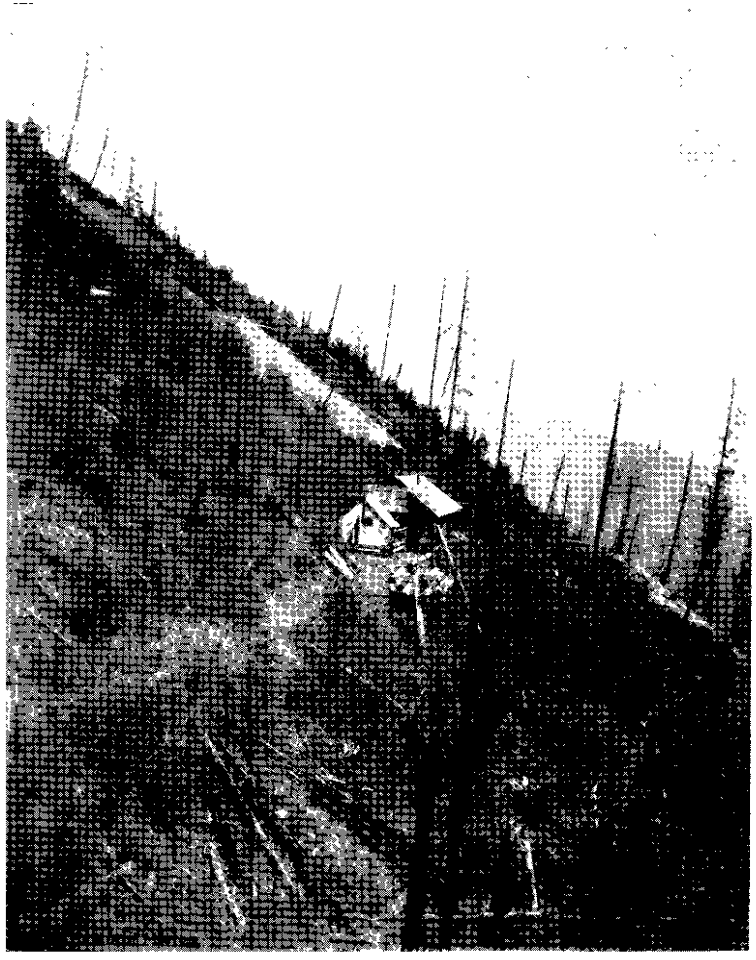
GRAND FORKS MINING DIVISION.

FRANKLIN CAMP.

Union.

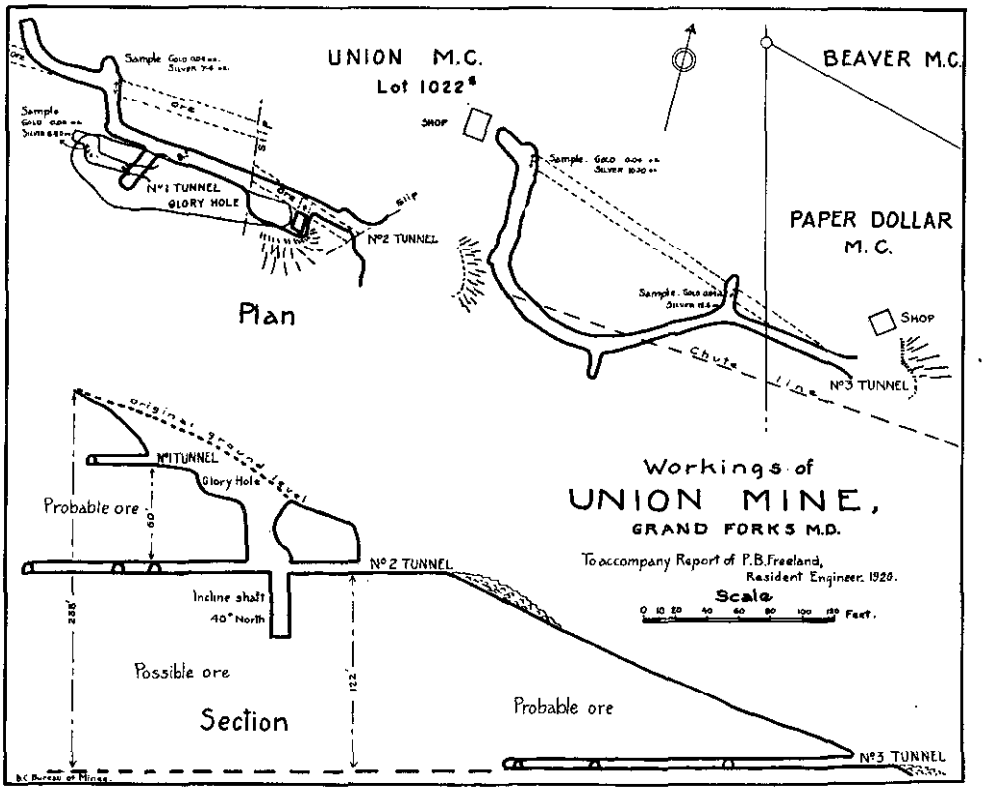
The Union Mining and Milling Company, Limited, a stock company, was formed towards the end of the year with the idea of financing a development programme and, if sufficient ore is found to warrant it, the construction of a

Government Drill, Franklin Camp.



Gloucester Mine, Grand Forks M.D.

concentration plant. The *Union* claim, which is one of a group of four—*Idaho, Paper Dollar, Union*, and *Union Fraction*—has been worked spasmodically for some years by the owners, who shipped several thousand tons of silver-gold ore from the upper workings. This ore assayed anywhere between $30 and $100 a ton and represented what was probably the bottom of a secondarily enriched zone. All development-work, as far as it has gone, below the second level showed leaner ore carrying values from 0.03 oz. in gold and 13.90 oz. in silver to 0.15 oz. in gold and 8.80 oz. in silver to the ton. With the possibility of price of silver declining to about 50 cents an ounce, it will be seen that a very close estimate of costs must be made before any outlay for plant could be considered.



The mine is well located for cheap operation, being close to the Granby river and on a hillside where tunnelling methods could be used to advantage. The hardness of the ore and adjacent rock will eliminate the necessity of timbering, which would reduce the cost of mining. The mineral contents of the ore, chiefly pyrite and silver sulphides in a gangue of silica, lend themselves particularly well to the oil-flotation treatment. A shipment of 28 tons of ore was sent to the Trail smelter early in the year.

A Memoir (No. 56) was written on the Franklin camp by the late Dr. C. W. Drysdale, of the Geological Survey of Canada, in which the geological conditions of the camp are dealt with in detail.

Maple Leaf.

This mine adjoins the *Union* group to the north and has been under development for some time by a stock company. Two car-loads of picked copper ore was shipped from the upper workings a few years ago, and it was discovered that the contents contained platinum up to 0.45 oz. to the ton, besides copper. This discovery did not create much interest at the time because there was not a very great demand for platinum, and unless there was a sufficient tonnage to supply one furnace at the smelter no payments for platinum would be received.

During the war the demand for platinum increased, and an examination of the *Maple Leaf* upper workings was made by the Munitions Board Commission of Ottawa, with the result that

platinum was found in conjunction with the copper ores, but that there did not appear to be sufficient tonnage blocked out or easily accessible to warrant further expenditure. It must be understood that platinum was needed by the Board at once, and the Board did not feel justified in spending the time to develop this property.

The surface excavations show copper sulphides in small segregations and in the fractures close to the contact of the pyroxenite and augite syenite. The pyroxenite rocks in this locality seem to be responsible for any platinum values that occur, and with the present price of platinum at about $85 an ounce it seems that if any development-work is done on the property it should be in the vicinity of the pyroxenite rocks, so that if a body of copper sulphides is uncovered the platinum values may be taken advantage of.

Most of the work has been done on the lower tunnel, where a freshet stripped the volcanic tuffs and showed native copper and carbonates in the fractures. A development-tunnel passed through this mineral zone and was continued in spite of the disappearance of the copper values. Probably the management hoped to strike the genesis of the native copper showing near the mouth of the tunnel. It seems probable that the copper in this case is of a secondary nature and its genesis should be looked for above. A contract for 100 feet of tunnel was let and completed during the year.

Gloucester and G.H.

The *Gloucester* and part of the *G.H.* claims, owned by Thos. Newby *et al.*, of Grand Forks, were diamond-drilled by the Provincial Government under the provision of the "Mineral Survey and Development Act." Drilling operations were commenced on the *Gloucester* claim on June 5th and finished on October 10th. A total of eight holes were drilled, aggregating 2,888 feet and varying in depth from 133 to 492 feet. The general type of the rock encountered was greenstone, cherty quartzite, and an altered tuff, which became intermingled with granodiorite on its contacts. All through this formation small veinlets were cut containing pyritohedrons of iron, with occasional segregations of hæmatite and specks of chalcopyrite.

On the *Gloucester* an old tunnel and shaft had developed a shoot of chalcopyrite about 4 feet wide and 25 feet long; drill-holes were bored under this showing with negative results. Other holes near the contact of the volcanic tuff and the augite syenite were drilled, also with negative results.

One hole was put down about 40 feet deep through the magnetite capping on the *G.H.* claim, which showed specks of chalcopyrite and a considerable amount of hæmatite and magnetite carrying small values in gold and silver. Another hole was started at a deeper angle under this outcrop, but was not finished owing to the contractor withdrawing his outfit.

North Fork of Kettle River.

Little Bertha.

Between 300 and 400 feet of crosscut tunnel has been driven on this claim under contract by Ab. Savage, of Grand Forks. No values have been developed up to the present time, other than a few mineralized stringers.

Rock Candy.

This property, owned by the Consolidated Mining and Smelting Company of Canada, was operated steadily throughout the year, except for an occasional shut-down on account of forest fires in the vicinity of the mine and a broken cable. Continuous development was carried on in the intermediate and lower tunnel (*see* map, 1919 report) on the strike of the deposit. The ore-body in the lower tunnel is split by small tongues of alkali syenite, which, though hampering the development-work, are being used for pillars to support the ground. The total drifting consisted of 427 feet and upraising 160 feet. The width of the deposit on the lower level averages about 25 feet and on the intermediate about 35 feet.

A new bunk-house was constructed at the mine and mill and a mill extension for a table addition consisting of two Wilfley and one Deister tables. A total of 22,673 tons of ore was mined and 19,730 tons of fluorite milled, giving 7,477 tons of concentrates. An average number of sixty-one men was employed at the mine and mill. The silica content constitutes one of the chief difficulties to be overcome, and the installation of the three tables was made with the idea of eliminating as much silica from the fines as possible. The concentrates from the tables are elevated and dumped into the hot product from No. 1 and No. 2 kilns, and thus most of the moisture is evaporated before screening.

COLTERN.

Emma. This mine is situated near the summit of the wagon-road between Grand Forks and Greenwood and is owned by the Consolidated Mining and Smelting Company of Canada. Operations were carried on for six months of the year, and 18,070 tons of low-grade copper ore was shipped, chiefly as a flux, to the copper-smelter at Trail. Development-work consisted of 131 feet of drifting and 62 feet of upraises. An average of thirty men was employed.

PAULSON.

Molly Gibson. The Molly Gibson Burnt Basin Mining Company, of Rossland, has developed this property in a small way during the year. The old shaft was sunk further and it is understood that a large ore-body was uncovered. Shipments amounted to 71 tons of ore carrying gold and a small amount of silver.

LIGHTNING PEAK.

Rampulo.—Development-work was advanced by the owner, A. Cortiana, on the lower tunnel and will be continued during the winter.

Equinox Group.—W. A. Calder shipped 6 tons of ore to Trail from the *Lightning Peak* claim of this group, carrying some silver and high values in lead.

CHRISTINA LAKE.

Fife Lime-quarries.—These quarries are situated near Christina Lake and are owned by the Consolidated Mining and Smelting Company of Canada, which uses the material mined as a flux in the smelter at Trail. A total of 22,338 tons of lime-rock was shipped.

GRAND FORKS.

Yankee Boy.—This property was leased by W. Bailey *et al.*, of Eholt, and 10 tons of ore shipped to the smelter, carrying values in gold, silver, and lead.

Granby Smelter.—The Granby Consolidated Mining, Smelting, and Power Company's smelter is being dismantled at the present time. The total amount of matte and "clean-up" material sent to the Trail smelter was 594 tons, containing gold, silver, and copper.

GREENWOOD MINING DIVISION.

WALLACE MOUNTAIN.

The owners and lessees of the silver-lead properties on Wallace mountain, Beaverdell, were materially assisted by the high prices of silver early in the year and a fair profit was made, although wages and supplies were high and the mining of the ore-bodies expensive on account of extreme shearing and faulting.

Bell. The owners, Dunc. McIntosh and Pat. Crane, in the early autumn installed a small compressor and oil-engine at the mine. A motor-truck was purchased to haul the ore to Beaverdell and to bring in supplies. Several hundred feet of tunnels and open-cuts was driven and 264 tons of silver, gold, and lead ore was shipped to the Trail smelter.

Sally and Rob Roy. This group is owned by the Wallace Mountain Mines, Ltd., of Penticton, and the property was worked during the greater part of the year. Practically all the development was done on the *Rob Roy* claim, which adjoins the *Sally* on the north, and consisted of 1,106 feet of drifting, 198 feet of crosscuts, 75 feet of upraising, and 26 feet of sinking. An average of eighteen men was employed and 355 tons of ore shipped to the smelter, carrying silver, lead, and some gold. Ed. Nordman is in charge of the work.

Wellington.—James Sutherland, *et al.*, of Greenwood, leased this claim and developed some fairly high-grade silver-lead ore. Shipments to Trail smelter amounted to 25 tons of silver-lead ore.

Rambler.—The owner shipped 13 tons of high-grade silver-lead ore to the smelter at Trail.

Highland Chief. About twenty years ago this property was prospected by tunnels and open-cuts in an endeavour to discover some high-grade ore. In the summer of 1920 Ed. Maloney, of Penticton, developed a small lead of silver-lead that carried

sufficient values to make the property attractive. A short tunnel was driven on this lead and about 4 inches of ore uncovered. It will be necessary to uncover more of this grade of ore before the mine can be placed on the shipping-list.

Castor Frac.—This property lies to the east of the *Bell* and *Sally* mines and was leased by Geo. Hambly, R. Perry, and R. D. McKenzie, of Greenwood, and 38 tons of high-grade silver-lead ore shipped to the Trail smelter.

LIGHTNING PEAK.

Part of this camp lies in Grand Forks Mining Division.

Waterloo. This mine is situated near Lightning peak, about 12 miles in a straight line west of Edgewood, on the Arrow lakes. The owners, G. A. Rendall, Geo. Bong, and Chas. Hammersley, of Greenwood, spent a short time in the early spring and late summer breaking and sacking ore from the intermediate tunnel. The weather conditions were so bad that only 22 tons of high-grade silver-lead ore was packed out on horses. This property is an attractive one and only its distance from transportation hinders it from being a regular producer.

GREENWOOD.

Providence. The three-year lease held by Al. Morrison and D. McGillis, of Greenwood, expired on November 14th and work on this property ceased. The owners, represented by C. Madden, of Chicago, are considering the possibility of operating the mine themselves. Development-work for the year amounted to 250 feet of tunnels and 135 feet of upraising and the installation of part of the surface plant. Shipments to the smelter amounted to 945 tons of gold-silver-lead ore.

Skylark.—A lease was taken on this property by Duhamel & Bryant, of Greenwood, and 30 tons of ore carrying values in gold and silver shipped to the smelter. Three separate leads branching from the original *Skylark* workings were found about 25 feet to the east.

Crescent.—This property was leased by Geo. Thompson, of Greenwood, and 7 tons of ore carrying gold, silver, and lead was shipped.

Last Chance.—James Poggi, of Greenwood, leased this mine and shipped 26 tons of gold and silver ore. It is understood that most of the ore was picked from the old dumps.

CARMI.

Carmi.—The construction of the 75-ton concentrating plant commenced in 1919 has not been completed yet. It seems a pity that the money spent in attempting to construct a plant at a time when prices were very high and labour scarce was not used for developing some ore, which may be badly needed when operation starts.

PHOENIX.

Granby Consolidated Co.—The dismantling of the underground and surface plants at the mines at Phoenix was finished in the early autumn and the town is now practically deserted. Such tonnage as remained in the mine was distributed in such a way as to make the mining of it expensive, and this factor, together with the high cost of supplies and the falling price of copper, made profitable operation impossible.

The concentration of the remaining ores was considered by the company, and it was found that after an outlay of about $75,000 for a new plant, plus the expense of moving and installing some of the old crushers, etc., the cost would average about 18.70 cents a pound of copper produced. It is understood that about 600,000 tons of mixed ore distributed over a large area still remains in the mine.

OSOYOOS MINING DIVISION.

Horn Silver Mine. This mine, under the management of the Condit Bros., of Similkameen, continued active operations throughout the year. Development-work on the intermediate and lower tunnels amounted to 500 feet. While drifting in the lower tunnel the lead was lost in a slide near the surface on the slope of the mountain. A crosscut tunnel was driven about 50 feet beyond the slide and the lead again picked up, averaging about 4½ feet in width and containing values of 41 oz. in silver and 0.12 oz. in gold to the ton. There seems to be little possibility of a further disturbance of the

lead for several hundred feet, other than the usual step-faulting. The average number of seventeen men was employed and 1,523 tons of silver and gold ore shipped to Tacoma and Trail smelters.

Hedley Gold Mining Co.—This company worked the mine and mill until the autumn, when operations ceased on account of conditions which cut down any margin of profit to a minimum. It is probable that some development-work will be done in the near future. The total tonnage milled amounted to 39,400 tons, carrying values in gold, silver, and arsenic.

Fairview Camp.

The high-power electric line between Princeton and Greenwood, now in operation, passes through this camp. With this means of acquiring power for operation purposes, it seems likely that the old *Stemwinder* and *Morning Star* groups of claims, which have lain idle for many years, will once more command attention. On the *Stemwinder* a shaft has been sunk for about 500 feet and crosscuts driven from this shaft to the vein. During the time of the writer's visit to this camp the old workings were filled with water, so no samples from underground could be taken nor an examination made, except over the surface. From some of the older reports when the mine was in operation it may be learned that the vein, which is mainly quartz, varies in width between 12 and 20 feet and carries values from $5 to $10 a ton in gold.

Formerly, a stamp-mill, concentrators, and cyanide plant were erected to treat the ores, but this plant has now been dismantled and sold for scrap. The vein can be easily traced for several hundred feet in the schist and quartzite. Two tons of concentrates was shipped in 1920 to the Trail smelter, having a total content of 6 oz. in gold, 102 oz. in silver, and 181 lb. of lead.

Morning Star Group.

This group consists of the *Morning Star*, *Diamond*, and *Star*, and is owned by Steve Maugot and Dan. McEachern, of Keremeos. The *Morning Star* adjoins the *Stemwinder* and was worked about the same time (1901). A considerable amount of development-work was done; i.e., a shaft 300 feet deep, open-cuts, and a short tunnel. The lead averages about 20 feet wide on the surface and contains free gold, mixed with lead and zinc (the zinc is gold-bearing) in a gangue of quartz and schist, stained with iron oxides. The values seem to vary between $5 and $12 to the ton. A thorough examination was impossible on account of the shaft being full of water. The surface showings are very persistent and can be traced for several hundred feet.

Copper King.—This property, near Olalla, was leased to A. Hagelberg by R. W. Northey and only assessment-work was done.

Golconda.—The development of this property, near Olalla, was carried on in the lower tunnel by the owners, McEachern Bros., with the idea of cutting the ore-body already developed in the upper workings. The ore is copper sulphides with a considerable amount of molybdenite.

Indiana and Fairview.

These claims have been staked by Joe Armstrong, of Chopaka, Wash., U.S., and are situated on the Indian reserve, about 14 miles below Keremeos. No development-work other than a little stripping had been done at the time of the examination. The lead, varying between 1 and 6 inches in width, contains native silver, pyrargyrite, argentite, and other sulphides of silver and iron in a gangue of quartz, and occurs as a fissure in the granitic rock. The vein, which is exposed for about 100 feet at the toe of a bluff, has evidently been badly fractured and its commercial value cannot be estimated until some development-work is done. A picked sample gave 0.02 oz. in gold and 82.50 oz. in silver to the ton.

Dallas.

This group of claims, consisting of the *Dallas*, *Independence*, *St. James*, and *Terminal City*, is situated about 6 miles from Keremeos, on the old Fairview-Keremeos wagon-road, and has been worked spasmodically by J. Patton, of Keremeos. The vein-matter is chiefly quartz containing small segregations of ore. The peculiar brass-yellow colour of the ore, together with its high gold content, probably places it amongst the tellurides. Unfortunately, as far as development shows, the segregations of mineral are somewhat rare. The vein is well defined and averages about 3 feet in width in a schistose formation.

Hidden Treasure Group.

This group adjoins the *Dallas* claim and is owned by J. Pitman, of Oroville, Wash. Several large and well-defined quartz veins have been prospected by tunnels and shafts, and at the time of writing this report only low values in gold and silver had been found. The country-rock is schist.

Prince. This claim is situated on the west side of the Ashnola river, about 5 miles up the river from the Great Northern Railway, and is owned by Dunc. Campbell and Thomas, of Keremeos. The lead occurs as a fissure and is mainly quartz, varying in width between ½ and 18 inches, and carries values in lead and silver. The country-rock is greenstone and quartzite, intruded by porphyry dykes.

Rawhide. This claim was staked many years ago, about the time the *Nickel Plate* mine was discovered, and a few open-cuts were put in on the pyrrhotite capping. Only low values were recovered. Nothing was done on the claim until recently, when a tunnel 15 feet long was driven under the capping, which developed a mineralized zone carrying chalcopyrite and some gold values in a gangue of quartz and calcite. The location of the claim is approximately 9,000 feet in a north-westerly direction from the town of Hedley, on the west side of 20-Mile creek.

Silver Crown, Silver Leaf, and North Pole. These claims are situated close to Osoyoos lake, adjoining the International Boundary-line, and are an extension of the *Submarine* group (now in litigation), located in the United States. The owners are Al. Hagelberg and Paul Nelson, of Oroville. A bond has been given to the Southern Minnesota and Oroville Mining Company. On the *Silver Crown* a tunnel 80 feet long has been driven, developing streaks of silver, lead, gold, and copper ore, and one vein about 4 feet wide. The values seem to be divided amongst these minerals, which makes the ore rather complex. The walls of the lead have not been discovered in this tunnel, but a surface estimate places them at about 20 feet apart. Another tunnel has been driven 20 feet and a shaft commenced at the end of the tunnel in an endeavour to find the foot-wall. The small streaks in this tunnel carry high values in silver and 0.50 oz. in gold to the ton.

The vein-matter is composed of crushed biotite granite and the streaks of ore are so intermingled that it is impossible to sort it. A concentration plant will probably be necessary. The strike of the vein is in an easterly and westerly direction and the dip nearly flat, a little west of north.

White Lake Coal-Basin. This basin is situated on the western side of the Okanagan valley, about 6.5 miles in a south-westerly direction from Okanagan Falls, in Township No. 53. About twenty years ago some shafts were sunk in the centre of the basin and a narrow seam mined for coal, which was used for blacksmithing purposes at Fairview. Very little information is available concerning the quality of the coal or size of the seam, except that it was of a bituminous nature. The area of the field is about 6 square miles, which includes nearly all the low-lying lands in the basin. The property is owned by R. Hookham and Reynolds, of West Summerland.

The development-work done upon the coal-beds consists of open-cuts and shallow shafts and one shot-drill hole about 35 feet deep. One old shaft filled with water is said to be about 100 feet deep. Samples were taken of the cleanest coal from four different locations.

No. 1 seam, about 14 inches wide; No. 2 seam, about 24 inches wide; No. 3 seam, about 40 inches wide; and No. 4 seam, about 30 inches wide, were sampled and analysed as follows:—

Contents.	No. 1.	No. 2.	No. 3.	No. 4.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture	6.1	8.6	8.0	12.5
Volatile and combustible matter	23.5	27.5	21.6	18.6
Fixed carbon	57.3	52.8	41.3	55.9
Ash	13.1	11.0	29.1	13.0

The nearest railway point is Penticton about 12 miles distant on Okanagan lake at an elevation of approximately 900 feet lower than the basin-rim. The main wagon-road from Fairview to Penticton runs through the property.

Coal-bearing rocks cover the area of the basin and consist of tufaceous sandstones and true tuffs, shales, conglomerates, breccia, and thin seams of coal. The beds are probably about 2,000 feet in thickness, unless there has been some slipping and faulting, which would cause a duplication. Both the sandstones and shales contain a great many plant remains, and the age, from a small selection of these, was placed as Oligocene.

An examination of the possible coal area was confined to the surface, with the exception of a few open-cuts and two shafts about 25 feet deep, which rendered it very difficult to make any definite statement regarding the commercial value of the field. The coal wherever exposed was dirty, which is probably due to descending waters and its proximity to the edge of the field. The analyses show a high percentage of ash and moisture which may disappear at depth. The coal is bituminous and, if larger and cleaner seams can be developed, should find a ready market.

Owing to the volcanic activity, which evidently took place after the deposition of the coal, it is possible that there may be a considerable amount of faulting, which might have carried a contaminating matter into the coal-beds. The analyses of the samples taken from a moisture and ash standpoint is not attractive, and it seems advisable for the owners to develop, if possible, a cleaner coal before taking the matter up with capital.

The cost of drilling would probably be between $3 and $4 a foot at the present time and it seems the cheapest way to develop the property. A drill-hole near the centre of the field dipping to cut the formation at right angles and well away from any igneous intrusions might be suggested, as there would be less chance of contamination from dirt and water.

SIMILKAMEEN MINING DIVISION.

Canada Copper Corporation, Copper Mountain.—The electric power from the South Kootenay power plant at Bonnington Falls and Cascade was supplied to the mine on Copper mountain on October 19th. Sixty thousand volt current is delivered at the mine sub-station and transformed to 2,200, 550, and 110 volts.

The machinery now installed comprises the following: One Rand duplex cross-compound compressor of 3,000 cubic feet capacity, driven by a 2,200-volt, 600-horse-power motor with a rope-drive; one Rand duplex compound compressor of 2,500 cubic feet capacity, driven by a 2,200-volt, 400-horse-power motor with rope-drive; one Rand cross-compound compressor of 1,000 cubic feet capacity, driven by a 2,200-volt, 150-horse-power motor, belt-driven; total capacity, 6,500 cubic feet a minute. A 14 by 20 Jencks geared hoist installed at the Main shaft; two motor-generator sets, 150 k.w., 250 volts, D.C., for trolly system and hoist at railway-tram; one 200-horse-power, 2,200-volt motor at the crushing plant, which operates one 42- by 36-inch Farrel-Bacon jaw-crusher and two No. 6 McCully gyratory crushers; two No. 10 and one No. 15 volt motors which run the conveyor-belt, Ross grizzlies, and the shuttle conveyor; one 550-volt, 100-horse-power motor at the river pump which is used to supply the plant and town with water. All this machinery, except the small compressor and river pump, was installed in 1920 and all the necessary pole-lines, etc., run.

The underground work was carried on with a few men all the year until October 18th, when the crew was increased preparatory to active operations. Before the power arrived 10,000 feet of 30-inch-gauge track was laid underground and at the tunnel portals. The haulage system consists of 7,700 feet of trolly-lines.

Four 7-ton Baldwin-Westinghouse locomotives are used to haul the ore-cars to the crushers. The mine-cars are of the Granby type, having a capacity of 130 cubic feet. Underground development was confined to manways and totalled 228 feet. Twelve new cottages were built for the employees.

The mine closed down on December 9th owing to the impossibility of operating successfully on 13-cents-a-pound copper.

Canada Copper Corporation's Mill, Allenby.—The mill started running shortly after operations commenced at Copper mountain. A few changes were found necessary in the flotation plant and the addition of another crusher on account of the extreme hardness of the ore. It is understood that good results were obtained during the short time the mill was in operation. Unless the price of copper advances or the cost of operation decreases, it will be some time before the mine and mill commence to operate.

Copper Farm. This mine is situated about 4 miles from Princeton, on the Similkameen river. The owners have installed a compressor and boiler and have built a new bunk-house and kitchen. It is the intention of the management to drive the lower tunnel ahead 100 feet and connect the intermediate and lower workings with a raise. The lead in the intermediate tunnel is small, but carries good values in copper.

Knob Hill Group. This group is situated on the west side of the Roche river, about 16 miles from the end of the Trans-Provincial highway. In driving a crosscut to develop an outcrop, the owners, John Broman *et al.*, of Princeton, cut an

entirely new ore-body about 10 feet wide and well mineralized with chalcopyrite and chalcocite in a gangue of calcite and quartz. The ore seems to occur as a lens in the schist and is lying parallel to the outcrops of what appears to be another lens. Future development of this claim is looked forward to with interest.

Red Star. Situated on Roche river. Development-work during the year was continued on the lower crosscut, showing no change of ground. The owners expect to cut, in another 20 feet, the lead showing in the upper workings. Both the *Red Star* and *Knob Hill* claims give promise, and should the Trans-Provincial highway be built it is probable that both these claims will develop into shipping mines.

Lucky Pair Group. This group, owned by Chas. Day, comprises four claims—*Lucky Pair*, *G.O.P.*, *Moon Winks*, and *Day & Night*—and is situated on Whipsaw creek, about 22 miles south-west of Princeton. Several open-cuts have been excavated and a good deal of stripping done, and a tunnel 492 feet long has been driven near the bottom of the hill. The open-cuts show segregations of lead carbonates and a considerable amount of iron-stain through the schist. The tunnel was driven on a lead varying in width from 3 inches to 1 foot and carries values up to 6.60 oz. in silver, 10 per cent. lead, and 8.5 per cent. zinc.

S. & M. Group. These claims are approximately 21 miles from Princeton, on the north-west side of Whipsaw creek. The owner, Sam Spencer, has done a lot of development-work near the surface in the fractured zone, which is heavily stained with iron oxides and some lead carbonates, with a few nodules of galena scattered through the crushed rock. These nodules of galena carry high values in silver and lead. It seems probable that the original lead has been crushed and leached, causing an extensive discoloration of the surrounding schist. Until the vein is found in-place the owner will probably have difficulty in attracting capital.

Marion Group.—This group, situated on Whipsaw creek, was reported upon by W. M. Brewer in 1916, and since that time development-work has not opened up any new bodies of ore.

Princeton Coal & Land Co.—This company operated steadily throughout the year on its coal properties at Princeton. The total tonnage amounted to 20,717 tons.

Coalmont Collieries, Ltd., Coalmont.—During the year this company, under the management of Donald McLean, developed the coal areas on its property situated about 2.82 miles south-west of Coalmont, on the Kettle Valley Railway. A new opening was made at the mine and the old one extended along the seam for several hundred feet. This seam averages about 10 feet in thickness, dipping in a southerly direction on an incline of about 18°. A new bunk-house was built for the miners.

The aerial tram, approximately 15,000 feet long, having a capacity of 60 tons an hour, was installed between the mine and the railway. A tipple and Marcus screens were built at the terminal, also a plant to generate electric power for the mine and town. The company expected to commence operations about the end of the year.

Tulameen Placers.—Chas. F. Law employed three men on the old *Swan* placers near the mouth of Slate creek. An old shaft was unwatered and retimbered and a new tunnel driven in the face of the bluff in an attempt to strike bed-rock.

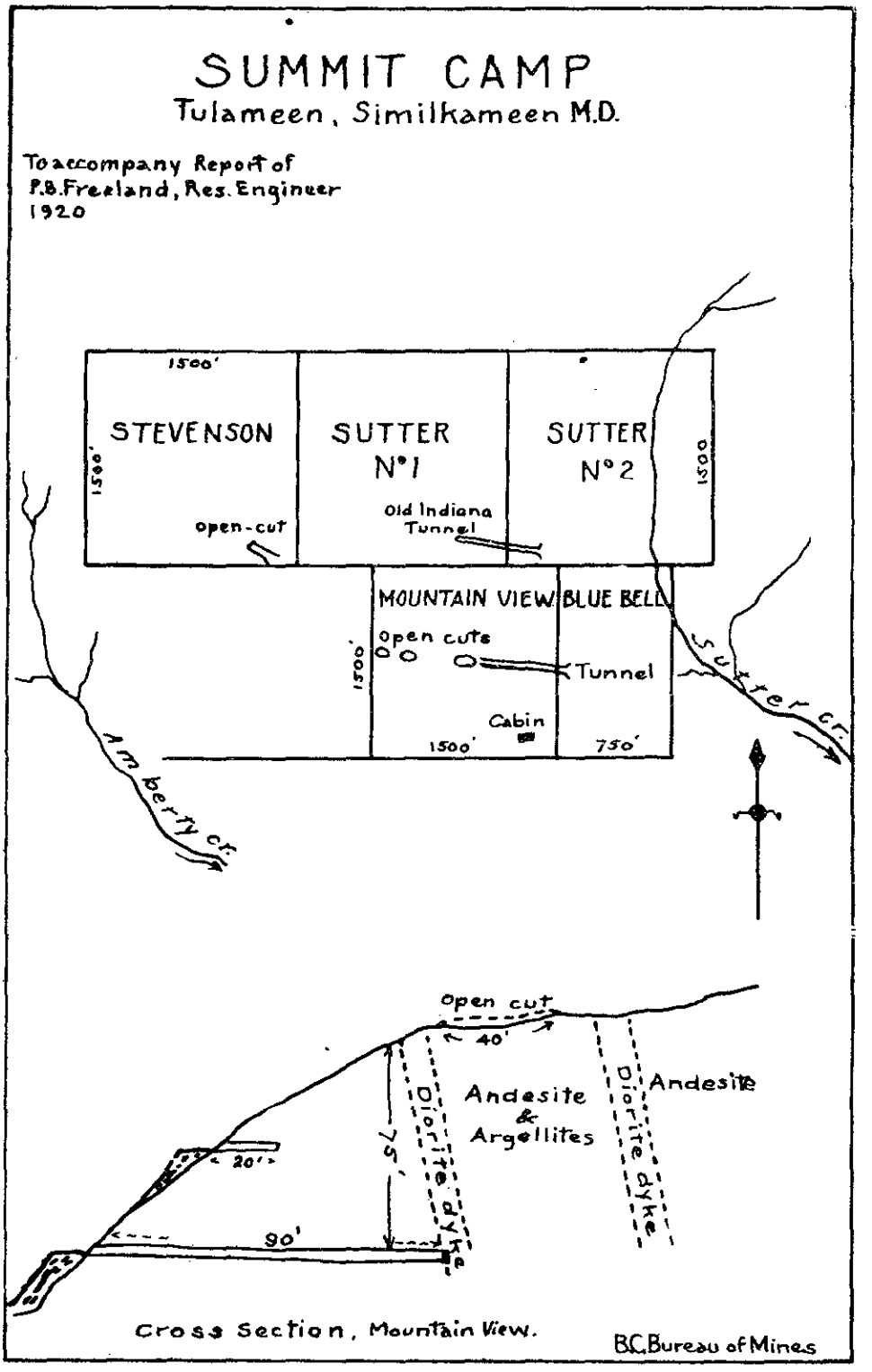
Other parties worked on the Tulameen River placers, the results of which are not to hand.

Summit Camp. This camp is situated near the divide between the Tulameen and Coquihalla rivers, on the headwaters of Sutter and Amberty creeks. W. H. Hess, of Tulameen, acquired the *Mountain View*, *Blue Bell*, *Sutter No. 1* and *No. 2* claims from Andy Jensen, of Tulameen. A good deal of surface prospecting was done and the lead traced for about 1,500 feet on the *Mountain View* before any underground work was undertaken. A tunnel is being driven under the outcrop which will give a depth of about 75 feet. The outcrop in the open-cuts shows oxides and carbonates of iron, also sulphides of iron, as well as calcite, manganese oxide, and some cubes of galena. A picked sample from this showing gave 22 per cent. lead and 40 oz. in silver to the ton.

The first 40 feet of tunnel was mineralized with iron and zinc sulphides, which changed to calcite, quartz, and iron carbonates. The lead strikes in an easterly and westerly direction and dips to the north. The country-rock in this vicinity seems to be andesite intermingled with slates and limestones and cut by a series of dioritic dykes.

Rock Candy Mine—Workings.

Rock Candy Mine—Sorting-house.


SUMMIT CAMP
Tulameen, Similkameen M.D.
To accompany Report of
P.B. Freeland, Res. Engineer
1920
1500'
STEVENSON
SUTTER N°1
SUTTER N°2
1500'
1500'
open-cut
Old Indiana Tunnel
MOUNTAIN VIEW
BLUE BELL
Open cuts
Tunnel
Cabin
1500'
750'
Amberly cr.
Sutter cr.
Open cut
40'
Andesite & Argellites
Diorite dyke
Andesite
Diorite dyke
75'
20'
90'
Cross Section, Mountain View.
B.C. Bureau of Mines

A new log house 16 by 18, a kitchen 12 by 18, a barn 12 by 14, a blacksmith-shop 12 by 12, and a 14 by 30 snow-shed over the mouth of the tunnel have been built.

Future development of these properties is looked forward to with great interest, for in other parts of the camp several strong leads of silver-lead and zinc have been partially developed, but nothing done to try and place the camp on an operating basis.

BOUNDARY DISTRICT.

GREENWOOD MINING DIVISION.

REPORT BY W. R. DEWDNEY, GOLD COMMISSIONER.

I have the honour to submit my annual report on mining operations in the Greenwood Mining Division for the year 1920.

NEAR GREENWOOD.

Providence.—This mine shipped 945 tons of lead ore to the Trail smelter, containing 578 oz. gold, 148,613 oz. silver, and 32,479 lb. lead; the gross value being about $141,000. The average number of men employed during the year was thirty-one monthly. The mine was leased to A. J. Morrison and Dan McGillis by Mark Madden and associates, of Chicago; the lease expired in November. The owners are preparing to resume operations.

Elkhorn Fraction.—Owned by R. D. McKenzie. A shaft over 20 feet deep has been sunk on the property with the intention of striking the ore extending from the 400-foot level of the *Providence* mine. Mr. McKenzie expects to reach solid rock at a depth of 50 feet, the shaft being in wash and gravel.

WALLACE MOUNTAIN, NEAR BEAVERDELL.

Bell.—Operated by Duncan McIntosh and Pat Crane. Some 264 tons of ore was shipped to the Trail smelter during the year, containing 4 oz. gold, 60,881 oz. silver, and 32,040 lb. lead. The development consisted of drifting 684 feet. An engine-house, blacksmith-shop, and garage were built and a 50-horse-power oil-engine, air-compressor, and air-drills installed; also a 1½-ton motor-truck bought.

Sally.—The development-work amounted to 1,405 feet and 355 tons of ore was shipped to the Trail smelter, with a total silver content of 73,620 oz. Some 45 tons of high-grade ore was in the bins at the end of the year. On the whole, the company, the Wallace Mines, Limited, had a very successful year and the mine is in splendid condition at the present time. Owing to the heavy drop in the price of silver and the high cost of supplies and labour the crew was reduced more than one-half. As soon as these matters are adjusted a full force of men will be put to work.

LIST OF MINES.

The following is a list of mines in the Greenwood Mining Division from which ore was shipped to the Trail smelter during the year:—

	Tons.
Providence, Greenwood	945
Bell, Beaverdell	264
Sally, Beaverdell	355
Castor Fraction, Beaverdell	38
Canada Copper Corporation, Greenwood	20
Crescent, Greenwood	7
Last Chance, Greenwood	26
Kokomo, Beaverdell	1
Napanee, Beaverdell	1
Rambler, Beaverdell	12
Skylark, Greenwood	30
Sunnyside, Rock creek	3
Wellington, Beaverdell	25
Waterloo, Lightning Peak camp	23

OFFICE STATISTICS—GREENWOOD MINING DIVISION.

Locations	37
Certificates of work	90
Free miners' certificates issued	84

Free miners' certificates issued (special)	1
Filings	10
Abandonments	3
Bills of sale recorded	9
Permits to search for lode	3
Powers of attorney	7
Certificates of improvement	1
Certificates from Department of Mines	2
Rerecords of placer claims	2
Placer leases granted	5
Layovers	2
Claims leased under "Taxation Act Amendment Act, 1916"	48

Under the "Taxation Act Amendment Act, 1916," the *Tam O'Shanter* claim was leased to A. J. Morrison, *formerly lessee of the Providence mine. This property is in Deadwood camp* and the results obtained from development so far are very encouraging.

GRAND FORKS MINING DIVISION.

REPORT BY S. R. ALMOND, GOLD COMMISSIONER.

I have the honour to submit the annual return of the office statistics of the Grand Forks Mining Division for the year 1920, as below.

As the mining industry in this Division will be covered in the report of the Resident Mining Engineer for the Southern District (No. 4), there will be no need of a report on this head from the Gold Commissioner.

OFFICE STATISTICS—GRAND FORKS MINING DIVISION.

Free miners' certificates	96
Locations	43
Certificates of work	93
Bills of sale	18
Abandonments	2
Filings	10
Certificates of improvements	2
Crown-grants	2
Leases of reverted claims	8
Above since Crown-granted	3

OSOYOOS MINING DIVISION.

REPORT BY JAS. R. BROWN, GOLD COMMISSIONER, FAIRVIEW.

I have the honour to submit the annual report on mining operations in the Osoyoos Mining Division, Yale District, for the year 1920.

I regret that for the year there has been but little improvement in mining matters. There has been a sale and some exploiting of an asbestos property near Okanagan Falls and a new strike near Hedley. On the other hand, the *Nickel Plate* mine at Hedley has closed down.

OFFICE STATISTICS—OSOYOOS MINING DIVISION.

Locations	102
Certificates of work	128
Conveyances	28
Free miners' certificates	190

SIMILKAMEEN MINING DIVISION.

REPORT BY HUGH HUNTER, GOLD COMMISSIONER.

I have the honour to forward the mining statistics of this office for the year 1920.

OFFICE STATISTICS—SIMILKAMEEN MINING DIVISION.

Free miners' certificates	212
Location records	93
Certificates of work	246
Bills of sale	18
Certificates of improvements	19
Record of placer claims	9
Leases of placer claims	1
Powers of attorney (placer)	8

CENTRAL DISTRICT (No. 3).

REPORT BY R. W. THOMSON, RESIDENT ENGINEER.*

INTRODUCTION.

The Central Mineral Survey District (No. 3) comprises the seven Mining Divisions of Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale.

The mineral production of the Central District for the year has had a considerable proportional decrease as compared with 1919. The only minerals in which increased production is recorded are coal and magnesium sulphate (Epsom salts).

The following table gives the mineral production for 1920, with corresponding figures for 1919:—

	Production, 1920.	Production, 1919.
Gold, lode (oz.)	372	3,158
Gold, placer (oz.)	225	475
Silver (oz.)	1,982	9,252
Copper (lb.)	260,808	556,681
Lead (lb.)	2,720	34,059
Coal (tons)	120,031	116,660
Magnesium sulphate (crude) (tons)	1,800	200

The decrease in the gold-output is almost entirely due to the closing-down of the *Pioneer* mine in the autumn of 1919.

Although there are no important silver-mines in the District, the *Mary Reynolds* mine, near Stump Lake, shipped over 6,000 oz. of silver during 1919; also the *Queen Bess* mine, on the North Thompson, produced about 1,000 oz. from silver-lead ore. Neither of these mines have been operating during the year 1920.

The decrease in the copper-output is accounted for by the closing-down early in the year of underground work at the *Iron Mask* mine, this being the principal producer of metalliferous ore in the district.

Lead.—The principal producer during 1919 was the *Queen Bess* mine. This, as stated above, has not been operating during 1920.

Coal.—This has maintained its production and showed a slight increase over 1919. Practically the whole output is from the Nicola coalfields in the vicinity of Merritt.

Increasing activity has developed during the year in the production of magnesium sulphate. The shipments from the Clinton lake were sent to Oroville, Wash., for treatment; those from Basque were sent, some to the Eastern market direct, and some to Vancouver for cleaning in the company's refining plant there.

The production to date of this district as a whole is small compared with the total production of the Province, but the outlook for the future is most promising, considering the potential resources as indicated by the results of prospecting-work being carried on. Geologically, the district is highly favoured so far as range of formation is concerned. In the eastern part of this district there are exposures of the Pre-Cambrian rocks in the Shuswap terrain which have scarcely yet been scratched. The northern central area, consisting largely of an elevated plateau is largely composed of ultra basic volcanic rocks not favourable generally to the deposition of valuable metalliferous ores. Development has been proceeding, however, on occurrences of hydromagnesite, magnesium sulphate, sodium carbonate, also chromite, and there is no doubt that some of these will develop into successful commercial propositions. It may be mentioned here that there are possibilities in this north-central area in the way of discoveries in the line of the semi-precious stones. Hyalite, a form of opal, but colourless and of little commercial

* *Note by the Provincial Mineralogist.*—Owing to a rather serious prolonged illness Mr. Thomson has been unable this year to write his usual annual report on his district. Mr. Thomson's Preliminary Report (with production figures revised) has therefore been republished as his annual report, together with a brief report on the Government work at the *Snowstorm* group, Ashcroft Mining Division, by Allan K. Stuart, superintendent, and a report on the *Emancipation* group by the Provincial Mineralogist.

value, is known to exist in considerable amounts in the vicinity of Hihium lake. Specimens of turquoise of commercial grade have been found by Geo. McDonald, of Kamloops, but, as the district in which they were found is very difficult of access, nothing has been done in the way of further investigation since the discovery was made.

In the west, south, and east of the district, where the granitic intrusives have reached their greatest development, we have the occurrences of the more pronounced metalliferous ores, the mineralization occurring not only in the granite, but also in the overlying volcanics and sedimentaries. I shall only mention here a few of the promising areas on which work is being carried out, giving more detail in the later descriptions under the heads of the respective Mining Divisions. The Taseko (Whitewater) limonite-deposit reported on by Wm. Brewer in 1919 has been investigated more fully by the Department of Mines during the present year. The Canadian Geological Survey also had a party under J. D. MacKenzie making a geological survey of this particular district. Assessment-work only has been carried out in the Gun Creek and Tenquille Creek areas. The Cadwallader Creek gold area has been very quiet during the past year. The 23-Mile camp on Skagit river, south of Hope, continues to show increasing indications of large bodies of copper, ore and galena, also small high-grade silver ore. The Ladner Creek-Siwash Creek gold-bearing argillite-belt has had considerable prospective value added to it as a result of work done by the Liberator Mining Company, Limited, operating the *Emancipation* mine. As this belt extends from north of the Fraser river south-easterly across Siwash creek, the Coquihalla river, and 23-Mile camp to beyond the International Boundary on the Skagit, there should be some potential importance accruing to the Hope vicinity as a future supply-point for mining requirements.

An area which should prove of considerable interest is that lying to the south-west of North Barriere lake. The country-rock surrounding the north half of the lake is granite; that surrounding the southern half is a schist, the contact between the two running in a north-westerly direction.

The Government work being carried out in the Highland valley has shown that a very large area of mineralized ground exists in the vicinity, the boundaries having not yet been fully determined. (*See* report following by A. K. Stuart.)

CLINTON MINING DIVISION.

Magnesium Sulphate (Epsom Salts) Lake.—About 1,000 tons of crust was shipped in the early part of the year from Clinton to Oroville, Wash., for treatment.

Watson Bar Creek Placer.—It is estimated by the Gold Commissioner, Clinton, that $2,000 of gold was taken out during the season.

Goodenough Lake (Carbonate of Soda).—This lake lies just to the west of Meadow lake, about 24 miles from the 59-Mile House, Cariboo road. Work largely of an experimental nature has been going on all summer under the direction of Mr. Silverton, of Vancouver, for the purpose of finding the most efficient method of producing the sodium carbonate in crystal form.

Taseko (Whitewater) River Iron-ore Deposits.—F. J. Crossland, under instructions from the Department of Mines, has been carrying out investigations in this limonite area during the summer. J. D. MacKenzie, of the Canadian Geological Survey, with his party, also spent the season in this vicinity.

LILLOOET MINING DIVISION.

Little of importance has taken place in this Division during the year.

In the Cadwallader Creek area the *Pioneer* mine has remained closed.

The *Lorne* mine has continued development in a small way and produced a small amount of gold from development-work.

The *Wayside* and *Ida May* also did some development-work.

Aid to Prospecting by Returned Soldiers.—Two parties of two men each worked in this Division during the season. One party operated in the vicinity of the headwaters of McGillivray and Cadwallader creeks; the other in the vicinity of the headwaters of Cayoosh and Texas creeks. No particularly interesting discoveries were reported, although some claims were staked.

Copper Mountain, Gun Creek.—Assessment-work only has been carried out on this property during the year.

Tenquille Creek Area.—Assessment-work on the several properties in this area has been carried out.

KAMLOOPS MINING DIVISION.

Iron Mask.—Underground operations were suspended in this mine during the early part of the year, but a considerable force of men has been kept at work repairing, making additions to surface plant, and putting in a plant to pump water from the Thompson river to the mine. The main shaft has been retimbered; new concrete foundations to the head-gear put in, and the head-gear practically rebuilt; a new belt-conveyor from head-gear to mill installed and increased storage for treatment liquids provided. Work is proceeding on the pumping plant previously mentioned.

Chu Chua Coal Mining Syndicate.—Trustees, W. H. Glass, 1507 North Thirty-ninth street, Seattle, Wash., and H. W. Schuett, 400 Central Building, Seattle, Wash.; local secretary, C. E. Max, Kamloops, B.C. This syndicate has secured options on approximately 5,000 acres of coal lands about 2 miles south of Chu Chua. A compressor operated by a 50-horse-power steam plant has been installed, a road built to a siding on the Canadian National Railway slightly over a mile away, and camp buildings erected to accommodate about twenty men. Production has been started, working on a 3-foot seam of coal. About 307 tons was produced by the end of the year.

Lynx.—Situated about a mile south-westerly from North Barriere lake; owner, Charles Loucks, Barriere. The country-rock surrounding the north half of the lake is granite; that surrounding the southern half is a schist, the contact between the two running in a north-westerly direction. Two samples were taken from a short tunnel on the property which gave small results in copper and silver. The mineralization continued underneath the section sampled, as the face and bottom of tunnel were all in mineralized ground.

On the *War Colt* group and others in the Thunder creek vicinity considerable work was done during the summer with very encouraging results, but the distance from transportation prevents work being conducted on an extensive scale.

ASHCROFT MINING DIVISION.

Basque Chemical Production Company.—J. G. Miller, manager, 415 Bank of Nova Scotia Building, Vancouver; operating Epsom Salts lakes near Basque. The management is working up a market that augurs well for the success of this company. Approximately 800 tons has been shipped during the year, part of which was treated in their refining and classifying plant in Vancouver.

Snowstorm Group, Highland Valley.—During the past season work has been confined to surface operations on the *Iona* sub-group as a preliminary to drilling operations. As the work of test-pitting advanced the area of mineralized ground continued to increase until an area approximately 1,000 feet across and 3,000 feet in length has been proven to exist. Surface values vary from roughly 0.5 per cent. copper to 2 per cent., with the lower values predominating. The averages from a few pits run as high as 6 and 10 per cent.

On Deadman creek there are some large deposits of diatomaceous earth of good quality.

NICOLA MINING DIVISION.

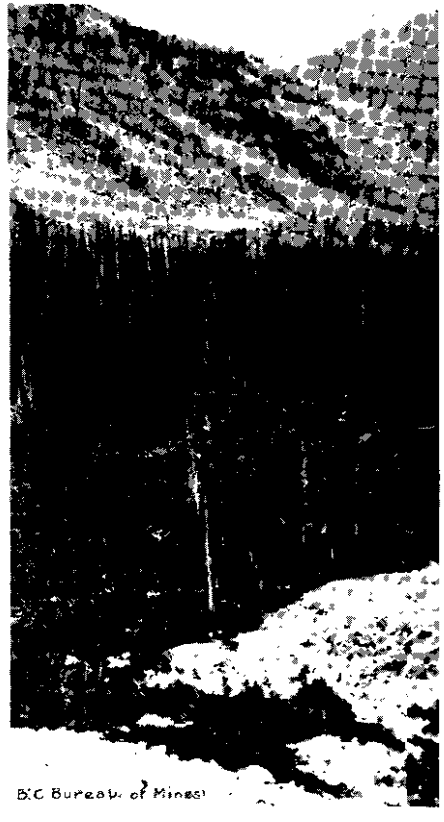
The principal output from this Division continues to be coal. The Middlesboro Collieries and the Fleming Coal Company have both been operating steadily during the year.

STUMP LAKE AREA.

Donohoe Mines, Ltd., Stump Lake.—This company operated the *Joshua* mine during the early part of the year, shipping 62 tons of ore, but closed down again during the latter part. This was the only property operating in the Stump Lake area this year.

ASPEN GROVE.

Some diamond-drilling was carried out in the southern part of this camp early in the year, but the results were not particularly encouraging. The same interests, however, which held an option on the field last year have turned their attention to the northern part, and intend doing some drilling in this section at an early date.



Views on Texas Creek, Lillooet M.D.

Bentonite.—This is a material of rather unusual occurrence. There is a deposit of this near Quilchena associated with the coal formation. In appearance it is a light-buff coloured, fine-grained, compact rock with a structural appearance which might be described as being between a hard clay and a chalk. When water is added it breaks down into a slimy mud. It is locally known by the name of soap-clay. There is an occurrence of this in Wyoming, where it is being worked on a commercial basis, the material being used largely in the manufacture of paper as well as in the manufacture of certain kinds of cloth.

The following description of "bentonite" is taken from Memoir No. 25 of the Canadian Geological Survey, being a report on "The Clay and Shale Deposits of the Western Provinces," Part II., by Heinrich Ries and Joseph Keele:—

"On the Triangle ranch near Quilchena we found some outcrops of coaly shale and *bentonite.* These outcrop on the lower slopes on the west side of a north-south valley, which is rimmed in by volcanic rocks. The coal-measures strike N. 10° E. and dip 30° S.E., and at a point where an opening was made in search of coal the limited section shows:—

	Feet.
Coaly shale	..
Concealed	10
Bentonite	3
White clay, probably dried bentonite	6
Coaly shale	6
Concealed	..

"The bentonite is dense, with a greasy look and conchoidal fracture. The bed below it is similar in structure, but is white and chalky-looking, and is probably the same material which has dried out on exposure to the sun.

"The bentonite has strong absorbent properties, and this particular sample required a high amount of water to work it up into a plastic mass. It is of no value for brick-making.

"As an experiment a sample of it was mixed with sand in the proportion of 1 to 3, and gave a fair bricklet whose air-shrinkage was 5 per cent. The fire-shrinkage at cone 010 was 0 and the absorption 14.4 per cent. It burned light red.

"The white clay occurring under the bentonite (1776) forms a very stiff plastic mass of soap-like character when wet and cracks badly in air-drying. It therefore behaves similarly to the bentonite.

"The air-shrinkage is high—viz., 12.3 per cent.—and the clay is not of commercial value for the manufacture of clay products. It may be remarked, however, that at cone 5 it burned to a body whose absorption was 5.9 per cent., but is not fused at cone 15.

"Bentonite has been used in the manufacture of soap, as a packing for horses' hoofs, as a diluent for certain powerful drugs sold in powdered form, and as an adulterant of candy. It is also said to have been used in the manufacture of antiphlogistine, and makes a good retarder for cement plasters. Its chief use perhaps has been for filling paper."

VERNON MINING DIVISION.

There has been little doing in this Division in the way of metalliferous production. A company has been formed, however, for the purpose of working up the clay-deposits which exist at Okanagan Landing. It is organized as the Lakeside Clay Products, Limited; manager, Louis J. Ball, Vernon.

During the summer a plant has been installed for the commercial production of brick and some kilns fired. It is the intention of the company to go into the manufacture of drain and hollow tile as soon as developments warrant.

The Enderby Brick and Tile Company made 331 M. bricks during 1920.

YALE MINING DIVISION.

The principal development in this Division during the year has been the operations carried out by the Liberator Mining Company, Limited, operating the *Emancipation* mine; Dr. E. T. Hodge, consulting engineer; Bradford W. Heyer, secretary-treasurer, 1522 Standard Bank Building, Vancouver.

A 50-horse-power Fairbanks-Morse oil-engine and compressor has been installed near the Kettle Valley Railway track, where a siding has been put in. An air-pipe line 3,700 feet in length connects the power-house with the mine, where two drills are being used for development

and stoping purposes. Ore is being sacked for shipment, and results of development indicate increasingly large reserves of ore of a milling grade which is being left in the mine.

The encouraging results of this work mean much for the whole of the Ladner Creek properties.

The following report on the *Emancipation* mine was made by W. Fleet Robertson, Provincial Mineralogist, dated August 28th, 1920:—

"The *Emancipation* group is situated on the south-eastern slope of Emancipation mountain, about 1¼ miles east of Jessica, a station on the Kettle Valley Railway 15 miles east of Hope.

"The property consists of thirteen mineral claims, covering a strip of country from the bank of the Coquihalla river north-westerly up the mountain to about the summit and crossing the track of the railway.

"The Coquihalla river here is at an elevation above sea-level of about 1,330 feet; the railway-tracks are at an elevation of 1,460 feet, while the main workings on the property are some 1,200 feet above the railway-tracks.

"The slope of the mountain averages about 30° and is heavily timbered. An aerial tram 3,000 feet long would convey ore from the mine to the railway siding.

"*History of the Property.*—As near as I can gather, the claims were originally staked by Mike Merrick and partners, prospectors, who did considerable work on the property and shipped some ore very rich in gold under the name of Emancipation Mining Company.

"The mine has been under bond to various parties and is now under bond to the Liberator Mining Company, of Vancouver (capital $1,000,000), of which A. H. McNeill is president; B. W. Heyer, director and secretary-treasurer; and P. L. Lyford and E. M. Jamieson, directors. Dr. E. T. Hodge is consulting engineer, and Thomas H. Kerruish, manager.

"The bond from the Emancipation Mining Company calls for an allotment of 10 per cent. of capital stock to seller, and payments of $5,000 in December, 1920; $5,000 in June, 1921; $10,000 in June, 1922; and $40,000 in June, 1923.

"The Liberator Mining Company is at present raising $50,000 by the sale of 200,000 shares of treasury stock; such money to be entirely spent on development-work.

"*Geology.*—The property is in a district of highly altered sedimentary rocks cut by various dykes and very closely adjacent to the Coast granites. Locally, in the vicinity of the claims, the dominant feature geologically is a large feldspathic dyke, said to be 1,000 feet wide, probably an altered diabase, as unaltered portions of the dyke indicate.

"This dyke appears to cut right through the mountain in a N. 40° W. direction, dipping at angles of 30° to 50° S.W. This dyke seems, at least locally, to form the western boundary of the mineralized area, and in contact with it on the east is an area of slate country-rock, the cleavage of which (although not the bedding) appears to be parallel with the dyke.

"The contact of the dyke and slates is very clearly marked; the lower or hanging-wall of the dyke on the east side being smooth and separated from the adjoining slate by a certain amount of gouge-matter, indicating a subsequent movement on the line of contact. As far as could be seen this dyke wall was not broken in any place.

"To the east of the dyke the slate country-rock seems for a distance of some 60 feet to be more or less crushed, forming a *crushed zone* of that width, to the east of which the slate appears to be comparatively unbroken.

"As far as could be seen from the development-work done, this crushed zone, 60 feet wide, between the dyke and the undisturbed slate represents the limits, in an east-and-west direction, of the zone of mineralization.

"*Mineralized Crushed Zone.*—The crushed zone is bounded on each side by a vein of quartz; on the west, and in contact with the dyke mentioned, is what may be designated as the 'Dyke vein,' and on the east side of the zone is the 'Big Quartz vein,' while between these two are a number of smaller cross-veins, all of which will be described in more detail.

"The Big vein has only been cut at one place underground in a crosscut tunnel, but is traceable distinctly on the surface for a long distance up the mountain beyond any present workings. The continuity of this Big vein and its parallelism to the dyke are very noticeable.

"The Dyke vein has been followed by an adit for over 200 feet, in which the dyke formed the hanging-wall, unbroken. From this 1,200-foot tunnel (1,200 feet above the railway-track) a crosscut has been run easterly across the crushed zone and Big vein to the solid slates. From the adit a couple of winzes have been sunk for about 15 feet, but were full of water and

could not be inspected. Above the adit a stope has been put up for about 30 feet and connects with a short adit on the 1,230-foot level. This Dyke vein is continuous for the length of the tunnel at least and is mineralized throughout, though not evenly. These facts are given as strong evidence of the continuity and regularity of the crushed zone and its features.

"The Dyke vein, as already stated, is continuous for the 200 feet length exposed in the 1,200-foot tunnel and varies in thickness from 6 inches to 3 feet, or roughly averaging 2 feet in width. For the entire length of the tunnel the vein is more or less mineralized, with free gold visible to the eye, together with pyrite, pyrrhotite, and arsenopyrite, the latter always associated with high gold values. The mineralization is stronger, however, in certain shoots, of which three have been found in the tunnel-length forming ore-bodies.

"From these shoots there has been mined, sorted, and sold, as shown by the smelter returns, about 118 tons of ore, netting over $35,000, while there is on the dump at present about 700 tons of second-grade ore, showing by sampling and assays of the management a value of $15 a ton.

"It is only on this vein that any extraction or serious development has been done, and it is quite evident the cost of extraction of the ore should not have been more than half the amount received for the ore. As already noted, only 200 feet of tunnel has been driven, with only 15 feet below the tunnel developed by winzes and some 30 to 35 feet above the tunnel by a stope.

"Should further and continued development on this vein anywhere nearly approach the results obtained with the development already done, and there is every reason to expect it will, this vein alone should make a small but profitable mine and justifies the requirements of the bond.

"In addition to this, we have to the east of the Dyke vein the crushed zone, some 50 to 60 feet in width, of brecciated slate, cut by several series of smaller quartz veins from 6 to 18 inches wide, which are evidently and visibly mineralized with arsenopyrite carrying gold values, forming a network which it is quite probable may prove high enough grade to mine as a whole and mill.

"The Big Quartz vein, from 5 to 25 feet wide, lying between the crushed zone and the undisturbed slate, has been prospected on the surface extensively and everywhere carries values, but too low on the surface to be attractive, but the vein underground looks as though it might be rich enough for milling-ore.

"There is but one crosscut through this crushed zone and the Big Quartz vein, so these are only seen at one place underground, an amount of development-work quite inadequate to form any definite estimate of their value. Should further development and crosscutting substantiate this present expectation, there would be proven a very large tonnage of milling-ore and the making of a large low-grade mine.

"The conditions as regards mining, timber, water-power, transportation to the railway, etc., are ideal for cheap work.

"The company has on the ground and in process of erection a gasolene-driven air-compressor and has a 3-inch pipe-line almost completed to the mine."

B.C. Silica and Talc Company.—Executive offices, 204-6 Crown Building, Vancouver; David McMaster, manager. The property consists of five claims situated along the north side of the Canadian Pacific Railway between Chaumox and the Nahatlatch river. A good road has been constructed from Chaumox to the principal talc and silica occurrences.

23-Mile below Hope, on the Skagit.—The assessment-work on the *Diamond* group continues to show increasing bodies of ore. Also work on *Mammoth* group shows interesting mineralization of scheelite in combination with pyrrhotite.

Strontianite is found on the *Defiance* group, across the valley from the *Mammoth* group.

SNOWSTORM GROUP, HIGHLAND VALLEY, ASHCROFT DIVISION.

REPORT BY ALLAN K. STUART, SUPERINTENDENT.

I have the honour to submit the following particulars of the surface development-work carried out under the "'Mineral Survey and Development Act" on the *Snowstorm* group of mineral claims in the Highland valley, Ashcroft Mining Division, during the year 1920. The work done under the diamond-drilling contract let by the Department of Mines in 1919 has already been dealt with in the report of the Resident Engineer, R. W. Thomson, and published in the Report of the Hon. the Minister of Mines for that year.

The tunnel on the *Iona* claim, which had been started at the same time that the whole *Snowstorm* group of claims was being surveyed by W. S. Drewry, D.L.S., in November, 1919, was carried to a distance of 280 feet, when instructions were received on May 27th, 1920, to also put in a series of test-holes on the surface. Sixty-two test-holes and cuts, many of them averaging over 20 feet in depth, owing to the very heavy overburden, were put down on the *Iona* claim; the result of this work showed that while the mineralized occurrence gave low assay averages, still proved the fact that it covers a large area, which well deserves further development at depth to reach the zone of secondary enrichment. Details of the results obtained are shown on plans prepared, but which would take up too much space to refer to in detail in this report. The last work on the *Iona* claim was the sinking of a shaft down to a depth of 40 feet. A combined average of this shaft down to 40 feet gave 1.50 per cent. copper.

Orders were received on January 5th, 1921, to stop further surface work pending the calling for tenders for drilling.

LILLOOET DISTRICT.

LILLOOET MINING DIVISION.

REPORT BY JOHN DUNLOP, GOLD COMMISSIONER.

I have the honour to submit the annual report on mining operations in the Lillooet Mining Division for the year ending December 31st, 1920.

The *Lorne* and *Pioneer* mines on Cadwallader creek, Bridge river, during the past season were comparatively inactive, and with the exception of about 30 tons of ore treated on the premises by the former, of rock mined during the winter of 1919–20, the milling and recovery of bullion ceased. The stamp-mill at the *Pioneer* mine remained idle. Both of these properties have for years held a conspicuous position as gold-producers; the apparent inactivity may be accountable as directly attributable to the present abnormal conditions. The management of these mines, with the services of small crews, confined attention to development-work, and operations were carried on during the year in that direction.

The *Wayside* and *Ida May* mines, while not classified as bullion-producers, likewise marked time by extending tunnels and stripping some of the surface lodes.

The Anderson Lake Mining and Milling Company's property on McGillivray creek, for some years dormant, was represented by the Brett Bros. The tunnels were thoroughly overhauled, with the aid of a small force development-work was carried on to the satisfaction of all parties interested.

Beyond the annual assessment-work required under the provisions of the "Mineral Act," there is but little to comment upon, as the season's operations disclose no outstanding feature worth while reporting.

Attention has been given the Bridge river and tributary creeks, where forty-six placer-mining leases have been issued during the year.

OFFICE STATISTICS—LILLOOET MINING DIVISION.

Free miners' certificates issued	185
Mineral claims recorded	124
Certificates of work recorded	251
Placer-mining claims recorded and rerecorded	3
Placer-mining leases in force	59
Transfers and agreements recorded	92

Revenue.

Free miners' certificates	$1,024 00
Mining receipts, general	5,834 30
Tax, Crown-granted mineral claims	391 50
Mineral-tax	1,216 74
Total	$8,466 54

CLINTON MINING DIVISION.

REPORT BY G. MILBURN, GOLD COMMISSIONER.

I have the honour to submit the annual report of the Clinton Mining Division for the year ending December 31st, 1920.

Fewer mineral claims were recorded during the year of my report than during the preceding year, but interest, as indicated by the number of certificates of work issued, kept up at about the same level.

It would appear that comparatively few of the claims staked for hydromagnesite, of which there were a considerable number during 1919, have been kept alive by assessment-work or payment in lieu thereof. This fact, I think almost wholly accounts for the difference in the number of claims recorded in the past two years.

Some of the larger fields of hydromagnesite probably did not come up to expectations in respect to purity and the samples taken did not prove the ground worthy of development.

It is interesting to note the nature of the minerals found in this Division, comprising that noted above and magnesium sulphate and sodium carbonate. The value of some of these deposits is apparent from the fact that on nineteen claims payment of $100 was made in lieu of work in order to obtain the necessary certificate of work to keep the claims alive.

The Stewart-Calvert Company, Inc., with refinery at Oroville, Wash., U.S.A., shipped magnesium-sulphate salts from the lake, situate about a mile south of Clinton, to the extent of about 2,000,000 lb. The whole amount was transported by the Pacific Great Eastern Railway.

The salts were ground and sacked at the lake and conveyed to the railway by motor-truck, whence a large proportion was carried direct to consumers and the less pure to the refinery at Oroville. The regrettable sudden death of the active member of the company, Frank Calvert, temporarily held up this firm's plans for extension of their activities, but I understand that as soon as arrangements can be completed a refinery will be established at the lake.

Three-mile lake, being 2 miles farther south of the one from which salts are now being extracted, also contains similar salts and the two lakes will justify the refinery.

The sodium-carbonate deposits have been receiving considerable attention this year, and, while none has been shipped, there is no doubt that extraction and shipping will result during 1921.

The Lillooet Soda Syndicate commenced work on its plant for the extraction of soda from the Crown-granted claims, *Goodenough* and *Last Chance*, situate near the Canoe Creek road, about 35 miles north of Clinton. These claims are something over 12 miles from the 59-Mile House Station on the Pacific Great Eastern Railway, and this will entail carriage of the product over a good road by auto-truck.

From the existing road to the claims about 1½ miles of road had to be built, and this has been done under promise, conditionally, of assistance from funds authorized under the "Mines Development Act."

The Soda Mining and Products Company, Limited, of Vancouver, has been incorporated and has taken over valuable deposits in the vicinity of Clinton and the 74-Mile House, and active operations are to be conducted during the ensuing season.

The American Nitrogen Products, Inc., Seattle, Wash., has acquired interests in the district and apparently intend producing as soon as they have matters properly lined up.

The Meadow Lake hydromagnesite-deposit, which at the date of last year's report was in litigation, is, I am informed by the successful litigants, to be worked next season, and by reason of its exceptional purity will readily find a market. This deposit is a few miles distant from the railway and will be another industry to engage motor-trucks on the roads.

Prospecting for metalliferous ores has again been carried out on the claims 6 miles south of Clinton by Martin J. Ravey and S. F. Mead, and assessment-work was recorded on a large number of the claims. Apparently nothing of importance was uncovered, but the country is regarded by these gentlemen as excellent ground for prospecting and they are most optimistic for the future.

The *Mad Major* group, referred to last year, was further developed and prospected and assessment-work was again recorded. I have no information touching on results from the work done.

Recovery of gold by placer-mining was this year only about half of the amount washed out last year. This was due to the fact that the miners were out prospecting other ground, when the water came down a little out of season in their absence and so was lost. The value of the gold recovered, as far as I can learn, was about $2,500.

One placer-mining lease was issued during the year and it covers ground on the First North fork of Watson Bar creek. The lessee, David Johnson, regards it as a nice property, especially in view of the downward trend of general commodity prices, which increases the buying power of the gold.

OFFICE STATISTICS—CLINTON MINING DIVISION.

Free miners' certificates	71
Mineral claims recorded	119
Certificates of work issued	102
Placer claims recorded	3
Placer claims rerecorded	16
Bills of sale, etc.	37
Placer-mining lease issued	1

Revenue.

Free miners' certificates	$ 310 50
Mining receipts, general	2,742 20
Total	$3,052 70

TASEKO VALLEY IRON-ORE DEPOSITS.

REPORT BY F. J. CROSSLAND.

To the Honourable William Sloan,
Minister of Mines.

SIR,—I have the honour to submit herewith my report on the Taseko Valley iron-ore deposits.

INTRODUCTION.

Under special instructions received from the Hon. Wm. Sloan, Minister of Mines, and under the provisions of the "Mineral Survey and Development Act," the writer, with a field party of five men, proceeded on June 3rd, 1920, from Vancouver to the Taseko Lake and River section of the Clinton Mining Division in order to examine the occurrences of limonite or bog-iron ores in that locality, and to ascertain by development and exploration work the extent, quality, and accessibility of the deposits. The route followed to reach the district was via the Pacific Great Eastern Railway from Newport to Lillooet, where pack-horses and supplies were secured; thence by launch via Seton lake to Shalalth, a station on the Pacific Great Eastern Railway at the foot of Mission mountain, from which place the Bridge River wagon-road was followed to the bridge crossing at Gun creek. The new trail which was constructed up Gun creek was followed to its northerly terminus at Green lake, a distance of about 30 miles. There are alternative routes from this point—viz., Taylor pass and Warner pass—the altitudes being 6,900 and 7,800 feet respectively. After a reconnaissance it was decided to proceed up Warner pass, as the snow was found to be too deep for the passage of horses through the basins approaching Taylor pass, though the pass itself is nearly 1,000 feet lower in altitude than the glacier of Warner pass. After negotiating the above pass the upper valley of the Taseko was reached. The distance travelled by the route described is about 85 miles from Lillooet and 200 miles from Vancouver, though the locality herein described is approximately not more than 75 miles in a direct line to the salt water of one of the Coast inlets.

GEOGRAPHY.

The area covered by this report is roughly about 15 square miles and embraces the upper part of the valley of the Taseko, formerly the Whitewater river, and its tributaries, as shown on the accompanying sketch-maps. The section which this report treats lies between the Coast range of mountains and the Interior plateau. The Taseko river has its source from the westerly slope of a chain of small glaciers and high peaks that reach elevations between 7,000 and 9,000 feet. This range of mountains forms the watershed between the creeks tributary to the Bridge

river on the easterly side and the drainage system of the Taseko river and lakes on the westerly side, and is the dividing line between the Lillooet and Clinton Mining Divisions.

GEOLOGY.

The valley of the Taseko river is geologically situated on the eastern edge of the Coast granite batholith. The rocks forming the mountain chain on either side of the upper valley of the Taseko river belong to a series of volcanic flows of Tertiary age. This zone of volcanic rocks consists of rhyolites, andesites, andesitic tuffs, breccias, and agglomerates. The north-westerly side is bounded by a high mountain range built up by basaltic flows having the usual palisading structure, which forms a prominent landmark and has become known from its characteristic appearance as the "Battlement range." The eastern flank of this belt of Tertiary volcanics consists of rugged snow-covered granite mountains which form the divide and pass into a lower and more subdued range system which is transitional eastward into the Interior Plateau system. The zone of volcanic rocks is approximately 5 miles wide and extends from the head of the Taseko river and roughly parallel to the stream for a distance of at least 15 miles westerly to the Taseko lake.

The valley itself is a basin-like field, being at no point more than a mile wide and curving inward to meet the group of peaks which protrude through the encircling snow lying on the sides of the basin, many of which are permanent snow-fields and form the source of the river. Evidence of glaciation is quite pronounced, and some of the small glaciers are still actively producing changes in the grinding-down of rock-masses in their vicinity, which accounts for the immense size of the talus-deposits which cover the lower slopes of the surrounding mountains and often down to the floor of the valley itself.

CHARACTER OF ORE-DEPOSITS.

Everywhere in this area the iron-ore deposits consist of bedded limonite, a variety of bog-iron ore, occurring mostly in platy layers of varying thickness. Covering some of the deposits are layers of disintegrated brown earthy limonite which have weathered to a crumbly pulverulent mass sometimes a foot thick, and ranging in size from a grain of powder to fragments an inch or two across. Below this loose covering the ore is found compact, with a solid laminated structure paralleling the slope or floor of the basin, on which it has been laid down in successive layers during the transformation of the iron sulphates in the surrounding rock.

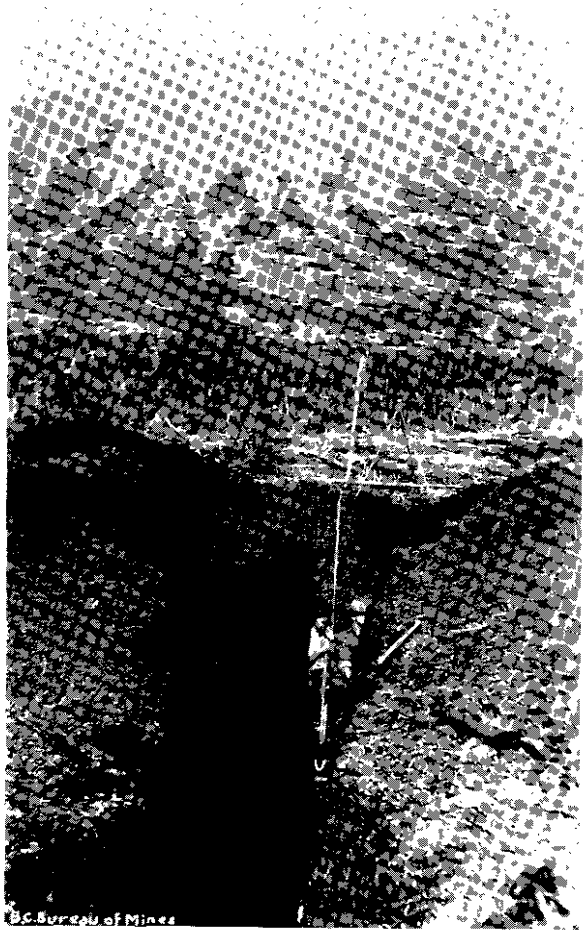
The deposits, being of secondary origin, are formed by the general circulation of water through iron-bearing rocks, often absorbing a vegetable acid which assists the water to take up iron in solution. Ferruginous minerals are amongst the first and earliest that fall a prey to alteration; carbonic acid in the water aids in dissolving out the iron in the surrounding country-rock. The organic acids also play a part, and the resulting alteration of the iron affords sulphuric acid and ferrous sulphate which readily enter into solution by the decomposition caused on the admission of air; ferric hydrate soon forms. Evidence of this process is borne witness to by the limonitized roots, twigs, and fir-needles found in the ore-beds that have been wholly or partly transformed to limonite.

This ferric hydrate — i.e., limonite ($2Fe_2O_3$, $3H_2O$) — is formed as a red scum which, following the law of gravity, is carried to the basins, where it gradually accumulates. Theoretically, therefore, the flatter the pitch the greater will be the quantity deposited, and in this respect much depends on the physical features of the floor of the original bed-rock to account for its varying thickness even over a small area covered by an individual deposit. On all the surrounding hills, the rock-masses of which are composed of cherty ironstone and rhyolite impregnated with pyrite, rusty impregnated water can be seen percolating down the hillside, carrying the light films of limonite which accumulate in the form of bog-iron ore-beds in the basins below.

The number of deposits herein described consist of eight widely separated groups or sections, each of which is made up of a number of ore-beds, which are shown in the accompanying sketch-plans and map. The analyses of samples taken in different ways with a view to arriving at the average character and quality of the ore agree very well as to the homogeneity of the different deposits and emphasize the purity of the iron ore.

In order to arrive at the surface area covered by the deposits, traverses were run at intervals of 100 feet and the mean of the width and length of the ore blocked out for that section. The

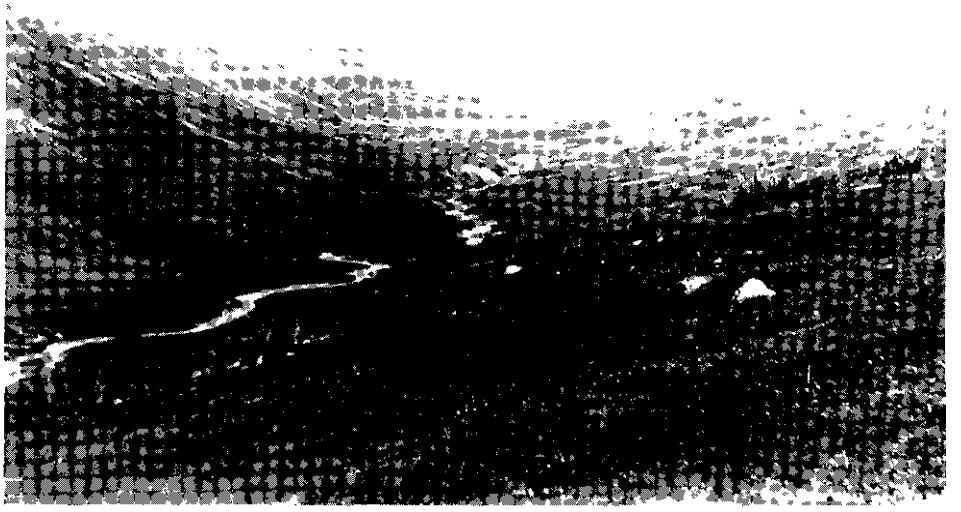
Bedded Limonite Ore, Tasekо River.



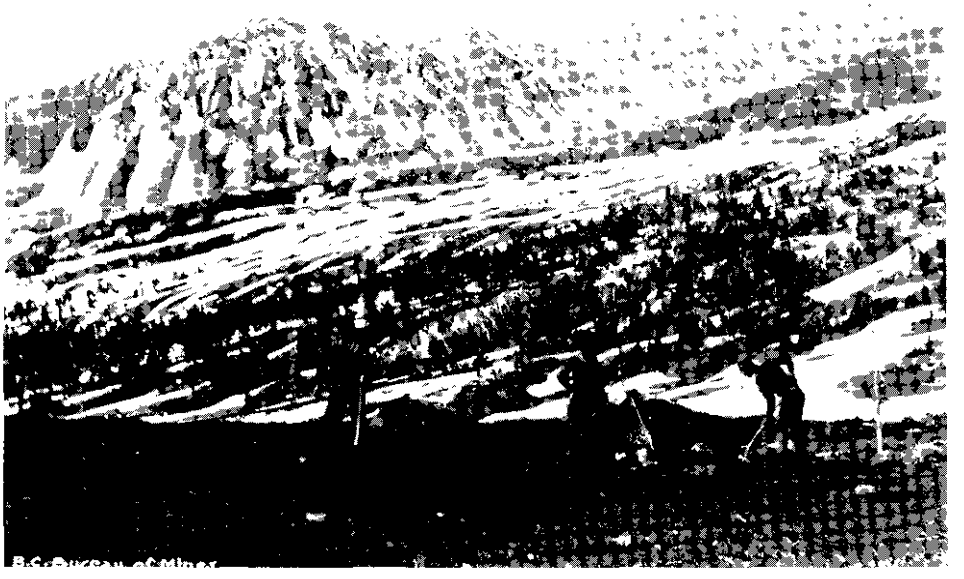
Trench in Limonite, Whale Mountain.

Limonite-deposit, Burton Creek, Clinton M.D.

Burton Creek, looking West towards Battlement Range.



Taseko Limonite-deposit, Iron Creek, Clinton M.D.



Taseko Limonite-deposit, Burton Creek, Clinton M.D.

thickness of the ore-beds was determined when possible by the open-cut or trench method, but where the depth exceeded 3 feet pits were sunk until the ore-body was penetrated. In this way an accurate estimate of the amount of ore in each block of each deposit was made.

NOTE.—In computing this tonnage of ore, I have calculated it on the basis of 16 cubic feet of the ore in-place to the ton of 2,000 lb., though its specific gravity of 3.5 would indicate that a less cubic measurement would equal a ton in weight. This estimate was arrived at after cutting out a measured block of average ore and weighing the same after drying, and no doubt, after allowing for some moisture still in the ore, this estimate of 16 cubic feet to the ton would be found to work out correct in mining practice.

The description of each of the different deposits is as follows:—

Section 1.—This group of deposits occurs at an altitude of 6,500 feet on the upper part of the U-shaped valley of Burton creek, which is here about 1,000 feet above the floor of the Taseko valley. There are four detached exposed bodies of limonite ore, all irregular in shape, extent, and thickness, and the ore-beds are all covered by a gravelly ore from 2 to 10 inches deep, which is underlaid by hard beds of massive laminated ore. As the depth of ore varied considerably, even within short distances of 100 feet, a number of pits and trenches were dug to penetrate the ore so as to arrive at the average depth and amount of ore in each individual deposit, the results of which are given in tabulated form, together with analyses and assays of ore samples made by the British Columbia Bureau of Mines.

Section 2.—These deposits, known as the "Whale Mountain group," are on the right or easterly bank of the Taseko river about 2 miles from the head of the valley. The two main exposures have been swept bare of timber by a recent snowslide which shows its course for a distance of about 5,000 feet by 500 feet wide. Three test-pits from 7 to 12 feet deep were sunk in the larger of the two deposits and the ore penetrated at 6 feet 6 inches, 9 feet, and 10 feet 6 inches respectively—this proving a conservative average depth of 9 feet. The trenches cut through the smaller deposit, which is only separated from the latter by about 100 feet of boggy hummocks, showed its greatest depth to be not more than 3 feet, and would not safely average more than 2 feet for the whole ore-bed.

In addition to these two prominently exposed beds there are a number of smaller exposures, separated by short intervals of debris and light vegetable growth, and extending northerly for a considerable distance to the foot of Whale mountain. A number of pits and open-cuts were dug, besides considerable stripping of the overburden over a large area, and the limonite ore found beneath showed varying depth, from a few inches to 7 feet in thickness. In estimating this as a probable area of 3 feet in depth, I have done so with a view of demonstrating, as the exploration-work proved, that the exposed boundaries of the beds of ore are not always the limit of their lateral extent, as in some of the areas here described the ore-beds were found underlying a covering of moss and talus. Where this was positively proven the area covered is referred to as "probable ore," though it is questionable if the ore could be recovered, as the cost of removing the overburden would in most cases not be warranted by the value of the iron ore, especially where 2 feet of debris covers only a like thickness of ore, though in some instances there are places where only a light mossy growth conceals ore-beds 4 or 5 feet deep; they are generally small irregular masses.

Section 3.—The main deposit of limonite in this group lies on the northerly bank of Feo creek near its source at an altitude of 7,000 feet. The valley of the creek is a succession of benches bare of timber and the stream flows between steep banks varying from 50 to 100 feet high. The deposit is 800 feet in length and has a mean average width of 200 feet. A noticeable and disappointing feature is the apparent depth of the deposit at first sight, the ore extending downward over the steep banks of the creek for a vertical depth of at least 50 feet below the surface of the deposit and nearly to the bed of the creek. As the deposit was not crosscut or worn through by the stream, its deceiving appearance is soon apparent when excavating into the banks. At no place was it found to be more than a foot thick, positively proving that the deposit is of recent origin, and has in its secondary deposition of the limonite simply laid down in conformity to the pre-existing contour of the ground, flowing as a scum in solution down the steep banks and settling in thin, almost vertical layers. The pits sunk on the flat surface of the deposit penetrated the ore at varying depths of from 2 to 5 feet. About one-third of the surface of the deposit is strewn with large angular boulders and smaller talus from the slope of the mountain, which rises steeply from the outer edge of the ore. There are some isolated beds

of limonite exposed on the benches of the creek-valley 4,000 feet distant below the above deposit, but they are negligible in extent, the largest patch containing about 1,000 tons of ore.

Section 4.—The limonite-deposits on Rae creek are a group of three irregular beds pitching at an average incline of 20°, and with the exception of this steep pitch are similar in other respects to altitude and position as the aforementioned deposits, and near the head of the valley of the creek, which is U-shaped and has no outlet at the upper end, being encircled by an unbroken mountain range averaging 1,000 feet above the floor of the valley, which in turn is 1,000 feet higher than the Taseko valley where Rae creek forms a junction with the Taseko river.

Section 5.—In this group there are twelve exposed deposits more or less separated and distributed over a distance of 2 miles between the upper and lower ore-beds in the valley of Iron creek. This stream flows parallel to Rae creek and, like the latter, drains into the Taseko river a mile farther west. The valley is wider than either of those aforementioned and is favoured by some as a route of travel into the Taseko district. A trail over the pass at the head of the valley leads into the Chilcotin plains and branches into alternative routes to Lillooet. The columnar structure of basalt ridges called "Battlement range" runs in a westerly direction on the northerly side of Iron Creek valley, and is apparently the northern boundary of the iron-bearing rocks from which the secondary limonite ores were derived.

On the lower portion of the valley several trenches had some years ago been made in the ore-deposits, which had partly filled in. There were also two pits 6 feet deep, this being the only evidence of any previous prospecting-work having been done. The work in these pits was said to have been abandoned on account of water trouble, and being still in clean ore at 6 feet in depth would indicate a much greater thickness, but further work I had done penetrated the ore-beds in less than a foot of increase in depth.

The appearance of so many closely related exposed beds of limonite ore would, in the absence of proof to the contrary, lead to the belief that the beds have continuity, particularly as some of the intervening ground from the detached ore-bodies is heavily impregnated with iron-rust, and where the moss has been removed in places thin shells of bog-ore are found underneath, but in no place is the amount appreciable enough to be classed as ore, and considerable stripping and prospecting failed to reveal any positive tonnage other than that defined by the boundaries of the exposed ore-beds as here given in tabulation form.

Sections 7 and 8.—These deposits are known as the "McClure Mountain group" and are divided into two sections about a mile apart. They are situated approximately 4 miles east of Taseko lake and 2 miles south of the Taseko river. McClure creek runs through Section 7, the easterly deposit, which has a maximum and minimum altitude of 6,800 and 6,100 feet. The westerly deposit on Section 8 is split into two branches which have a maximum and minimum altitude of 7,000 and 6,200 feet. The upper half of the deposit occurs in a series of steps or gently sloping benches for a length of 3,000 feet, with varying width of from 100 to 250 feet; then gradually tapers down to 50 feet in width, extending in a long narrow pointer for a distance of 1,200 feet, which is here separated from the smaller or lower half of the deposit by a bushy hummock 100 feet across.

The McClure Mountain deposits are the greatest in extent and of chief importance. The limonite ore is characteristically the same as the other deposits here described, having the soft loose layer on the surface and the harder dark platy ore beneath. The exposed deposits are free from boulders and debris. Private interests have developed the ore-beds by assessment-work in a persistent manner for a number of years, and as such work was in progress the writer visited the section with an assistant for the purpose of examining, surveying, and estimating the character and amount of the limonite ore in-place. Finding that, apparently on account of water trouble, as no system of making drainage-cuts had been adopted, most of the pits and trenches had been abandoned at varying depths without penetrating the ore-beds, an attempt was then made to continue the work with the Provincial field working party, but, having to ford the river at high water with tools and camp equipment from other points, very little was accomplished before severe snow-storms made it advisable to discontinue.

The deepest work done on the deposits at the time of my visit was 6 feet; there were many holes dug to depths of 4 and 5 feet, most of which had not bottomed or penetrated the ore-beds. An average depth of 5 feet may be considered as certainly proven, and probably the depth is greater at least in places, but in the absence of proof is not certain.

Section 8.—On the west bank of Warner creek are a number of iron-deposits which are more of the soft, red, earthy variety of bog-ore, not having the heavy dark appearance and laminated structure of all the deposits on the Taseko Valley side of the Warner Pass divide. These deposits are prominently in view from the Gun Creek trail and would appear to be much greater in extent than is the case. The surrounding country-rocks and banks of the creek are heavily stained with iron oxides, which at no great distance give the impression of huge masses of limonite-iron ore. The work done did not prove up any great extent or depth of the several ore-beds.

ANALYSES OF SAMPLES OF LIMONITE.

Description.	Sample No.			
	6315.	6319.	6323.	6325.
Iron (metallic)	47.6	48.8	49.2	50.8
Silica (SiO_2)	5.2	1.6	4.7	2.5
Manganese (Mn)	*Nil.*	*Nil.*	*Nil.*	*Nil.*
Phosphorus (P)	Trace	Trace	Trace	Trace.
Sulphur (S)	0.86	1.34	1.06	1.77
Water (combine)	6.7	7.1	6.0	7.1

ASSAYS OF TASEKO VALLEY LIMONITE ORE.

Sample No.	Section No.	Iron.	Description.
6300	1	46.40	Open-cut on upper deposit.
6301	1	51.70	Gravelly surface ore, No. 2 deposit.
6302	1	44.40	Pit 5 feet deep.
6303	1	49.08	Open-cut under moss, Nos. 2 and 3 deposits.
6304	1	48.06	Upper trenches on No. 3 deposit.
6305	1	49.28	Lower trenches on No. 3 deposit.
6306	1	46.40	Open-cut on No. 4 deposit.
6307	1	46.04	Open-cut under drift.
6308	2	48.00	Feo creek, upper deposit.
6309	2	48.00	Feo creek, lower deposit.
6310	2	58.50	Hæmatite from Feo Creek ridge.
6311	3	50.00	Whale mountain, pit No. 1.
6312	3	46.00	" pit No. 2.
6313	3	47.20	" pit No. 3.
6314	3	51.00	" trench, No. 2 deposit.
6315	3	47.60	" open-cut, No. 2 deposit.
6316	3	44.60	" pit No. 4.
6317	3	44.60	" pit No. 5.
6318	3	46.40	" pit No. 6.
6319	4	48.80	Rae creek, No. 1 deposit.
6320	4	51.60	" No. 2 deposit.
6321	4	51.00	" No. 3 deposit.
6322	5	47.60	Iron creek, distributed samples.
6323	5	49.20	" distributed samples.
6324	6	49.00	McClure mountain, E. section, distributed samples.
6325	7	50.80	McClure mountain, W. section, distributed samples.
6326	8	47.00	Warner Creek deposits, distributed samples.

TONNAGES OF TASEKO LIMONITE ORE.

Section No.	Locality.	Deposit No.	Positive Ore. Area in Sq. Feet.	Depth.	Tons.	Probable Ore. Area in Sq. Feet.	Depth.	Tons.
1	Burton creek	1	80,000 × 2/16	=	10,000	299,000		
1	"	2	100,000 × 3/16	=	18,750	8,000		
1	"	3	55,000 × 1½/16	=	5,156	2,000		
1	"	4	20,000 × 1/16	=	1,250	1,000		
					35,156	310,000 × 1/16	=	19,375
2	Whale mountain	1 (lower)	100,000 × 3/16	=	56,250	160,000 × 2/16	=	20,000
2	"	2 (upper)	70,000 × 2/16	=	8,750	3,000,000 × 3/16	=	562,500
					65,000			582,500
3	Fee creek	1 (upper)	160,000 × 3/16	=	30,000			
3	"	2 (lower)	20,000 × 1/16	=	1,250	*Nil.*		
					31,250			
4	Rae creek	1	50,000 × 1½/16	=	4,687			
4	"	2	30,000 × 3/16	=	5,625			
4	"	3	75,000 × 3/16	=	14,063	60,000 × 1/16	=	3,750
					24,375			
5	Iron creek	1½	267,000 × 2/16	=	33,375	80,000 × 1/16	=	5,000
6	McClure mountain	E. half	1,650,000 × 5/16	=	78,125	900,000 × 3/16	=	56,250
7	"	W. half	1,197,500 × 5/16	=	374,210	3,750,000 × 3/16	=	234,375
					452,335			290,625
8	Warner creek	1 to 4	250,000 × 2/16	=	31,250	16,000 × 1/16	=	10,000
			Total		672,741	Total		911,250

SUMMARY.

The opinion of many engineers and other authorities regarding the economic importance of the Taseko Valley iron-ore deposits has not been borne out by the exploration and field-work accomplished; it has positively demonstrated that the ore tonnage is insufficient to warrant the installation of the necessary equipment to mine out the ore-beds under the existing conditions.

The unfavourable features are: These deposits are not continuous in one consolidated block, but consist of a number of widely scattered aggregates; the comparatively shallow depths of the ore-beds, and the fact that these are not, as a casual appearance would indicate, continuous over greater distances underlying the light moss covering the floors of the valleys. Given a much greater tonnage of ore, some very favourable features obtain, such as the high average value of the ore and the even tenor of its iron content. It contains no excess of impurities that would influence the character of furnace pig-iron. The ore is easily broken down and suited to cheap mining, but with the present distance from transportation there is not sufficient quantity to class the district as an important source for future iron-ore supply.

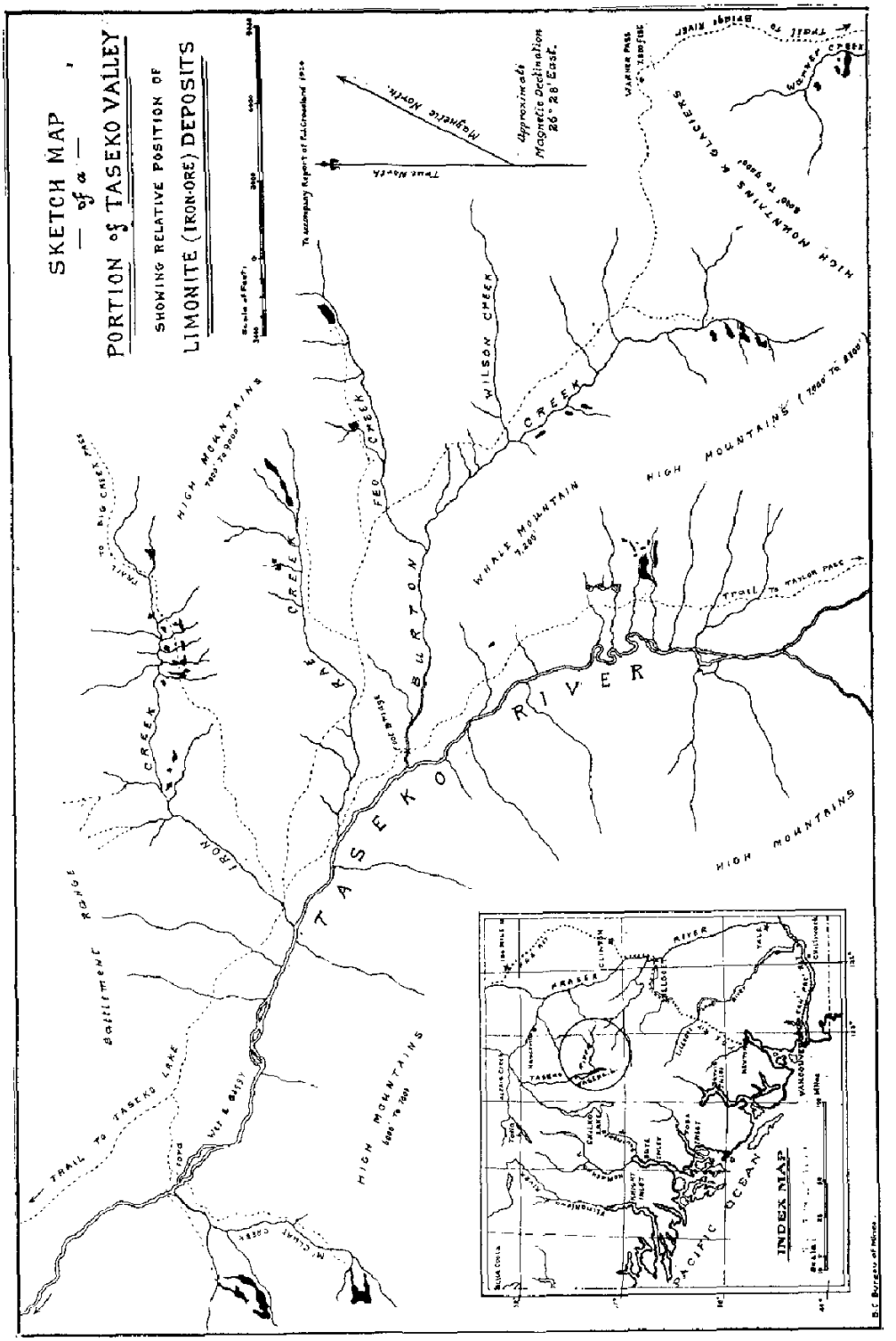
In conclusion, I would like to add that many other similar deposits of limonite occur in adjacent localities to the north and west. It is reported on good authority that beds of this character of iron-ore exist approximately 20 miles distant on the west side of the Taseko lake, and there are known to be a number of deposits in the valley of the Big creek and its tributaries, but owing to the lateness of the season it was not possible to explore these other localities, and in the absence of definite information I am not able to report as to their character and extent.

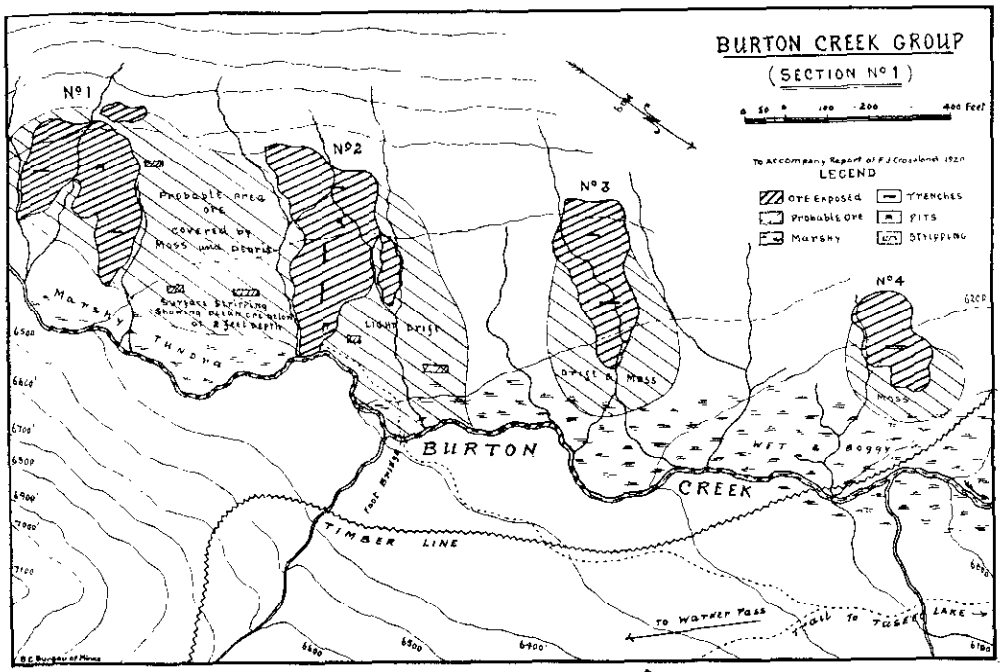
Should any of the points I have laid down in this report not be quite clear, I will be pleased to explain and give any other information within my knowledge.

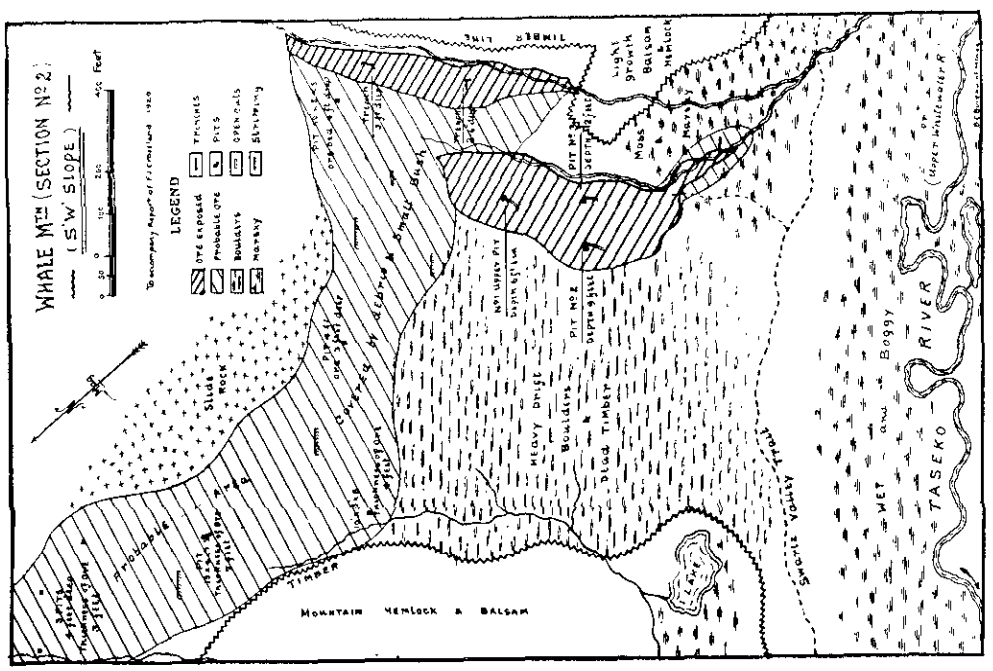
I have, etc.,

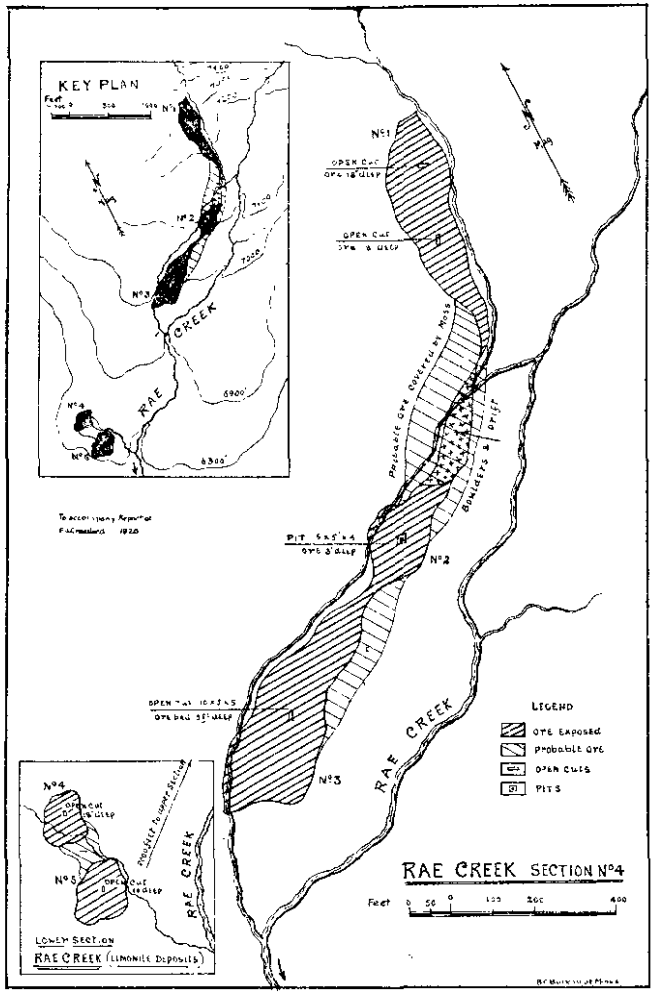
F. J. CROSSLAND,

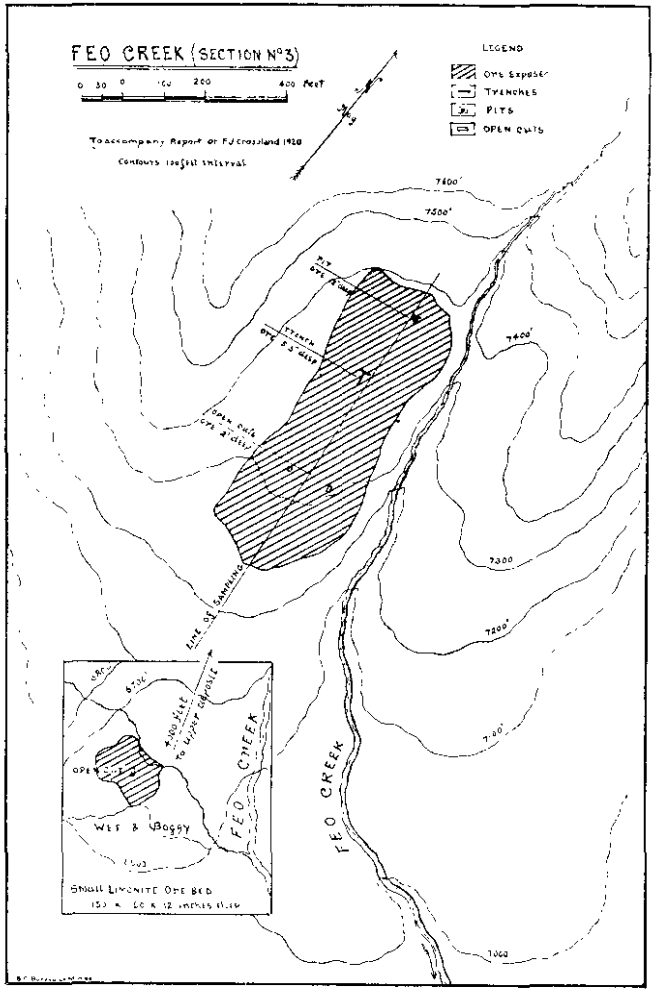
Mining Engineer and Geologist.

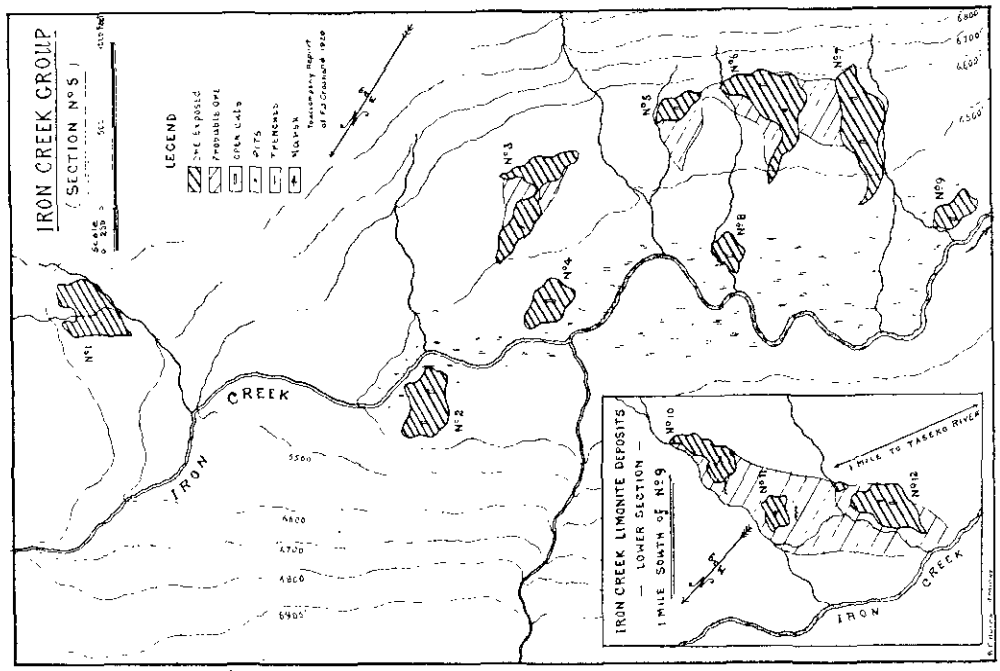

SKETCH MAP
— of a —
PORTION of TASEKO VALLEY
SHOWING RELATIVE POSITION OF
LIMONITE (IRON-ORE) DEPOSITS
To accompany Report of Fall Creek and
Magnetic North
Approximate Magnetic Declination 26° 28' East.
WILSON CREEK
HIGH MOUNTAINS
WHALE MOUNTAIN
TRAIL TO TAYLOR PASS
TRAIL TO BIG CREEK PASS
IRON RANGE
SETTLEMENT
TRAIL TO TASEKO LAKE
HIGH MOUNTAINS
TASEKO RIVER
INDEX MAP
PACIFIC OCEAN
B.C. Bureau of Mines

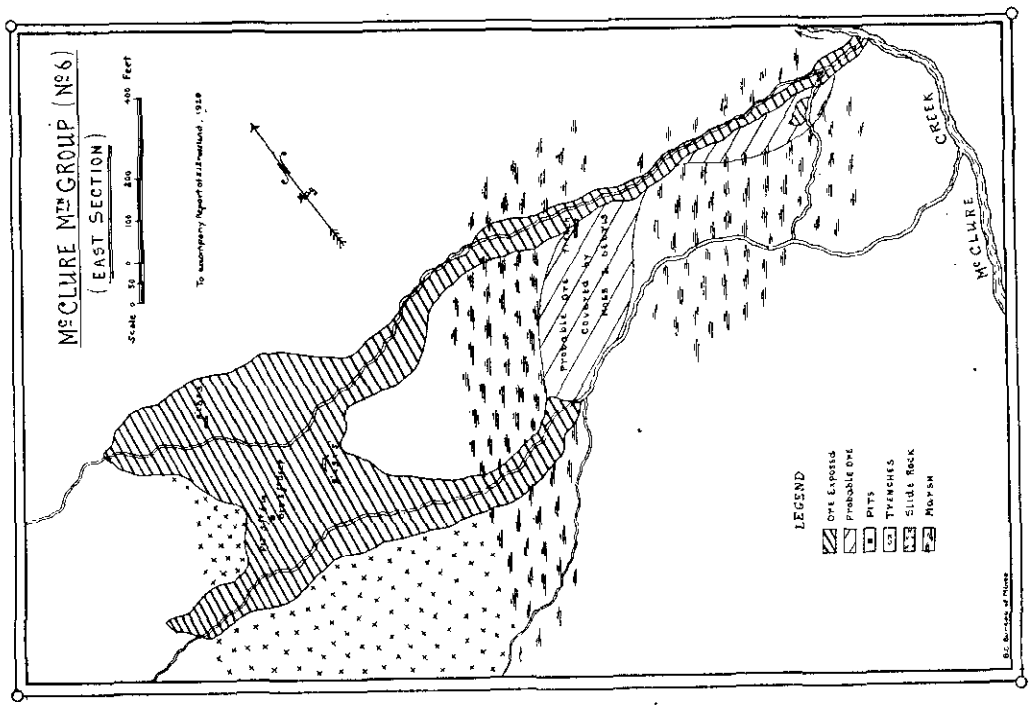

BURTON CREEK GROUP
(SECTION Nº 1)
LEGEND
Nº 1
Nº 2
Nº 3
Nº 4
Probable area ore covered by moss and gravel
Marshy
Light drift
Drift & moss
Wet & boggy
BURTON CREEK
TIMBER LINE
To Warner Pass
Trail to Tyaughton Lake

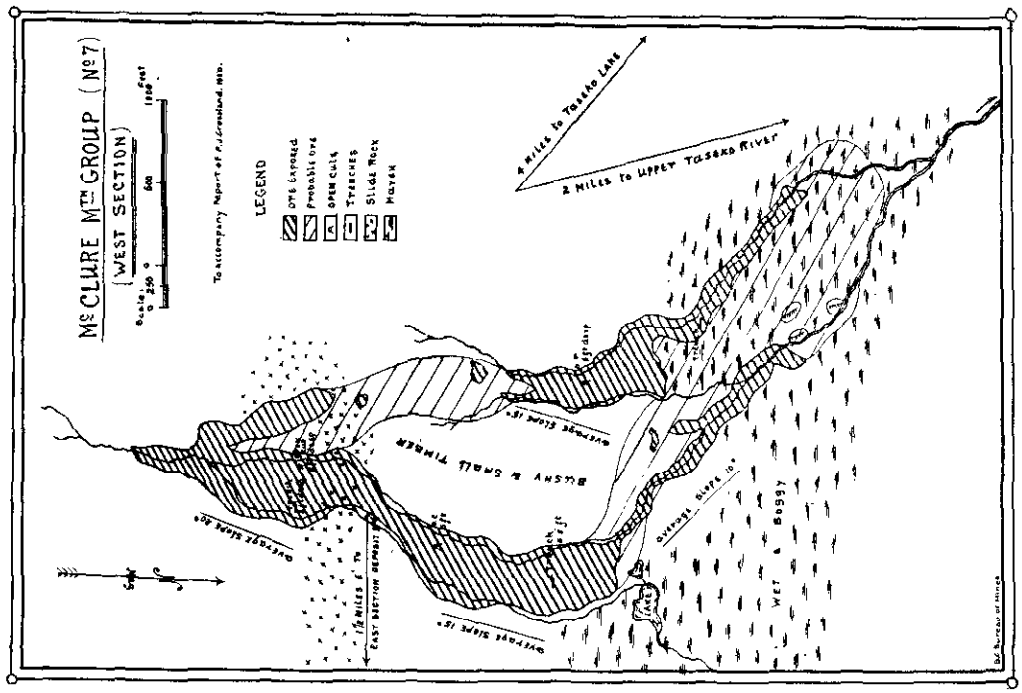

WHALE Mtn (SECTION Nº 2)
(S.W. SLOPE)
LEGEND
Ore exposed
Probable ore
Boulders
Marshy
Trenches
Pits
Open cuts
Slumping
TIMBER LINE
Light growth Balsam Hemlock
Moss
Marshy
Heavy drift
Boulders
Dead timber
Mountain Hemlock & Balsam
Timber
Probable
Slide Rock
Slide
Swartz Valley
Wet and Boggy
TASEKO RIVER

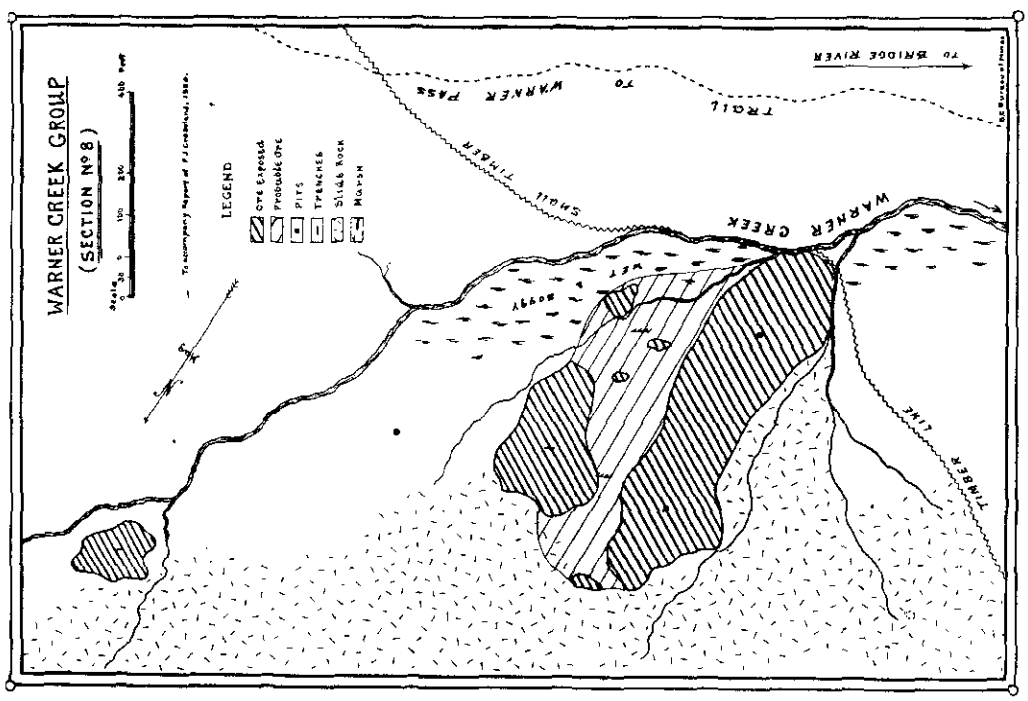

KEY PLAN
RAE CREEK
No 1
No 2
No 3
No 4
No 5
OPEN CUT
OPE 18' DEEP
OPEN CUT
OPE 8' DEEP
PROBABLE OPE COVERED BY MOSS
BOULDERS & DRIFT
PIT 5x5'x4
OPE 3' DEEP
OPEN CUT 10x7x5
OPE 5½' DEEP
RAE CREEK
LEGEND
OPE EXPOSED
PROBABLE OPE
OPEN CUTS
PITS
RAE CREEK SECTION No 4
Feet
LOWER SECTION
RAE CREEK (LIMONITE DEPOSITS)
250 FEET TO UPPER SECTION


FEO CREEK (SECTION No 3)
Feet
LEGEND
OPE EXPOSED
TRENCHES
PITS
OPEN CUTS
To accompany Report of Fyc Crossland 1920
Contours 100 feet interval
No 1
OPE 4' DEEP
TRENCH
OPE 5' 3" DEEP
OPEN CUT
OPE 3' DEEP
LINE OF SAMPLING
7400'
7500'
7300'
7200'
7100'
7000'
FEO CREEK
WET & BOGGY
SMALL LIMONITE OPE BED
150' N. 50° W. 12 INCHES TO 18"


IRON CREEK GROUP
(SECTION N°S)
LEGEND
Ore Exposed
Probable Ore
Open Cuts
Pits
Trenches
Moraine
IRON CREEK
N°1
N°2
N°3
N°4
N°5
N°6
N°7
N°8
N°9
IRON CREEK LIMONITE DEPOSITS
— LOWER SECTION —
1 MILE SOUTH OF N°9
N°10
N°11
N°12
1 MILE TO TASEKO RIVER
IRON CREEK


McCLURE Mtn GROUP (N°6)
(EAST SECTION)
Scale 0 50 100 200 400 Feet
LEGEND
Ore Exposed
Probable Ore
Pits
Trenches
Slide Rock
Marsh
McCLURE CREEK


McCLURE Mtn GROUP (No 7)
(WEST SECTION)
LEGEND
Ore Exposed
Probable Ore
Open Cuts
Trenches
Slide Rock
Moraine
4 Miles to Tagish Lake
2 Miles to Upper Tagish River
Bushy & Small Timber
Wet & Boggy
Overage Slope 10°
Overage Slope 18°
Overage Slope 30°


WARNER CREEK GROUP
(SECTION No 8)
LEGEND
Ore Exposed
Probable Ore
Pits
Trenches
Slide Rock
Moraine
To Bridge River
To Warner Pass
Trail
Small Timber
Warner Creek
Boggy
Timber Line

YALE DISTRICT.

NICOLA MINING DIVISION.

REPORT BY J. A. MURCHISON, MINING RECORDER.

I have the honour to submit herewith the annual report and office statistics of the Nicola Mining Division for the year ending December 31st, 1920.

Owing to the unfavourable economic conditions no progress has been made in mining in this district during the year 1920.

OFFICE STATISTICS—NICOLA MINING DIVISION.

Locations recorded	111
Free miners' certificates	144
Certificates of work	155
Bills of sale	18

VERNON MINING DIVISION.

REPORT BY L. NORRIS, GOLD COMMISSIONER.

During the year 1920 there was little activity in mining circles. Several placer leases were staked on Whiteman's creek and several on Cherry creek. In each case considerable preliminary development-work was done, but no returns to date. There have been no new discoveries of any importance.

OFFICE STATISTICS—VERNON MINING DIVISION.

Free miners' certificates	146
Mineral claims recorded	106
Placer claims	35
Certificates of work	14
Placer leases	14
Transfers	3
Crown grants	2

YALE MINING DIVISION.

REPORT BY H. BEECH, MINING RECORDER.

I have the honour to submit the annual mining report and office statistics for the year ending December 31st, 1920.

PLACER-MINING.

Parties claiming to have improved machinery for the treatment of placer-ground have filed applications on ground near Yale.

LODE-MINING.

Development-work has proceeded steadily on most of the claims in the Yale Mining Division.

The Emancipation Mining Company has bonded its claims to the Liberator Mining Company. The latter company at once put in a compressor plant and has been driving the main and lower tunnels. High-grade ore has been opened up in the main tunnel and a body of milling-ore in the lower tunnel. A railway siding is to be put in to connect with the Kettle Valley Railway.

Reports of other properties having been bonded have been made and the new year should show great developments in this district.

OFFICE STATISTICS—YALE MINING DIVISION.

Free miners' certificates issued	148
Mineral claims recorded	143
Certificates of work	164
Bills of sale	29

ASHCROFT MINING DIVISION.

REPORT BY J. S. ALEXANDER, MINING RECORDER.

I have the honour to submit my annual report as Mining Recorder for the Ashcroft Mining Division for the year 1920.

I understand considerable work has been done on the *O.K.* group and the *Snowstorm* group, situated in Highland valley. The annual assessment-work has been done on the majority of all the old claims.

The Resident Mining Engineer is, I understand, making a comprehensive report on mining conditions in this Division.

OFFICE STATISTICS—ASHCROFT MINING DIVISION.

Mineral claims recorded	93
Certificates of work issued	97
Bills of sale, etc.	15
Free miners' certificates issued	58

KAMLOOPS MINING DIVISION.

REPORT BY E. FISHER, GOLD COMMISSIONER.

I have the honour to submit my annual report for the Kamloops Mining Division for the year ending December 31st, 1920.

Active quartz-mining has been practically at a standstill during the past year in this district. The *Iron Mask* mine, the principal producer, suspended operations early in the year, but a force of men has been kept at work doing general repairs, overhauling of plant, and putting in plant and works for the pumping of water direct from the Thompson river to the mine.

The Queen Bess Company ceased operations on its properties at Black Pool and confined its activities to the development of coal properties at Chu Chua, on which an option is held. Good progress has been made and the production greatly increased; the coal now being produced is clean and of excellent quality. The demands of the local market and the proximity of the mine to the Canadian National Railway for shipping purposes should make this enterprise a big asset to the district.

The number of new claims recorded shows a considerable falling-off from the previous year, but assessment-work has been well kept up.

The only placer-mining done has been on 3-Mile creek, but owing to the late high water not much work was possible, but what was done gave promising results. Several parties representing outside capital have been looking over the ground, and as a result several bench leases have been taken up, and should the prospecting-work at present being carried out on these leases prove satisfactory, it is the intention to install up-to-date machinery to work the ground.

OFFICE STATISTICS—KAMLOOPS MINING DIVISION.

Free miners' certificates	450
Mineral claims recorded	134
Placer claims recorded	11
Placer leases	5
Certificates of work issued	194
Bills of sale	57
Mining receipts	$3,019.45

WESTERN DISTRICT (No. 6).

REPORT BY WM. M. BREWER, RESIDENT ENGINEER.

INTRODUCTION.

The Western Mineral Survey District (No. 6) includes the seven most westerly Mining Divisions in the Province. These are Alberni, Clayoquot, Quatsino, Victoria, and Nanaimo on Vancouver and adjacent islands, and New Westminster and Vancouver on the Mainland.

During the past year the field-work as outlined by the writer at the beginning of the year as desirable to be accomplished was curtailed for several reasons beyond his control, and especially on account of the heavy rainfall in September, October, and November, which caused so much high water in rivers and creeks, that are usually easily crossed on foot-logs or fordable, as to make crossings impossible and therefore impede travelling on foot. About twenty-five groups of mineral claims were examined during the past season, which necessitated trips along the west coast of Vancouver island; to Buttle lake, in Strathcona Park, near the centre of Vancouver island; to Jordan river and East Sooke, Victoria Mining Division; to Texada island; to Lasqueti island; to the headwaters of Phillips river, on the divide between that river and Bute inlet, on the Mainland; as well as to Thurlow island, Phillips and Frederick arms, Jervis inlet, Howe sound, and Seymour creek.

AID TO RETURNED SOLDIERS IN PROSPECTING.

During the months of May and June considerable time was occupied in carrying out the regulations in relation to the policy of the Minister of Mines with regard to aiding returned soldiers in prospecting. It was arranged that twenty-five parties of two returned men in each—one to be an experienced prospector, the other an inexperienced man—should be selected, grub-staked, and assisted to prospect in such section of the Province as each party desired during the season of 1920. As the number of men to be sent out was apportioned to each of the six Mineral Survey Districts in proportion to the population of the various districts, and as District No. 6 contains about 70 per cent. of the population of the Province, it fell to the lot of the writer to select fifteen parties of two men in each out of the twenty-five parties, the total number provided for.

As this selection had to be made from over 100 applications, considerable correspondence and many interviews were necessary before the parties were finally dispatched to the several sections of the Province in which they desired to prospect.

Only eight men or four parties of those selected desired to prospect in District No. 6, the remainder choosing other districts. Of those parties which favoured District No. 6, two parties went on to the west coast of Vancouver island; one to the mountains in the vicinity of Jervis inlet, on the Mainland; and the other to the Tyzoone river, which flows into the Narrows arm of Secchelt inlet, also on the Mainland. The results so far as locating mineral claims are concerned may be considered as being only fairly satisfactory, while the results from the standpoint of valuable information brought back by the respective parties relative to the fields in which prospecting was done are considered as being quite sufficient to justify the policy pursued by the Government.

The two parties that went to the west coast of Vancouver island located two mineral claims on Kokshittle arm of Kyuquot sound, and the party that went up Jervis inlet also staked two mineral claims near Mount Diadem, but the fourth party did not locate any mineral claims.

The parties on the west coast of Vancouver island were visited about the middle of August, when it was learned by the writer that the coast in the vicinity of Nasparti and Ououkinsh inlets, southerly of Cape Cook, had been quite thoroughly prospected by them, and that the remainder of the season would be devoted to prospecting in the mountains bordering on Kokshittle arm of Kyuquot sound.

An attempt was made in September to visit the parties who were prospecting on the Mainland, but this was abandoned after the writer reached Jervis inlet in a gasolene-launch,

partly on account of the south-easterly storms that were prevailing and lack of sheltered anchorages in the inlet, and also for the reason that the men were reported as being back in the mountains some 4 or 5 miles and the location of their camps was unknown to the residents at Egmont Point Post-office, where the prospectors had been receiving mail and obtaining supplies.

The parties who went to the west coast of Vancouver island returned to Victoria on October 9th, and those who went to Jervis and Seechelt inlets returned to Vancouver about October 1st. From the reports brought in, as well as from other information, the writer was satisfied that all of the men had carried out their contracts in a satisfactory manner, and consequently paid them off according to the agreement entered into when they started.

For convenience in the following report it is deemed advisable to divide each Mining Division into sections and subsections. These Divisions are as follows:—

Name of Mining Division.	Section.	Subsection.
Alberni	Alberni Canal.	
	Barkley Sound	Uchucklesit Harbour.
		Copper Island.
		Henderson Lake.
	Great Central Lake.	
Clayoquot	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.
	West Arm.	
	Kyuquot Sound	Kokshittle Arm.
Nanaimo	Strathcona Park	Buttle Lake.
		Quinsam Lake.
	Salmon River.	
	Quadra Island.	
	Phillips Arm.	
	Texada Island.	
	Redonda Island.	
	Comox.	
	Cumberland.	
	Nanaimo	Cassidy.
		Nanoose.
	Tatlayoko Lake.	
	Lasqueti Island.	
Vancouver	Britannia Belt.	
	Lynn Creek.	
	P.G.E. Railway	Alta Lake.
		Cheakamus Lake.
		Stawamus River.
	Jervis Inlet.	
New Westminster	Cheam Range.	
	Agassiz.	
	Stave River.	
	Harrison Lake.	
Victoria	East Sooke.	
	Jordan River.	
	Saltspring Island.	
	Cowichan Lake.	
	Koksilah River.	

As an introduction to this, the fourth annual report on the Western District No. 6, it may be mentioned that, although there have been no very outstanding events or phenomenal conditions to record in connection with the mining industry during 1920, very considerable progress has been made in development-work, especially on mineral claims on Vancouver island, where a total amount approximating $500,000 has been spent with satisfactory results.

The writer desires to express his appreciation for the many courtesies, assistance, and general all-round good-fellowship he has experienced from each and every man connected with

the mining industry in District No. 6 with whom he has come in contact. As it is impossible to make a personal acknowledgment for the kindness he has universally received, he desires that this expression may be accepted in lieu of such.

It is gratifying to be able to report that the relations between capital and labour in District No. 6 in all branches of the mining industry have been quite cordial, harmonious, and satisfactory, and that all the indications at the close of 1920 point to a continuance of such desirable conditions.

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 since then, which are as follows:—

Summary Report, Geological Survey, Canada, 1917, Part B. Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet; also Indian River Copper Deposits, Vancouver Mining Division.

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.

Annual Reports, Minister of Mines, for years ending December 31st, 1918 and 1919.

Cooke, H. C. Gabbros of East Sooke and Rocky Point. Canada Department of Mines, Museum Bull. No. 30, November 15th, 1919.

Daniels, Joseph, Associate Professor of Mining, Engineering, and Metallurgy. The Coking Industry of the Pacific Northwest. University of Washington, Engineering Experiment Station Series, Bull. No. 9.

Summary Report, Geological Survey, Canada, 1918, Part B. Britannia Map Area (S. J. Scofield); also Quatsino Sound and Certain Mineral Deposits of the West Coast of Vancouver Island, B.C. (V. Dolmage).

Summary Report, Geological Survey, Canada, 1919, Part B. Barkley Sound, Vancouver Island, B.C. (V. Dolmage); also Sunloch Copper District, B.C. (V. Dolmage).

METALLIFEROUS MINING.

It is to be regretted that owing to the fall in the price of copper last November the Britannia Mining and Smelting Company, operating in the Vancouver Mining Division, considered that the most advisable course to pursue was to discontinue production temporarily; consequently the concentrating-mill at Britannia Beach, Howe sound, as well as the electric railway and incline tramway, were closed down. The company reduced the pay-roll to about 40 per cent. of its total under normal conditions and operations at present are confined to development-work only in the mine. As this company's mine was the only regular producer of metalliferous ore in the Western Mineral Survey District during 1920, the results, until production is resumed, are serious, especially when the fact is considered that the tonnage of ore mined under normal conditions is about 2,500 tons each day and the number of employees on the pay-roll is about 1,000.

The wage schedule paid by the company when the reduction in the force went into effect was practically the same as when copper was selling at more than 20 cents a pound on the New York market. The fall in November brought the price down to about 14 cents a pound, with comparatively no demand for the metal.

On the other hand, it is gratifying to record that the Tidewater Copper Company, Limited, operating on Sidney inlet, west coast of Vancouver island, made its first shipment of concentrates in December, 1920, from the *Indian Chief* copper-mine since the completion of the reconstruction of the concentrating-mill and the substitution of electric power in place of steam.

During 1920 there occurred some notable changes in the personnel of the management in several of the metalliferous mines in No. 6 District.

J. W. D. Moodie, who has since 1911 occupied the position of general manager of the Britannia Mining and Smelting Company, resigned, and E. J. Donohue was promoted from the position of secretary-treasurer, which he had held for several years, to that of general manager.

H. B. Price, who came from Guatemala in the spring of 1918 to manage the Tidewater Copper Company, Limited, resigned as general manager in the autumn of 1920 to return to the

position of general manager of a gold-mine in Abangarez, Central America, and S. P. Silverman was appointed general manager, with D. M. Drumheller, Jr., general superintendent.

John Hanna, who has acted as superintendent of the *Sunloch* mine on Jordan river since development was first started in the spring of 1917, resigned the latter end of May last, and G. H. Kilbourne was transferred from the management of the *Sullivan* mine, in the Fort Steele Mining Division, to the same position with the Sunloch Mines, Limited, the controlling interest in which has been purchased by the Consolidated Mining and Smelting Company of Canada.

A. S. Williamson, who has superintended the prospecting and development work on the *Lucky Four* group of mineral claims in the Cheam range of mountains, resigned that position for the management of the development-work on the old *Eureka* silver-mine, in the Yale Mining Division.

It is to be regretted that for the first time since 1898 the *Marble Bay* mine on Texada island has failed to ship any ore. The operations of the Tacoma Steel Company, which owns the mine, have this year been confined to diamond-drilling on and below the 1,700-foot level.

The production from the metalliferous mines in District No. 6 has consequently been confined to that from the *Britannia* mine, except as to one shipment of about 400 tons of concentrates from the *Indian Chief* mine of the Tidewater Copper Company, Limited. Early in 1920 it was reported that concentrating-mills would be built by the Consolidated Mining and Smelting Company to treat the copper ores of the *Old Sport* mine, in Quatsino Mining Division, and the *Sunloch* mine, in the Victoria Mining Division, but work on the construction of these plants has been suspended on account of the extreme high cost of labour and material, in addition to the refusal of manufacturers to guarantee delivery of machinery on a time contract.

It was also reported last spring by reliable authority that the Ladysmith Smelting Corporation, Limited, might possibly reconstruct the old Tyee smelter at Ladysmith and blow it in, but that desirable event has failed to materialize and any ore mined in the Southern Coast District must still be shipped to the Tacoma smelter for treatment.

IRON AND STEEL.

There has been considerable talk and many rumours relative to the establishment of the iron and steel industry on the Coast, but beyond the organization of three new companies there has been but little headway made during 1920. The three new companies are known as the Coast Range Iron and Steel Company; the Shipton Electric Pig Iron and Steel Smelting Company, Limited; and the British Columbia Iron and Steel Works, Limited.

One group of British capitalists evinced such serious interest in the iron and steel industry in British Columbia that Walter D. Rock, an eminent engineer, had been sent out from England twice since October, 1919, to investigate and report on the feasibility of establishing a blast-furnace plant and rolling mills on the Coast. Unfortunately, during his second trip last autumn Mr. Rock died suddenly in Vancouver. It is gratifying to be able to state that his work will be carried on by a successor who is expected to arrive in the near future.

Experiments were made in Vancouver during the past year by J. D. Shipton, who constructed a small electric pig-iron furnace in which he smelted magnetite ore from the *Lake* mine on Texada island and produced a good grade of pig-iron, thereby further demonstrating the fact that the magnetite ores which occur in British Columbia are readily amenable to treatment by electric smelting.

The "Iron-ore Supply Act" passed in 1919 remained in force during 1920, and the writer was authorized by the Honourable the Minister of Mines to continue to administer it. Under this authority ore for experimental purposes was supplied to J. D. Shipton, of the Shipton Electric Pig Iron and Steel Smelting Company, Limited, of Vancouver. In July last a shipment of magnetite was made to Walter E. Agnew, of Los Angeles, California, for experimental purposes in an electric furnace of new design. In December last a supply of magnetite was furnished Dean Milnor Roberts, of the College of Mines, University of Washington, Seattle, for experimental purposes by the United States Bureau of Mines and the University of Washington.

PROSPECTING.

Prospectors have been rather more numerous in District No. 6 during 1920 than has been the case for some years past, but although interest in prospecting appears to be reviving, yet it

MINERAL CLAIMS ON JORDAN RIVER

VICTORIA M.D.

To accompany Report of
W.M.Brewer, Resident Engineer, 1920.

Scale:
Feet: 0 500 1000 1500 2000 3000

Note: Sunloch properties within heavy border.

L 859 VIKING 2
L 860 VIKING 3
L 858 VIKING 1 48.31
L 861 VIKING 4 Fr. 51.15
L 852 MUD WASP 35.12
L 831 QUEEN BEE 35.99
L 857 BEE Fr. 45.72
L 829 ADALINE 51.65
L 827 YELLOWJACKET 41.91
L 830 WAR EAGLE 51.45
L 828 BLACK HORNET 44.62
L 853 HOPE
L 841 BLACK BARE
L 840 WHITE BARE
L 839 SOMBRIO
L 843 KING
L 844 ADA Fr.
L 842 OLIVE 48.44
OLIVE Fr. 51.46
LUCKY BUNCH L 257
L 824 VULCAN 6
L 836 HORNET
L 829 VULCAN 1 38.28
VULCAN 2
L 823 VULCAN 5 16.9
VULCAN 4 21.49
L 821
TIGER
VULCAN Fr.
VULCAN 3 51.65
L 796 SUNLOCH 5 30.89
L 797 SUNLOCH 2 32.59
L 794 SUNLOCH 3
L 795 SUNLOCH 4
L 793 SUNLOCH 2 30.97
L 792 SUNLOCH 1 51.34
L 846 COUR DE LINE 47.7
L 258 L 485 ROSSLAND 46.58
L 322 L 825 GABBRO 38.18
L 847 MORNING 45.24
L 848 NOONDAY 30.3
L 260
L 849 LEROY 44.82
L 850 NELSON 51.61
L 851 TRAIL 51.53
L 857 DODY Fr. 4.28
L 856 AYAH Fr. 46.79
L 855 PEGGY 51.65
L 862 31.36
L 865 GAMMA 51.65
WHITE ROCK
L 863 ALPHA 51.65
L 864 BETA 51.65

T.L. L.54

Jordan River
Sunloch Mine Road
Power Co's. Pipeline
Vancouver Island Power Co's. Pipeline
Tramway
Mineral Springs
V.I.P.Co. Power House
Road to Victoria
Transmission Line

L 4 L 3 L 7
L 2 L 9 L 71 L 72 L 8

B.C. Bureau of Mines.

does not begin to reach the point attained in this district about twenty years ago. The system adopted by the Government of aiding returned soldiers in prospecting is responsible in part for the revived interest being taken.

Reports brought in by the prospectors, other than returned soldiers, who returned to Vancouver and Victoria to pass the winter, prove that most of the men are extending their explorations farther back into the mountains bordering the mainland coast than in the past, and are realizing the importance of prospecting thoroughly and systematically the contacts along the easterly side of the Coast Range granitic batholith, as well as searching the belts of metamorphosed sedimentary and igneous rocks which form inclusions in the main batholith. Examples of the occurrence of such inclusions are reported from the Tyzoone River section, which flows into the head of Narrows arm of Seechelt inlet, where Ben Coates with four assistants has located about seventy claims as agents for a number of free miners, residents of Vancouver. Near Mount Diadem, in a northerly direction from the head of Hotham sound, Jervis inlet, Tom Lillie, of Pender Harbour, and partners have been working for the past two years, and in the vicinity of Mount Elsmere, on the west side of Howe sound, M. Johanson and partners have been prospecting for some years. Near the head of Seymour creek, near Loch Lomond, Roy D. Watson and Thomas Fry, of Vancouver, have prospected for some years.

Prospecting in the interior of Vancouver island has been popular during 1920, especially in the vicinity of the westerly slope of Big Interior mountain at the head of Bedwell (Bear) river, where J. B. Woodworth and associates have located the *You* group of mineral claims; also at the head of Buttle lake in Strathcona Park. On the west coast of Vancouver island the most popular sections for prospectors in 1920, in addition to the parties of returned soldiers, have been Jordan river, the Tahsis canal, Nootka sound, Kokshittle arm, Tofino creek at the head of Tofino inlet, and Elk river, which flows into Kennedy lake. The number of prospectors along the west coast has not been great, but the men engaged in that pursuit were all thoroughly experienced, and for that reason it is expected that during the coming year it will be found the locations made have commercial value.

While discussing prospecting it may be advisable to refer to some of the most promising sections in District No. 6 in which the geologic conditions are apparently favourable for the occurrence of ore-bodies. On the Mainland there is the northerly part of Nanaimo Mining Division which can be approached by water from Toba, Bute, Loughborough, Knight, Drury, and Seymour inlets. This section has received but little attention from prospectors for several years past, when such properties as the *Dorotha Morton* and *Douglas Pine* were being operated, and at that time the attention of prospectors appears to have been confined to the vicinity of the shore-lines.

Quadra island is another section deserving of more thorough prospecting than it has received, also the southerly part of Texada island.

The interior of Vancouver island is gradually becoming more accessible through the construction of railways and therefore should present an attractiveness it has not done heretofore. The Great Central and Sproat lakes will in the near future be connected with the Port Alberni branch of the Esquimalt & Nanaimo Railway, which will make the mountainous sections beyond the heads of these lakes more accessible than heretofore. The mountain ranges bordering on Sooke, Shawnigan, Cowichan, and Nitinat lakes are to-day within easy access of the Canadian National Railway. This fact has already been mainly responsible for the development of the talc-deposits on Wolf creek, a tributary of Sooke river.

ALBERNI MINING DIVISION.

Considering the large number of mineral claims in good standing in the Alberni Mining Division, it is with regret that it is necessary to report that there has been but little activity in the mining industry in the Division during 1920. At the time the Annual Report for 1919 was written it appeared as though there would be serious development-work carried on during the 1920 season at least on the *Big I.* and *Monitor* groups of mineral claims, but such has not been the case.

With regard to the *Big I.* group of mineral claims near the head of Great Central lake, on which the Consolidated Mining and Smelting Company took a bond in the autumn of 1919, the Company did send during the summer a force of mining engineers on to the property to make geological and topographical surveys and to systematically sample the extensive outcroppings.

About the time this work was completed some complications with regard to the title to two of the claims of the group of four mineral claims arose, and the party of engineers was withdrawn from the work until the matter was settled.

The *Big I.* or *Big Interior* group of mineral claims has been fully described in the Annual Reports for the years 1906 and 1916.

With regard to the *Monitor* group of mineral claims on Alberni canal, on which development-work was suspended during the autumn of 1918, followed by a lawsuit instituted by James Skene against Samuel Ryder, of St. Albans, England, the owner, the lawsuit was settled out of Court in October last. During the pendency of this litigation it was not deemed advisable to continue the development-work, but it is hoped that during the coming season active operations will be resumed.

The *Monitor* group of mineral claims is fully described in the Annual Reports for 1917 and 1918.

BARKLEY SOUND SECTION.

Uchucklesit Harbour Subsection.

Saucy Lass Group.

This group of mineral claims was examined on May 3rd, 1920. It contains seven mineral claims known as the *Saucy Lass*, *Saucy Boy*, *Saucy Lass No. 1*, *Waterfrontage*, *Thunderbolt*, *Thunderbolt No. 1*, and *Iron Cap*, and is owned by T. H. Knight-Bayne, who resides on the property. The group is located on Cass (Cascade) creek near Kildonan Cannery, on Uchucklesit harbour, and extends from the waterfront for a distance of about a mile back into the mountains, with the respective boundaries of the claims adjoining each other. The waters in the upper part of Cass creek flow through the *Saucy Lass* and *Saucy Lass No. 1* mineral claims, on which most of the mining-work has been done.

Geology.—The rock formations occurring on the *Saucy Lass* group are made up for the most part of the Vancouver series of volcanic rocks, with interbedded limestones and rather extensive bodies of epidote, associated with which are occurrences of magnetite and chalcopyrite. These ore-bodies belong to the contact-metamorphic type. Intrusions of a black igneous rock with gneissic structure are noticeable in the immediate vicinity of the ore-bodies. This black rock is considerably sheared in places and the whole of the rock formations show much evidence of movement. There are several slickensided shear-planes.

Characteristics of Ore-deposits.—The occurrences of copper-sulphide ore on the *Saucy Lass* group so far found occur on the steep banks of Cass creek. There are apparently several isolated bodies of chalcopyrite, judging from the outcroppings, but sufficient development-work has not yet been done to warrant an unqualified opinion on this feature of the extent of the ore-bodies. The occurrences of chalcopyrite ore are associated with magnetite, garnet, and epidote and belong to the contact-metamorphic type of ore-deposits.

Two samples were taken from two apparently distinct occurrences. The first, a selected sample from near the portal of a short adit on the *Saucy Lass* claim in the steep easterly bank of Cass creek, assayed: Gold, trace; silver, 0.8 oz.; copper, 14.5 per cent. The second, from the portal of a short adit on the *Saucy Lass No. 1* claim in the westerly bank of Cass creek, assayed: Gold, trace; silver, trace; copper, 0.3 per cent.

Development-work.—The development-work consists of three adits—one 60 feet long, another 10 feet long, and the third 10 feet long. There is also a cabin on the property and a trail is being constructed from the shore of Uchucklesit harbour, in the construction of which Government assistance was rendered under the terms of the "Mineral Survey and Development Act."

CLAYOQUOT MINING DIVISION.

The extension of the development-work in the mine, reconstruction of the concentrating-mill and installation of water-power to replace steam on the *Indian Chief* mine, Sidney inlet, together with the beginning of development-work on the *You* group of mineral claims on Bedwell river, have been the chief events in the mining industry in the Clayoquot Mining Division during 1920. The usual assessment-work has been done in the Division during the past year on mineral claims that have not been Crown-granted, while on the *White* group on Tofino (formerly known as Deer) creek there was quite a considerable amount of development-work done in addition to the annual assessment-work. The writer had arranged to visit the *White* group during one of his

trips on the west coast of Vancouver island, but was unfortunately unable to do so after the work had been finished; consequently there is no detailed description of this work in the following report.

Dr. Victor Dolmage, of the Geological Survey of Canada, with his assistant, P. C. Emmons, made a reconnaissance of the geology along the coast-line and adjacent islands in the Clayoquot Mining Division during the past summer, the summary report of which will be published in the near future.

CENTRAL WEST COAST SECTION.

Ahousat Subsection.

Flores Island Coal.

On account of rumours of the discovery of a seam of coal on the south-west corner of Flores island near the entrance to Clayoquot sound, an examination of that section was made on August 10th and 11th last. The trip out was made by the Coast trail from the head of Matilda creek and the return trip by a trail crossing the interior of the island. Both of these trails were for the most part in bad condition; the distance by either is about 10 miles. By reason of the exposed coast on the west side of Flores island and the difficulty of landing except in extremely fine weather, when the sea is calm, one of the trail routes is usually taken by travellers.

Fitzpatrick's Land Lot No. 1565.—This land lot was taken up by Edward Fitzpatrick several years ago for ranching purposes and stocked with some cattle, chickens, and hogs. Later he claimed to have discovered a seam of coal and did some open-cut work in the bank of Cow creek, which flows into the sea about a quarter of a mile easterly from Fitzpatrick's cabin, which is situated about 2½ miles east of Raphael point, the extreme south-west corner of Flores island.

Geology.—The rock formation in the vicinity of Land Lot No 1565 is for the most part made up of granodiorite, but at low tide there is a well-defined narrow belt of light-coloured sandstone exposed, which has its line of strike towards the north-west and dips at varying angles towards the south-west, the angles of the dip being from 20° to 50°.

No outcroppings of coal indicating the occurrence of a seam of commercial value could be found by the writer, who was accompanied by Edward Fitzpatrick in his examination. The comparatively narrow belt of sandstone, apparently of the Cretaceous period, was thoroughly examined during extreme low tide, which at the time of the examination happened during the afternoon, thus affording every facility for a thorough examination.

Some very narrow seams of carbonaceous material were noted and sampled. An assay of the sample showed it to contain: Moisture, 0.7 per cent.; ash, 60 per cent.; volatile combustible matter and carbon, 39.3 per cent.

The sandstone-belt was traversed towards the west to a small bay locally known as Siwash bay, where there occurs a fairly extensive body of a dark-coloured sandstone dipping south-west 20° under the sea. This is overlain by a layer of dark-coloured conglomerate rock, much of which has been carried away by erosion. The conglomerate dips and strikes in conformity with the underlying sandstone. No indications of coal-outcroppings could be found, although this dark-coloured belt of sandstone was very thoroughly examined.

Mr. Fitzpatrick informed the writer that the place where he discovered an outcropping of a workable seam was in the bank of Cow creek, where he had done some prospecting-work some years previous, but that as the open-cut had caved there were no exposures of the coal-seam visible. However, Cow creek was examined, with the following results:—

The prevailing rock formation where it is exposed near the mouth of Cow creek is granodiorite, which farther up the creek is hidden by an undetermined thickness of a bluish-coloured glacial clay covered by a layer of gravel several feet thick. A shaft was being sunk in the gravel alongside the westerly bank of the creek for the purpose, as explained by Fitzpatrick, of continuing to sink through the gravel and clay in the expectation of finding coal underlying the clay. As this part of the formation occurs at a lower horizon in the series than the strata of sandstone already referred to, which is exposed about a quarter of a mile westerly from Cow creek, and dipping towards the south-west at an angle of about 55°, it appeared as though the work at the point where it was being done was a useless waste of energy.

Travelling up the creek about a mile, the geologic formation is that of a dark-blue slaty shale, dipping at an angle of 35° towards the south-west and apparently underlying the sandstone

strata. An open-cut had been made still farther up the creek, which had caved and, as Fitzpatrick claimed, had covered up and hidden the exposure of coal; consequently an examination was useless.

The conclusion arrived at after the examination was that, while there was some possibility that coal might occur in the Cretaceous sandstone, there were no indications sufficiently promising to warrant further work.

Sidney Inlet Subsection.

Indian Chief.

This property contains eight mineral claims owned by the Tidewater Copper Company, Limited. The boundaries of the claims, which adjoin each other, extend from the water-front on the West arm of Sidney inlet northerly across the summit of a mountain nearly 2,000 feet in elevation. The mine-workings have been very fully described in the Annual Reports for 1917, 1918, and 1919, so that the following report will be confined to the operations during 1920, from an examination made on August 7th last and from information received up to the end of that year.

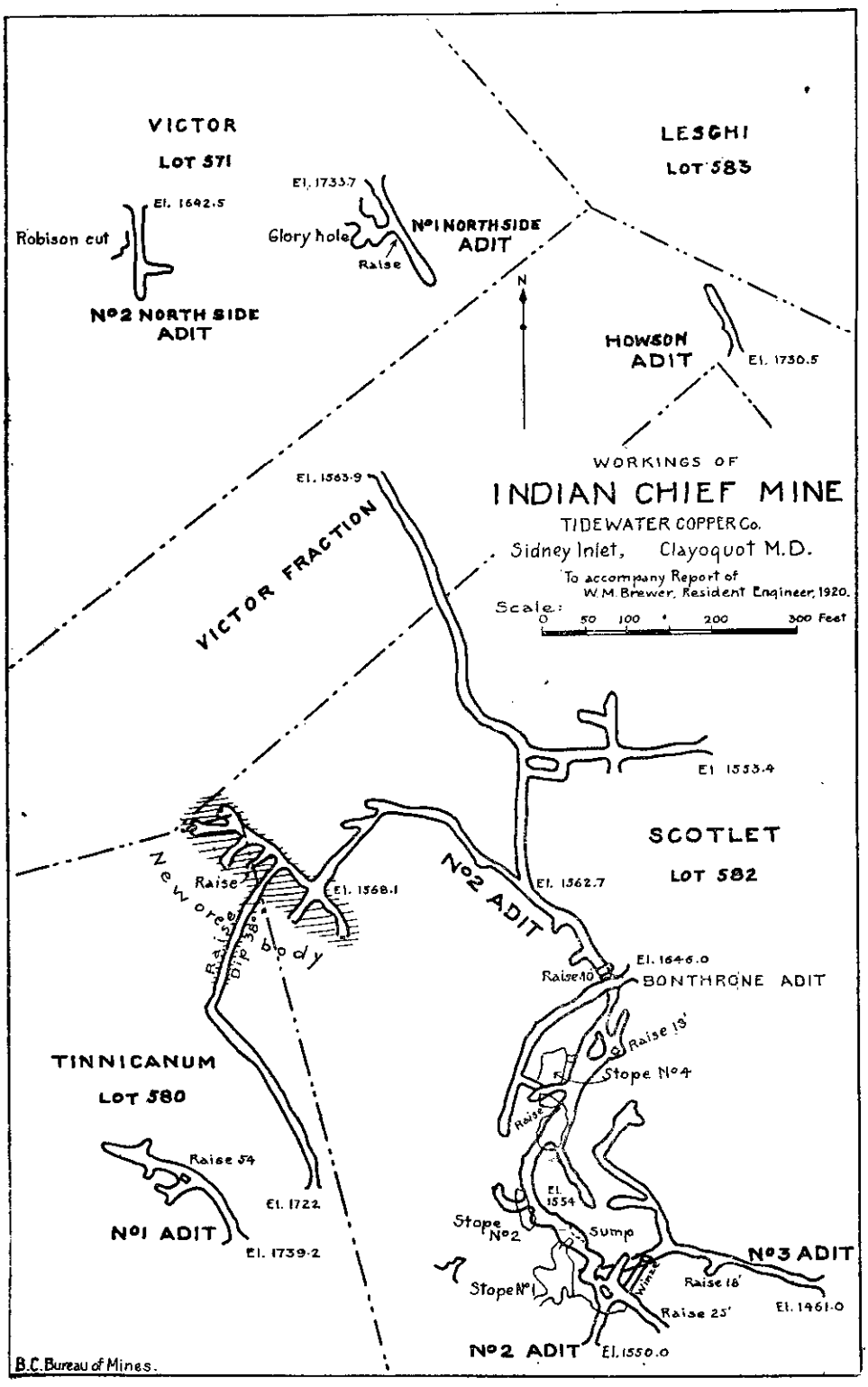
About September last H. B. Price, who had been the general manager since the spring of 1918, resigned to leave for Abangarez, Central America, to take the management of an extensive gold-mine for Minor Keith and associated capitalists, of New York. Previous to his departure he appointed D. M. Drumheller, Jr., general superintendent to superintend the operations at the mine and mill, and Mr. Drumheller still retains that position. S. P. Silverman is general manager, with headquarters in Victoria.

Beach Camp.—Before describing the extensions to the underground workings that have been made during 1920 it is deemed advisable to mention the improvements that have been carried on at the beach camp, where the concentrating-mill, lower terminal of the aerial tramway, and bunkers are located.

Two creeks—Indian and Mill creeks—flow down gulches from the summit of the mountain northerly from the beach camp, emptying into the West arm of Sidney inlet about a quarter of a mile from the camp. The waters from both these creeks have been diverted through flumes to a common penstock about 600 feet vertically above the beach. The flume from Indian creek is 4,300 feet long, 700 feet being of wood and 3,600 feet of galvanized iron strengthened by a framework of wood, and costing very much less per foot than the all-wood part. The flume from Mill creek is 1,200 feet long. The working-head of this water-power is 600 feet. From the penstock, into which both flumes discharge, there is a pipe-line 1,600 feet long to the wheel-house at sea-level, where eight Pelton wheels are housed and connected with individual dynamos, thus furnishing individual drives to all machinery in the mill, the compressor plant, and electric-light plant. Air from the compressor plant is carried from the beach to the mine by a pipe-line, while electricity for lighting at the mine camp, about 1,400 feet elevation above sea-level, is carried by wires.

The reconstruction of the concentrating-mill has increased its capacity to 300 tons of ore a day. A description of the flow-sheet is as follows: The mill is arranged so that the ore is brought from the mine by an aerial tramway, delivered over a 3-inch grizzly into a bin at the top of the mill building from the tram-buckets; the oversize passing through a 20 by 10 Blake crusher on to a ¾-inch grizzly, over which the undersize from the 3-inch grizzly also passes into a second bin equipped with a No. 2 Telesmith reduction-crusher. From this crusher all of the feed passes through a chute into the mill-bin. From the mill-bin the feed passes into a 6 by 5 Traylor ball-mill; thence into a Dorr classifier, from which all ore finer than 40-mesh passes directly into a battery of six 6-foot Peterson flotation-cells, while the coarser material passes from the classifier, as well as the underflow from the cells, to be reground in either a 5 by 22 tube-mill or a 5 by 4 ball-mill, from which the reground material is returned to the Peterson cells. The concentrates from the cells pass into a Dorr thickener, 16 by 22, and the overflow from the cells is carried to tailings-dump. The overflow from the Dorr thickener is also carried to a tailings-dump, while the underflow goes into a 10 by 12 Oliver filter, from which the concentrates go into a 6 by 24 Lowden dryer and thence to the shipping-bin. The entire system of treatment works automatically; consequently the cost for manual labour is cut down to the lowest possible minimum.

Development-work.—In the Annual Report of the Minister of Mines for 1919 a full description and plan of the extension of the development-work that had been done since 1917 was published,


VICTOR
LOT 571
LESCHI
LOT 583
El. 1642.5
Robison cut
No 2 NORTH SIDE ADIT
El. 1733.7
Glory hole
Raise
No 1 NORTH SIDE ADIT
N
HOWSON ADIT
El. 1730.5
WORKINGS OF
INDIAN CHIEF MINE
TIDEWATER COPPER Co.
Sidney Inlet, Clayoquot M.D.
To accompany Report of W.M. Brewer, Resident Engineer, 1920.
Scale:
0 50 100 200 300 Feet
El. 1563.9
VICTOR FRACTION
El. 1553.4
SCOTLET
LOT 582
No 2 ADIT
El. 1562.7
El. 1568.1
Raise
Raise Dip 38°
ore body
El. 1646.0
Raise 10
BONTHRONE ADIT
Raise 15'
Stope No 4
Raise
TINNICANUM
LOT 580
Raise 54
El. 1722
No 1 ADIT
El. 1739.2
El. 1554
Stope No 2
Sump
No 3 ADIT
Raise 18'
Stope No 1
Winze
Raise 25'
El. 1461.0
No 2 ADIT
El. 1550.0
B.C. Bureau of Mines.

with particular reference to the ore-body that had been exposed by the south-west drill-hole bored from the main No. 2 South side adit at a point about 100 feet northerly from the junction of the Green or No. 2 East drift with the main No. 2 South side adit. During 1920 most of the development-work has ben confined to extending the West drift to a length of 500 feet, cross-cutting the ore-body by driving three crosscuts towards the south-west from the West drift; No. 1 being about 30 feet long, No. 2 about 60 feet long, and No. 3 about 60 feet long; also making a raise about 300 feet on the foot-wall of the ore-body on an incline of 38°, which connects with an adit driven about 150 feet long, with its portal at an elevation of 1,722 feet above sea-level and about 350 feet north-westerly from the portal of the main No. 2 South side adit, which, though, is at an elevation of 1,550 feet above sea-level. The top of the raise is about 150 feet vertically below the surface.

This work has blocked out a tonnage of "actual" ore, with working-openings exposing three sides, of approximately 200,000 tons, and assures, without necessitating sinking, a production of about 300 tons of ore a day for two years from this one ore-body.

In addition to the development-work above recorded, two stopes, each 50 by 50 feet, were opened during the summer of 1920 and production of ore for transportation to the mill was begun.

Owing to an extremely dry summer season it was not possible to start the mill by water-power until in September last, and owing to the difficulty of obtaining a vessel to carry concentrates to the Tacoma smelter it was not until December last that the first cargo of about 400 tons was shipped.

QUATSINO MINING DIVISION.

KYUQUOT SOUND SECTION.

Since about 1903 until during the season of 1919 the Kyuquot Sound section of the Quatsino Mining Division received but little attention from prospectors, but during the seasons of 1919 and 1920 a few prospectors selected that field for their operations. The result was the staking of the *Caledonia* group of mineral claims on the Kokshittle river, which flows into the arm of that name at its extreme head, also of a group on Kokshittle arm near its head. These groups will be described later in the following report.

Quartz-Alunite Rocks.

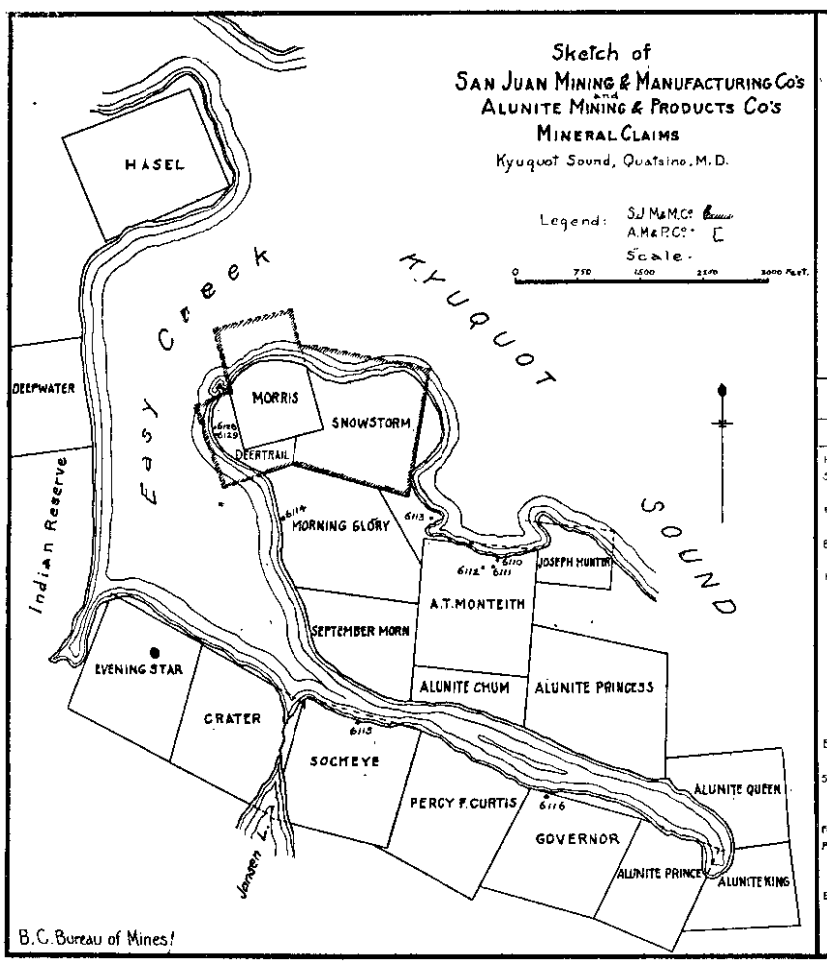
The Summary Report for 1913, Geological Survey of Canada, pages 109–126, contains a description by Dr. C. H. Clapp of alunite or natro-alunite rocks carrying a percentage of potash situated on Kokshittle arm of Kyuquot sound. Dr. Clapp fully described the geologic occurrence of the alunite and pyrophyllite rocks; consequently it is not necessary in this report to repeat his descriptions. During recent years so many statements have been made by the owners of the mineral claims described in Clapp's report, relative to the occurrence of soluble potash in commercial quantities in the quartz-alunite rocks, that these have attracted much attention from the public and created considerable comment.

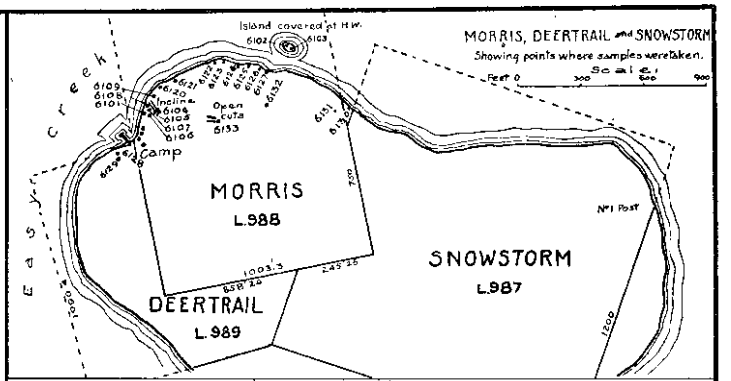
The necessity of verifying statements with regard to the potash in the rocks was considered of such importance that the Honourable the Minister of Mines requested Philip B. Freeland, Resident Engineer for Mineral District No. 4, to accompany the writer in making an examination and systematic sampling of the rocks which, it was alleged, contained potash in commercial quantities, the potash contents to be the primary feature of such report.

The party, including two men to assist in drilling and sampling, in addition to the engineers mentioned, together with John J. Baird, manager of the San Juan Mining and Manufacturing Company, and Doctor Alfred R. Baird, managing director of the Alunite Mining and Products Company, Limited, left Victoria on February 20th, 1920, on the Canadian Pacific Railway Company Coast steamer "Princess Maquinna" and arrived on the property on February 24th. From that time until March 6th was occupied in doing the work necessary.

San Juan Mining and Manufacturing Co.—This company owns the Crown-granted mineral claims known as the *Morris*, *Snowstorm*, and *Deer Trail*, as shown in the accompanying map on the north-westerly part of a peninsula between the Kokshittle arm of Kyuquot sound and Easy creek.

During the examination of the several mineral claims the representatives of their respective companies were consulted as to the areas on which the most encouraging results as to the occurrence of potash (K_2O) could be obtained, and, in sampling the engineers were guided by





KYUQUOT SOUND CLAIMS. Table of Analyses
To accompany Report of W.M. Brewer, 1920

Location whence sample came	Owners	Mineral Claim	B.C. Govt Laboratory Sample No.	Analyses for Potash K_2O. Samples by Brewer & Freeland: analyses by J. Adams. Total K_2O in ore by method of analysis A	One ton crushed as in Pine Tree process. K_2O in ore as got (with roasting) as treated as above B	Water soluble K_2O in ore as got (with roasting) as treated as above C	Water soluble K_2O in ore crushed and roasted 1 hour cooled D	Other Chief Constituents					
									Lime (CaO)	Alumina	Ferric Oxide	Magnesia	Sulphuric Anhydride	Insoluble matter
Holes blasted along shore	S.J.M.&M.Co.	Morris	6101		20.0	0.80	0.64	A	3.55	3.19	2.68	3.65	
Small island, submerged at high tide, 300 ft from shore	"	"	6102	3.40	23.8	2.88	2.20	B	22.82	22.50	26.10		
"	"	"	6103		22.0	1.30	1.10	C	3.06	3.43	3.36	3.16	2.14
Face of inclined shaft	"	"	6104		22.0	0.70	0.55	D		2.45	2.60	2.34	
" " "	"	"	6105		17.0	0.70	0.69						
Bluff in which are an old tunnel	"	"	6106		19.0	0.90	0.73						
" " "	"	"	6107		18.0	1.30	1.07						
Holes blasted along shore	"	"	6108		19.0	1.90	1.54						
" " "	"	"	6109		4.0	Trace	Trace						
" " "	"	"	6120		12.0	0.90	0.80						
" " "	"	"	6121		4.5	Trace	Trace						
" " "	"	"	6122		12.5	1.10	0.97						
" " "	"	"	6123		17.5	2.00	1.66						
" " "	"	"	6124		17.0	2.60	2.16						
" " "	"	"	6125		18.3	2.10	1.72	A		3.19	3.10	2.0	3.42
" " "	"	"	6126	3.10	18.6	2.23	1.83	B		18.03	17.61	21.10	
" " "	"	"	6127		22.0	2.30	1.80	C	2.72	2.89	3.24	2.44	2.02
East shore, Easy Creek	"	Deertrail	6128		5.0	Trace	Trace	D		2.56	2.67	1.32	
" " "	"	"	6129		6.0	Trace	Trace						
Sample across 20 ft out cropping	"	Snowstorm	6130		1.0	Trace	Trace						
" from bluff 30' above water	"	Morris	6131		1.0	Trace	Trace						
" " " 40' " "	"	"	6132		25.0	3.50	2.62						
From Open cuts 70' " "	"	"	6133		18.0	0.90	0.75						
Facing Hohshittle inlet	Alunite M. & P. Co.	Monteith	6110		21.0	0.90	0.89						
" " "	"	"	6111		2.0	Trace	Trace						
" " "	"	"	6112		4.0	0.20	0.19						
East shore, Easy Creek	"	Hastie	6113		0.5	Trace	Trace						
" " "	"	Morning Glory	6114		3.5	0.10	0.09						
" " "	"	Sockeye	6115		2.3	Trace	Trace						
" " "	"	Governor	6116		4.1	Trace	Trace						

the advice received from J. J. Baird as to the property of the San Juan Mining and Manufacturing Company, and from Doctor Alfred R. Baird as to the property of the Alunite Mining and Products Company, Limited.

On account of the very limited quantity of development-work on the claims, the heavy overburden, down timber, and underbrush which covers the rock formation, it was not possible to sample cross-sections systematically; therefore the several exposed outcroppings occurring near and along the beach at about high-tide mark, apparently parallel, or nearly so, with the line of strike of quartz-alunite rocks, were selected as offering the best opportunity to secure fair representative samples. Holes about 18 inches deep were drilled at the several points designated in the accompanying assay plan as Nos. 6101–6109 and 6120–6133. The assay results from these samples for potash contents are given on the attached table of analyses. From reference to this it is shown that the boundaries of the deposit are confined to the *Morris* mineral claim.

In the attached table of analyses it will be noted that the results in columns C and D are given in percentages of water-soluble potash (K_2O), which is the customary method adopted in commerce, as for fertilizing purposes the water-soluble content only is given consideration.

The direction of the strike of the rocks is east, with their dip at an angle of about 35° to the south. The boundaries of the quartz-alunite rocks along the line of strike, in which the content of potash (K_2O) is 2 per cent. or over, are apparently between the points sampled; as, Nos. 6123–6127, a distance of approximately 300 feet, with a possibility that the deposit may extend under the water to the small island, which is submerged at high tide, an additional 300 feet. The samples from this island are numbered 6102 and 6103.

All of the other samples taken, not only on the *Morris* mineral claim, but also on the *Deer Trail* and *Snowstorm*, yielded less than 2 per cent. potash (K_2O).

Alunite Mining and Products Co., Ltd.—This company owns the following named mineral claims on the same peninsula as those owned by the San Juan Mining and Manufacturing Company: *A. T. Monteith, Joseph Hunter Fraction, Athens Fraction, Hastie, Morning Glory, September Morn, Alunite Chum, Alunite Princess, Alunite Queen,* and *Alunite King.* The company also owns the following named mineral claims on the southerly side of Easy creek, opposite the peninsula: *Alunite Prince, Governor, Percy F. Curtis, Sockeye, Crater,* and *Evening Star;* also the *Deepwater* and *Hasel* on the west side of Easy creek.

Samples numbered 6110–6116 were taken from some of these claims from points marked on the accompanying assay plan, but as none of these samples carried any appreciable quantity of potash (K_2O) as shown by the results from assays it is, deemed unnecessary to describe the property of the Alunite Mining and Products Company, Limited, in this report, for the reason that the primary object of the examination and sampling was to determine whether the quartz-alunite rocks contained potash (K_2O) in commercial quantities.

The writer deems it advisable to include in the present report copies of correspondence exchanged between the Provincial Mineralogist at Victoria and A. E. Wells, of the Department of the Interior, Bureau of Mines, Mining Experiment Station, Salt Lake City, Utah, as follows:—

"BUREAU OF MINES,
VICTORIA, B.C., June 11th, 1920.

"*Bureau of Mines,*
Washington, D.C.

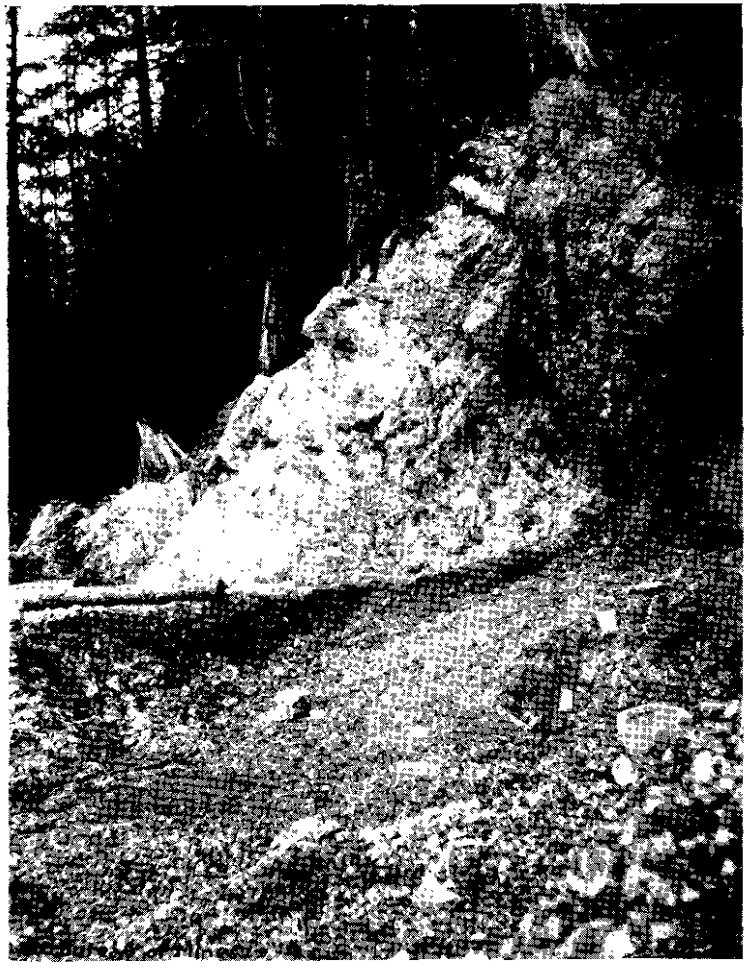
"*Attention Mr. Arthur Wells.*

"DEAR SIR,—I would be greatly obliged if you would kindly allow me to take advantage of your greater experience and research into the question of the production of potash from alunite, and favour me with a little advice on a question that has been placed before me here officially.

"We have a deposit of rock on the west coast of Vancouver island which has recently been thoroughly sampled, and some thirty analyses made of the ore after roasting for four hours at a temperature of from 700° to 850° C.

"The loss in weight in roasting varies from 17 to 24 per cent. and will average about 20 per cent.

"The roasted mineral was leached with hot water, and the highest water Sol. Potash found in such roast was 3.36 per cent. K_2O, which was equivalent to 2.60 per cent. on the crude ore.



September Mora Claim, Kyuquot Sound.

Morris Claim, Kyuquot Sound.

"As far as I can gather from your report, at Marysvale they did not find 9 per cent. K_2O profitable, and their ore was low in silica and silicates, whereas ours is high.

"Our highest assay is less than 3.5 per cent. K_2O, but even if we were to assume 3.5 per cent. K_2O as our average, would that bring our deposit even within the range of practical consideration as a commercial possibility?

"Can you give me any figures as to costs of grinding, roasting, leaching, and crystallizing out salts?

"Our investigations as to analyses show that the results we obtained by the platinic chloride are somewhat lower than those obtained by the perchloric method, but we have a suspicion that some soda is included in latter results.

"What method is commercially accepted now in the trade? Could you refer me to a publication describing the method of analysis you consider best? I would be greatly obliged if you could give me the benefit of your investigations on this matter.

"I am,

Yours truly,

"(Sgd.) WM. F. ROBERTSON,

Provincial Mineralogist."

"DEPARTMENT OF THE INTERIOR,
BUREAU OF MINES,
MINING EXPERIMENT STATION,
SALT LAKE CITY, UTAH, June 20th, 1920.

"Mr. Wm. F. Robertson,
Department of Mines,
Office of the Provincial Mineralogist, Victoria, B.C.

"DEAR SIR,—I have your letter of June 11th asking in regard to the cost of treating alunite at Marysvale, Utah.

"There was only one large plant at Marysvale and that was the plant of the Mineral Products Company, which has subsequently been bought out by the Armour Fertilizer Works. As you stated in your letter, their ore ran not less than 9 per cent. K_2O and was low in silica and silicates. I have no definite figures regarding the costs of mining, roasting, leaching, and crystallizing out the salts, as that company has been very reluctant to give out such data. However, from what I can learn, the costs were such that they could not expect to operate and make money with the market for potash at less than $2 per unit on the Atlantic seaboard. It is my impression that their potash in potassium sulphate cost them about $2 per unit when they were operating in 1918, and again in the summer of 1919. I do not see how material containing less than 3.5 per cent. K_2O could possibly be treated for the production of potash salts at a cost of less than $3 per unit K_2O. I would say definitely that a 3½-per-cent. material in this country (U.S.) would not be within the range of practical consideration as a commercial possibility. There may be places where locally the cost of potash is so high that the treatment of such material would be commercially a possibility, but certainly not in the United States. The nearest approach to the treatment of such low-grade material of which I have a knowledge is the treatment of the shales from Atlanta, Georgia. At that point the shales can be mined at a very low cost and can be ground at a low figure, as they are easily broken up. The cost to roast is low because the shales do not have to be heated above 800° C. Subsequent leaching and crystallizing operations involve no special difficulties. With all these favourable factors, nevertheless, the cost of recovering potash salts from shales containing 6 per cent. potash is not less than $1.50 per unit K_2O contained.

"In regard to the method of analysis: The method generally used by the Bureau of Mines staff is that described by R. C. Hall and E. H. Schwartz in the *Journal of Industrial Engineering Chemistry*, Volume 9, page 785, 1917. In this method potash is precipitated by cobalti nitrite and the precipitated sodium potassium cobalti nitrite is oxidized by permanganate.

"Very truly yours,

"(Sgd.) A. E. WELLS."

The foregoing copy of the letter from Mr. Wells appears to the writer to practically settle the question as to the commercial possibilities possessed by the mineral claims included in this report so far as the use of the alunite rock for a fertilizer is concerned, and it would appear

unnecessary to continue this report further than to state, in conclusion definitely, that so far as the potash content of the rock is concerned it is of too low a percentage to be considered as a commercial possibility for fertilizing purposes.

Caledonia Group.

This group contains fifteen mineral claims, named *Caledonia Nos. 1* to *14* and the *Caledonia Falls* claim, and is owned by J. Dernberger and Charles G. Nordstrom, post-office address Kyuquot Whaling Station, entered in the "Postal Guide" as Cachalot, with whom was associated Dr. Alfred R. Baird, of Vancouver, at the time the examination was made on February 29th, 1920. The group is located about 1½ miles from the head of Kokshittle arm of Kyuquot sound, near the Kokshittle river, which flows through a box canyon for about a mile, in which are a succession of falls that would furnish a good water-power if developed.

Geology.—The rock formation on the *Caledonia* group of mineral claims is made up largely of the Vancouver volcanics, and in the vicinity of outcroppings of copper-sulphide ore the country-rock, as classified by Dr. Victor Dolmage, of the Canada Geological Survey, is a silicified argillaceous tuff composed of quartz, andesine feldspar, chlorite, volcanic glass, carbonaceous material, kaolin, and a small quantity of magnetite. A belt of white crystalline limestone occurs about 700 feet south-easterly from the ore-bearing zone. The volcanic rocks are considerably sheared, fissured, altered, and fractured.

Characteristics of Ore-deposits.—As the *Caledonia* group of mineral claims had only been located in July, 1919, when the occurrence of outcroppings of magnetite and copper-sulphide ores was discovered, there was only a very limited amount of mining-development work done previous to the examination at the end of February, 1920.

There are several isolated outcroppings on *Caledonia Nos. 5* and *6* claims which appear to occur in a dimly defined zone which has its line of strike in a general north-easterly direction, but further development may demonstrate that the outcroppings belong to separate mineralized zones which parallel each other and strike in a general north-westerly direction. The outcroppings apparently belong to the contact-metamorphic type of ore-deposits, although, so far as is known at present, they do not occur at or very near the contact of the volcanic rocks with crystalline limestone, which occurs about 700 feet distant.

The presence of considerable quantities of epidote and garnet rock, which make up the gangue in which the minerals found in the outcroppings occur, indicates the contact-metamorphic origin. The minerals occurring in the outcroppings are: Magnetite, chalcopyrite, some bornite, and occasionally copper-carbonate stains. Shallow open-cuts have been made to expose the ore-bodies below the surface.

Samples were taken from three open-cuts, which assayed as follows:— No. 1: Gold, trace; silver, 0.2 oz.; copper, 0.5 per cent. No. 2: Gold, trace; silver, trace; copper, 4 per cent. No. 3: Gold, trace; silver, trace; copper, 3.7 per cent.

Development-work.—The mining-work on February 29th last consisted of several open-cuts and some stripping. A blacksmith-shop 10 by 10 feet had been built near the mine-workings. Camp buildings consisted of a cabin 16 by 22 feet, with kitchen addition 10 by 14 feet, and cellar for vegetables 10 by 10 feet. These buildings are on the *Caledonia Falls* mineral claim overlooking the falls in Kokshittle river.

SOUTH-EAST ARM SECTION.

Elk Lake Subsection.

Old Sport.

This mine is owned by the Coast Copper Company and is operated under the management of Wm. Clancy, who with a crew of about thirty men has continued development-work during 1920 on the *Old Sport* and other adjoining groups of mineral claims. As this property was described in detail in the Annual Reports for 1916, pages 240, 241; for 1917, page 255; and for 1919, pages 203–205, it is only necessary in this report to refer to the extension of the development-work done during the past year.

This has been confined to driving the lower adit to intersect the *Old Sport* ore-body. The length of the adit is 2,000 feet; it is driven all the way from the foot-wall side of the ore-body in diorite and is 475 feet vertically below the outcrop, or 800 feet on the dip of the vein on a 37° incline.

In addition to this work, the regular assessment-work has been done on the other groups of mineral claims which comprise the property—namely, *Penstock*, *Idaho*, *Edith*, and *Machete* groups.

NANAIMO MINING DIVISION.

In the Annual Report for 1919, the writer, on pages 207–209, gave a full geographical description of the Mainland part of the Nanaimo Mining Division, together with a list of the various streams from which it was possible to develop water-power situated on the Mainland, as well as on Vancouver island, within the boundaries of the Division. In the following report that part of Vancouver island that is in the Nanaimo Mining Division will receive more attention because of its having been more closely examined during 1920 than in past years, also for the reason that a trip into the only partially explored northern section of the Division on the Mainland had to be postponed owing to the inclemency of the weather in September, which was the earliest date possible to make it on account of other departmental business.

During the coming summer it is proposed to make as thorough an examination as possible of the northern section, especially of the country bordering on the Klinaklini river and Tatlayoko lake, where it is reliably reported that considerable activity in prospecting and development work was manifested during the late summer of 1920. This is shown by the fact that twenty-nine locations of mineral claims were recorded on Chromium creek, a tributary of the Klinaklini river, and that arrangements were made to haul machinery for a small concentrating plant to be erected on the property of the Tatlayoko Gold Mines Company, Limited.

COAL-MINING INDUSTRY.

The most important industry in the Nanaimo Mining Division is coal-mining. All of the producing collieries on Vancouver island are in that Division, as well as nearly all of the area underlain by the coal-measures.

When it is considered that during 1920 the collieries produced a total of 1,801,731 long tons of coal, employed about 4,000 men in all capacities above and underground, and paid out approximately $500,000 each month for wages, independent of the amounts paid out for machinery, explosives, rails, and general supplies, some idea can be formed of the importance of the industry in the Nanaimo Mining Division on Vancouver island. One of the most outstanding features of that industry during 1920 was the increased total output over that of 1919, which was 102,383 long tons.

With the above-mentioned facts in view, it is considered to be desirable to refer in this report briefly to some of the main features connected with the coalfields along the north-easterly coast of Vancouver island.

There are three recognized coal-basins in the Nanaimo Mining Division—namely, Nanaimo, Comox, and Suquash—with Nanaimo as the most southerly, of which the city of Nanaimo is the main centre, although geographically near the north-western boundary of the productive area. The Comox basin is north-easterly from the Nanaimo and separated from it by an axis of Vancouver volcanics which occur north and south of Nanoose bay; its distributing centre is the town of Cumberland, about 70 miles distant from Nanaimo in a north-easterly direction. The Suquash basin occurs about 120 miles up the north-east coast of Vancouver island from Cumberland, and is separated from the Comox basin by a wide belt of Vancouver volcanics extending from near Menzies bay, the northerly boundary of the Comox basin, to Port McNeill, the south-easterly boundary of the Suquash basin; its nearest distributing centre is Sointula, on the south side of Malcolm island.

Suquash Coalfield.

The Suquash coalfield was the earliest discovery of coal on Vancouver island. This was made by Indians in 1835, and attention was first directed to it by Dr. W. F. Tolmie, of the Hudson's Bay Company's post, Fort McLaughlin, Milbanke sound. Mining on a limited scale was carried on by the Hudson's Bay Company until 1853; since then the mine has been idle, except spasmodically, during recent years after it was acquired by the Pacific Coast Coal Mines, Limited.

During the summer of 1920 that company sent an engineer and crew of miners to unwater and reopen the mine with the intention of shipping coal, but up to date this intention has not materialized and work has again been suspended.

Aside from information contained in a report by Dr. G. M. Dawson in the Annual Report, Geological Survey of Canada, Vol. II., 1886, pages 61–70B, also in a short report by Chas. H. Clapp in Summary Report, Geological Survey of Canada, 1911, page 106, both of which are referred to by D. B. Dowling in Memoir 69, Can. Dept. of Mines, "Coalfields of British Columbia," 1915, pages 112–124, there is comparatively little known as to the possibilities of the Suquash coalfield.

Clapp states: "The basin is, however, somewhat larger than generally supposed, containing Malcolm and Cormorant islands and possibly extending south-west to Quatsino sound. On account of the uniformity and regularity of the coal-seams and strata and their small amount of disturbance, the mining conditions are excellent. The coal is of good quality, burning with a long flame and little smoke. The large number of partings in the seam which is at present being worked and the thinness of the other known seams are the chief disadvantages of the field. The conditions are such, however, as to greatly encourage further development and prospecting, especially in the lower part of the measures."

The extent of the Cretaceous rocks, chiefly sandstone, in the Suquash coalfield along the north-east coast of Vancouver island is about 14 miles from Port McNeill, or about 7 miles south-easterly from the Suquash coal-mine to Beaver harbour, about 7 miles north-westerly from it.

Comox Coalfield.

The Comox coalfield extends in a south-easterly direction from a point about 10 miles north-westerly from Menzies bay, about 20 miles north-west from the northern boundary of the Esquimalt & Nanaimo Land Grant, to North-west bay, about 18 miles northerly from Nanaimo. It is bounded on the south-west by the Beaufort range of mountains and on the north-east by the strait of Georgia. Excepting the short reports by James Richardson and C. H. Clapp, the former contained in the Report of Progress, Geological Survey of Canada, 1876–77, pages 161–170, and the latter in Summary Report, Geological Survey of Canada, 1911, pages 105–106, there is no literature published relative to the Comox coalfield. The late Wm. Sutton, Geologist for the Wellington Collieries Company, and later for the Canadian Collieries (Dunsmuir), Limited, made a detailed geological report and map of the area for the private information of those companies, which have not been published.

The first development-work in the Comox field was done by Robert Dunsmuir in 1888 at the Union Collieries in Cumberland, where the mines are still being operated and producing the bulk of the production made by the Canadian Collieries (Dunsmuir), Limited, which is the only operating company in the Comox coalfield.

The producing area is at present confined to the Cumberland mines, about midway between the south-eastern and north-western boundaries of the Comox field, and although considerable drilling has been done in other parts of the field, but little is known of the possibilities of the discovery of workable seams of coal, except to the private organizations which have undertaken the enterprise.

Henry S. Fleming resigned as vice-president of the Canadian Collieries (Dunsmuir), Limited, during the autumn, and J. M. Savage, general manager, was promoted to the position previously occupied by Mr. Fleming, as well as being elected a member of the directorate, but continues to fill the position of general manager in addition to taking over the other duties and responsibilities, while Thos. Graham remains as general superintendent.

In the Cumberland section the Canadian Collieries (Dunsmuir), Limited, has been prospecting with two diamond-drills on the Tsable river, which empties into Baynes sound opposite Denman island, during 1919 and 1920. During 1920 there has been a total of 7,453 feet of diamond-drilling and 37,400 feet of roadways completed.

As all of the details relative to the producing coal-mines in and around Cumberland are given in the report of the Inspector of Mines, it is unnecessary to refer to such in this report.

Some years ago prospecting for workable coal-seams was carried on by Messrs. McGowan and Priest, of Vancouver, in the north-westerly part of the Comox field outside of the Esquimalt & Nanaimo Land Grant, and more recently rumours have been circulated that Thos. Stockett, predecessor to George W. Bowen, the present general manager of the Canadian Western Fuel Company at Nanaimo, purposed developing that part of the field under an option of purchase held by him. Up to the present time these rumours have not resulted in any activity.

The following extract from the report of Chas. H. Clapp is interesting at the present time when coal is attracting so much attention, due to the scarcity of fuel-oil. He says: "In the Comox field the coal is found in several seams that occur in a sandstone formation closely resembling the Protection formation of the Nanaimo series. Three of the seams have been mined. The formation, which may be called the Comox formation, consists chiefly of a white or greyish-white sandstone, composed largely of rounded quartz grains with a coating of kaolin and with accessory chloritic micas. Interbedded in the sandstone are thin beds of carbonaceous sandy shale, with which the coal is usually associated. The formation has a maximum thickness of about 800 feet and rests directly on the metamorphic volcanics of the Vancouver group. It is overlain by a thick group of shales, called the Trent River shales, which are very much like the Cedar District shales that overlie the Protection sandstone in the Nanaimo district. The sediments of the Comox basin have a much simpler and more regular structure than those of the Nanaimo basin, and form, in general, a simple monocline with a low uniform dip of about 10° to the north-east. The coal-seams are more regular than those of the Nanaimo basin and must be the result of a more uniform condition of sedimentation, although a similar uniformity of conditions appears to have existed in the Nanaimo basin during the deposition of the Protection formation. However, the coal-seams of the Comox district show, but to a less degree, the pinching and swelling and sharp rolls so characteristic of the Nanaimo coal-seams. Large wants due to a replacement of the coal by silts are probably more frequent in the Comox field. One peculiar feature met with in the Comox field is not met with in the Nanaimo field. The lowest seam of the former field occurs very near the base of the Comox sandstone, and as the Comox basin resembles the Nanaimo basin in that the crystalline rock surface, on which the sediments are deposited, was very irregular, many of the higher irregularities of the base remained above the depositional level when the lowest seam was deposited, and in consequence the lowest seam is frequently cut off by knobs of the underlying volcanics projecting through it. There is also another feature which is not met with in the Nanaimo field. North of the producing mine in the Comox field between Brown and Puntledge rivers a dacite porphyry has broken through the Comox sandstone and forms a flow or intrusive sheet which overlies it. Near the dacite-porphyry intrusion, which occurs near the outcrop of the lowest seam on Brown river, the coal is broken, partially coked, and rendered valueless. It is probable that the intrusion of dacite-porphyry occurred in early Tertiary times and was a phase of the widespread Eocene volcanic activity."

Nanoose Coalfield.

Coal-bearing areas of limited extent occur in an isolated field a short distance easterly from Blynden point, near the entrance to Nanoose harbour, between the south-eastern boundary of the Comox field and the north-western boundary of the Nanaimo field, as described in Clapp's and Richardson's reports. The occurrence of coal in this location indicates that it is an outlier of the Wellington seam, the lowest of the seams in the Nanaimo basin, and appears to be cut off from that basin by the axis of Vancouver volcanics referred to by Clapp as occurring to the north of Departure bay, a short distance north of the old Brechin mine, which is known as the northern boundary of the Newcastle and Douglas coal-seams.

This field was first developed on a limited scale several years ago, but operations were abandoned previous to 1898, when it was known as "Jack's coal-mine." In 1915 interest was revived in the field by the securing by John Grant, of Nanaimo, and associates, as the Nanoose Collieries Company, of some foreshore leases in addition to the Jack property. A shaft was then sunk 133 feet deep near the beach, and later an endeavour made to mine the coal on the dip under the strait of Georgia; but, although a slope was driven for about 700 feet, the angle of the dip was not sufficient to gain the requisite depth below the bottom of the sea, as provided by the "Coal-mines Act," to enable the operators to open rooms from the slope, but the life of the mine was saved by the company securing a lease in 1919 from the Canadian Collieries (Dunsmuir), Limited, of an area of the coal-basin adjoining the property the company already owned. This enabled the management to mine under solid ground. In the autumn of 1919 the Nanoose Collieries Company sold out to the Nanoose-Wellington Coal Company, a full description of whose operations and new plant, including washery, etc., was given in the Annual Report for 1919; consequently it is unnecessary to here repeat it. The fact that the production of the

mine during 1920 was more than double that made during 1919 makes a most satisfactory showing for the area that may be called the Nanoose coalfield to distinguish it from the Nanaimo or Comox fields.

Nanaimo Coalfield.

There has been so much more information about the Nanaimo coal-mines published from time to time than about the other coalfields on Vancouver island that it seems almost unnecessary for the writer to devote any space to the subject, especially in view of the fact that the report of the Mines Inspector for the district will give full details relative to the operation of the several collieries in the field. There have, however, been some notable events happening during 1920 connected with coal-mining in the Nanaimo field on Vancouver island which merit mention in this report, because they point to an increased production and necessarily increased prosperity in that part of the island which to-day ranks as the equal of, if not superior to, any other portion of the Province in regard to industrial development.

In this respect it is well to call attention to the estimated extent of the Nanaimo coalfield according to Clapp's report, of which he says: "The Nanaimo basin on Vancouver island extends south-east from Departure bay, north of Nanaimo, to Crofton, a distance of about 30 miles. Its greatest inland extent south of Nanaimo is about 10 miles. It extends, however, much farther east and south-east, comprising the northern part of Saltspring Island and the islands to the east and north; extending still farther south-east to the islands in the State of Washington. Its greatest exposed length and width in Canadian territory is 55 and 15 miles respectively."

The Canadian Western Fuel Company, Limited, which operates the No. 1 or Esplanade, Reserve, Harewood, and Wakesiah mines, Nanaimo, has increased the production during 1920 by approximately 60,000 tons over the 1919 production of 638,565 long tons, and retains the distinction of not only operating the oldest coal-mine on Vancouver island, but also the largest producer.

In that part of the Nanaimo field known as the Wellington-Extension section the Canadian Collieries (Dunsmuir), Limited, has been prospecting the section of the Cedar district known as the Haslam flats, where one diamond-drill has been in operation during 1920, by which about 1,000 feet has been bored.

The Granby Consolidated Mining, Smelting, and Power Company completed the equipment of the Blainey loading-dock near Ladysmith by installing a rubber belt-conveyor 1,300 feet long which connects the small storage-bins with the hold of a vessel at the wharf. In the coal-washing plant at Cassidy seven Overstrom concentrating-tables have been installed for the purpose of more thoroughly cleaning the slack coal than was possible with jigs alone. A new radial drill, a shaper, and other equipment have been added to the machine-shop. The main slope has been extended about 1,000 feet during 1920, thus reaching a total length of 3,500 feet, passing through that part of the field in litigation and into that section the title of which is not in dispute. The output from the mine has been very considerably increased during the last six months. A Dorr thickener is being installed near the washing plant; the tank of the thickener is 75 feet in diameter by 13 feet high on a concrete foundation. The ventilating equipment at the mine has been enlarged by the installation of a Sirocco fan with a capacity of 150,000 cubic feet of air a minute. During 1920 the production was increased from 72,885 tons in 1919 to 207,236 tons.

The East Wellington Coal Company is a new organization that has secured a lease on a royalty basis from the Canadian Collieries (Dunsmuir), Limited, of a tract of approximately 2,800 acres of land adjoining the old Jingle Pot mine and extending to the northward. This tract of land is for the most part virgin territory, presumably underlain by the Wellington coal-seam, but also includes the Old East Wellington mine, which it is proposed to unwater. Up to the present time the work being done consists of clearing 10 acres for mine buildings, driving a new slope 611 feet, counter-slope 86 feet, crosscuts 155 feet, sump 6 by 12 by 30 feet, and erecting buildings for the following mentioned machinery which has been installed under the supervision of John John, the mine manager: Two 60 by 16, 200-horse-power boilers installed and equipped; two compressors, one 14 by 18 C-2 and one 16 by 16 C-2, installed and equipped; one hoisting-engine at pit-mouth.

In addition the following surface work has been completed: All air and steam lines completed; one blacksmith-shop and equipment; one machine-shop; one oil-house; three air-receivers; water and air lines completed; one water-tank, 35,000-gallon capacity; 700 feet of

railway spur completed from main line to pit-mouth, also 1,200 feet of mine-tracks all completed; Main-slope, counter-slope, and crosscuts all completely timbered, approximately 50,000 feet of timber used; engine-house, boiler-house, and compressor-house all constructed; mine-fan of 5,000 feet capacity free air installed and equipped with pipes, etc., leading to and from same; water and air lines all completed to bottom of shaft.

The Jingle Pot mine, west of the Canadian Western Fuel Company's farm, which was owned and operated by the Vancouver-Nanaimo Coal Mining Company, Limited, from about 1907 until its reorganization, during the war, into the British Columbia Coal Mining Company, Limited, was closed down as worked out early in 1920, after having produced approximately 800,000 tons of coal from an area of about 70 acres. The seam of coal mined on this property is the Wellington or lowest seam in the Nanaimo coalfield.

The Old Wellington mine, which was first opened by the late Robert Dunsmuir in 1868, and laid the foundation to his fortune, has been leased by the Canadian Collieries (Dunsmuir), Limited, to Alfred G. King, Jr., and Edward R. Foster, of Nanaimo, who are reopening the old workings on the Nos. 2 and 3 mines, Old No. 1 slope, and Old adit. These operations were started about the end of 1920, when some coal was mined after the old workings had been examined and found in good condition, considering that they have been closed down since 1901. In these old workings there occurs the coal-seam known as the Little Wellington, which overlies the main Wellington seam in the extreme north-western part of the basin at a distance of 20 to 60 feet, and was mined at the Old No. 1 shaft at the Old Wellington Collieries, which is included in the lease secured by King & Foster.

Round Island.—It is reported that John Arbuthnot and associates, of Victoria, have secured bonds on Round island and submarine coal areas in that vicinity, and propose opening a colliery provided the prospecting-work now being done results satisfactorily. Round island is near the northerly island of the De Courcey group, a short distance south-easterly from Dodd narrows and about 8 miles in the same direction from the city of Nanaimo.

Full particulars relative to the details of the workings in the coal-mines are given in this Annual Report under the head of "Reports of the Inspectors of Coal-mines."

METALLIFEROUS-MINING INDUSTRY.

The Nanaimo Mining Division is the largest in area of the several Mining Divisions in the Western Mineral Survey District No. 6, but metalliferous mining during 1920 has not progressed in as marked a degree as could be desired. One reason for this lack of progress is the fact that a very large proportion of the Division lies within the Esquimalt & Nanaimo Railway Belt, or "Dunsmuir" concession, in which all of the coal and base metallic minerals are owned by the Esquimalt & Nanaimo Railway Company, while the precious metals only belong to the Crown. In consequence of this fact and the difficulty of securing any title to the minerals owned by the railway company, prospectors have little incentive to explore within the boundaries of the concession.

Operations in metalliferous mining on Vancouver island have in consequence been confined to the north-westerly portion of the Nanaimo Mining Division, outside the Railway Belt, and to the several islands lying between Vancouver island and the Mainland.

STRATHCONA PARK SECTION.

Buttle Lake Subsection.

Paramount Mining Co.

From July 18th to 27th, 1920, the writer was occupied in making a trip to the head of Buttle lake, Strathcona Park, to examine the three groups of mineral claims on Myra and Price creeks, on which diamond-drilling and other prospecting-work was being carried on by the Paramount Mining Company under the superintendence of J. D. Tolman. This company was organized by Joseph Errington to acquire the *Lynx*, *Paw*, and *Shot* groups, comprising a total of forty mineral claims.

Area and Location.—The *Lynx* group contains fourteen mineral claims located on the northerly side of Myra creek, which flows into Buttle lake near its head. The *Paw* group contains eight mineral claims on the southerly side of the same creek. The claims in the two groups are staked in solid blocks, and the groups are connected by the *Bessie* mineral claim, which is staked from side to side of Myra creek, thus forming a connecting-link between the *West* and *South Paw* claims of the *Paw* group and the *Mink* and *Red Squirrel* claims of the

Lynx group. The *Shot* group contains eighteen mineral claims located on Price creek, and this group is separated from the *Paw* group by a high mountain divide which rises between Myra and Price creeks to an elevation of about 5,000 feet.

Geography.—The source of Price creek, which flows into the head or southerly end of Buttle lake, is in the easterly slope of the Beaufort range and a short distance northerly from Mount Septimus, altitude 6,300 feet.

The above-mentioned groups of mineral claims are reached from the Campbell River settlement on the east coast of Vancouver island, near the northern terminus of the Island Highway auto-road, and is a port of call for nearly all vessels sailing north from Vancouver. From Campbell river the route of travel to the head or south end of Buttle lake is via auto or wagon in a westerly direction to the foot of Upper Campbell lake, distant about 16 miles; thence by pack-trail in a southerly direction about 14 miles to the northerly end or foot of Buttle lake, where there is a good log cabin erected for the Government during the time when surveying and trail-building were in progress in Strathcona Park about 1912. From this end of the lake to Myra creek is about 22 miles, which distance must be travelled by boat or canoe. From the beach near the mouth of Myra creek the Paramount Mining Company has constructed a main pack-trail about 3 miles long to the camp on the *Lynx* group on the north side of Myra creek, also a branch trail about 1½ miles long from the main trail to the *Paw* group on the south side of the creek.

Geology.—The rock formation in the mountains adjacent to the northerly end of Buttle lake belongs to the series of Vancouver volcanics, but at Marble creek, a tributary emptying into the lake on the west side, about 9 miles from its foot or northerly end, there is a well-defined contact between the volcanic rocks and crystalline limestone which occurs to the south-east of the volcanics. Southerly from Marble creek and the belt of limestone the rocks appear to be mostly metamorphic, with belts or zones of considerable extent showing gneissoid structure.

Within the boundaries of the *Lynx* and *Paw* groups of mineral claims there occurs a zone of metamorphic schists, usually greenish in colour, and talcose. The schists are so extensive as to be 1,000 feet in width in places. The line of strike is north-west and the dip of the schistose structure is approximately vertical. The schist-zone also occurs on Price creek on the *Shot* group of mineral claims in a south-easterly direction from the *Paw* group. As the *Shot* group had only been staked a short time before the examination it was not visited.

Ore-deposits.—In the schist-zone there are innumerable narrow stringers of quartz, and where these are the most plentiful the minerals, chalcopyrite, pyrite, and occasionally crystals of zinc-blende, occur. In some open-cuts made for prospecting on the *Lynx* mineral claim on the north side of Myra creek a general sample moiled across 12 feet assayed: Gold, trace; silver, 1.2 oz.; copper, 1.75 per cent.

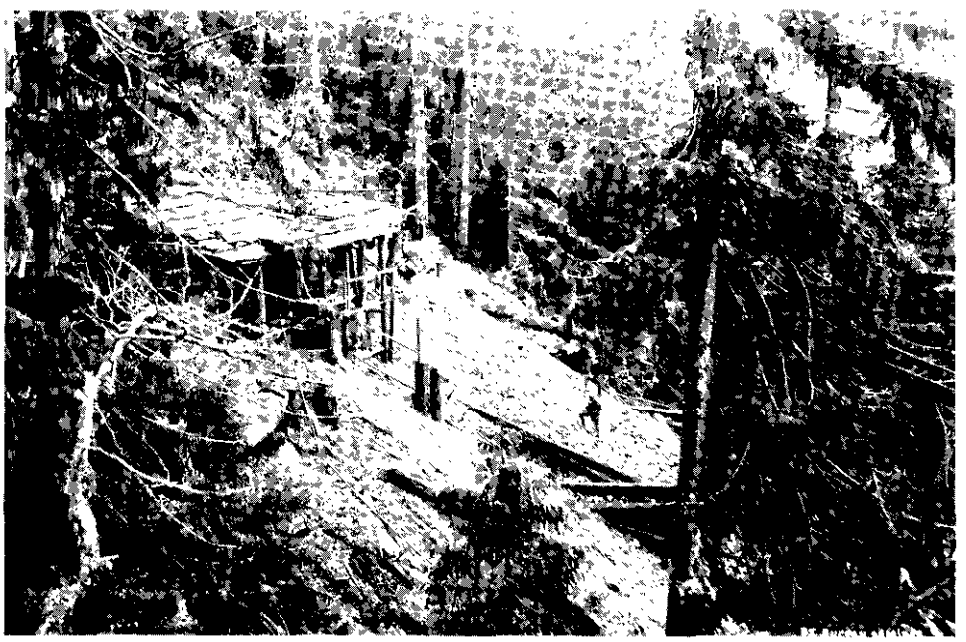
On the south side of Myra creek, on the *East Paw* mineral claim, the schist-zone has the same characteristics as on the *Lynx*. The zone on the *East Paw* mineral claim has been prospected by diamond-drilling across the mineralized part of the zone, and consequently the extent in width of that part of the zone is exposed by the cores from the several drill-holes. These show that the average width of mineralized schist, which may be termed the ledge material, where drilled at an angle of 45° is 253 feet, but where drilled by flat holes is 150 feet, and as the dip is practically vertical the flat holes would expose the true width more accurately than the inclined holes. No samples were taken of the drill-cores.

Development-work.—The Paramount Mining Company has had ten diamond-drill holes bored on the *East Paw* mineral claim, totalling 2,008 feet. In addition several open-cuts have been made, and on the *Lynx* group of mineral claims several open-cuts and prospect-trenches have been made. The main camp is on the *Lynx* claim, where a large log bunk-house and cook-house connected by a porch reaching the full width of the cabins, in Southern style, have been built, also a commodious office cabin. At the beach a good log cabin has been built for the packers and storing supplies. In addition to the trails already mentioned as built up Myra creek from the beach camp, there has also been a trail built up Price creek to the *Shot* group of mineral claims.

PHILLIPS ARM SECTION.

The Phillips Arm section of the Nanaimo Mining Division includes that part of the Division on the Mainland in the vicinity of Phillips and Frederick arms of Cardero channel, about 120

Eagle Talc & Mining Co., Sooke River, Victoria M.D.



Emancipation Mine, Coquihalla River, Yale M.D.

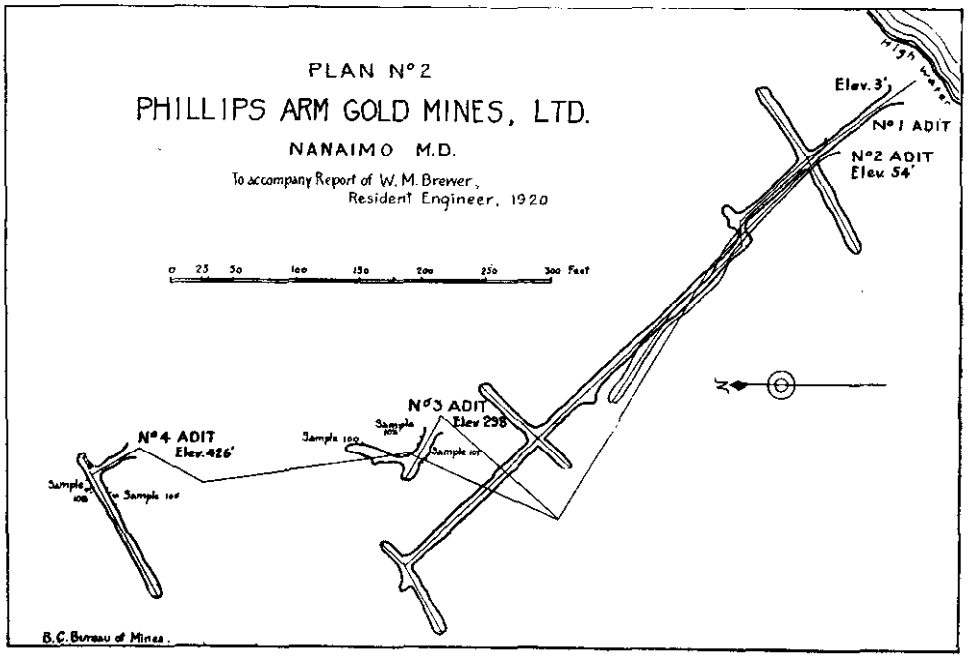
miles north-westerly from Vancouver, as well as the country inland along Phillips river and vicinity.

During 1920 development-work was done on some of the mineral claims in the Phillips Arm section which have been idle for the past fifteen years or more. From September 1st to the 15th the writer's time was occupied in making examinations in this section, when he examined the *Red Cap, Amethyst, Blue Bell,* and *Alexandra* groups of mineral claims.

Red Cap Group.

This group contains the *Magnet, Providence, Kitchener, Bermuda, Extension,* and *Neccotive* mineral claims, owned by the Thulin Bros., of Lund, and associates. The group of mineral claims is located on the East fork of Phillips river, about 20 miles by trail from the head of Phillips arm in a north-easterly direction.

Geography.—Phillips arm of Cardero channel penetrates into the Mainland for a distance of about 6 miles in a true north direction to the mouth of Phillips river, which flows from Phillips lake, situated about 3 miles up the river. The lake is about 4 miles long to the point where it becomes shallow from the filling-in of debris brought down from the upper part of Phillips river, which has its source in the high mountains of the Coast range, about 16 miles, as the crow flies, north-easterly from the head of the lake. Phillips river is not navigable even for a canoe, except under very favourable conditions, and for the most part flows through deep canyons.



The trail travelled to the *Red Cap* group of mineral claims follows the general course of Phillips river. The second lake is crossed by canoe or raft and a trail followed for about 5 miles up the Second East fork of Phillips river.

Geology.—The rock formations exposed along the route described above belong to the Coast Range batholith. No bands of metamorphosed argillites or other sedimentary rocks were seen until the upper reaches of the Second East fork of Phillips river were reached. There the occurrences of extensive areas of such rocks occur, enclosing wide veins of quartz sparingly mineralized so far as can be judged from samples taken during the examination.

Ore-deposits.—On the *Red Cap* group, on the northerly side of the Second East fork at about 2,500 feet elevation, the timber-line is reached, and above it the mountain-side is quite bare and precipitous. Here there occurs a wide belt of metamorphic argillites striking nearly east and enclosing several veins of quartz stained with iron oxides, on account of which the group of mineral claims was staked. Five samples taken from an adit crosscutting the formation assayed traces only in gold and silver and no copper.

Development-work.—The work consisted of the adit driven 142 feet across the metamorphosed argillites. Three cabins had been built by the owners of the *Red Cap* group—one at the head of Phillips lake, one at the crossing of the second lake, and the third on the mountain-side about 700 feet lower elevation than the adit.

Amethyst Group.

This group consists of two mineral claims known as the *Amethyst* and *Pathfinder*, owned by Thos. Golby and associates, of Victoria. The group was examined on September 11th, 1920, when the writer expected to meet Mr. Golby on the property, but unfortunately that gentleman had been called away on account of sickness, and the examination had to be made without the assistance of a guide conversant with either the surface or the underground workings, which was very unsatisfactory.

Geography.—The *Amethyst* group adjoins the old Crown-granted *Monte Cristo* mineral claim on the north side of Fanny bay, Phillips arm. The entrance to Fanny bay is on the west side of Phillips arm about 3 miles from Cardero channel. The property can be easily reached by launch or small boat from Shoal Bay, on Thurlow island, a port of call for several steamers plying from Vancouver, from which city it is distant about 120 miles.

Geology.—The *Amethyst* group of mineral claims, together with the *Monte Cristo* claim, occupy a zone made up of metamorphosed argillites, crystalline limestone, quartzites, schists, and shales, designated by Bancroft as "undifferentiated," which occurs as an inclusion in the granodiorite batholith of the Coast range. This belt of metamorphosed rocks is typical of many such occurrences along the mainland coast, and, as is usual in these zones, there are veins of quartz, mineralized with iron sulphides, gold, silver, and copper minerals. The formation has been intruded by several igneous dykes which generally occur in the limestone in the region of mineralization.

Ore-deposits.—The occurrence of ore was first discovered from outcroppings on the *Monte Cristo* claim about 1901, when some development-work was done. This was confined to open-cuts which appear to have exposed lenses of ore on either side of an igneous dyke. These lenses belong to the contact-metamorphic type of ore-deposits, occur irregularly, and are such that considerable time would be required to work out satisfactory conclusions. Apparently, judging from the work done, the lenses of ore were easily followed from the *Monte Cristo* claim on to the *Amethyst*, where the open-cut work was changed to driving adits, and the rock formation became much broken up, slickensided, and generally disturbed. There was no ore exposed in the face of either of the two adits examined, but there were indications that ore occurred in the floor of the lower adit. A sample taken from the dump at the portal of the No. 2 adit assayed: Gold, trace; silver, 2.4 oz.; copper, 3.5 per cent. This dump evidently represented the ore taken from the adit as the work progressed. A shaft that had evidently been sunk several years ago could not be examined on account of its dangerous condition.

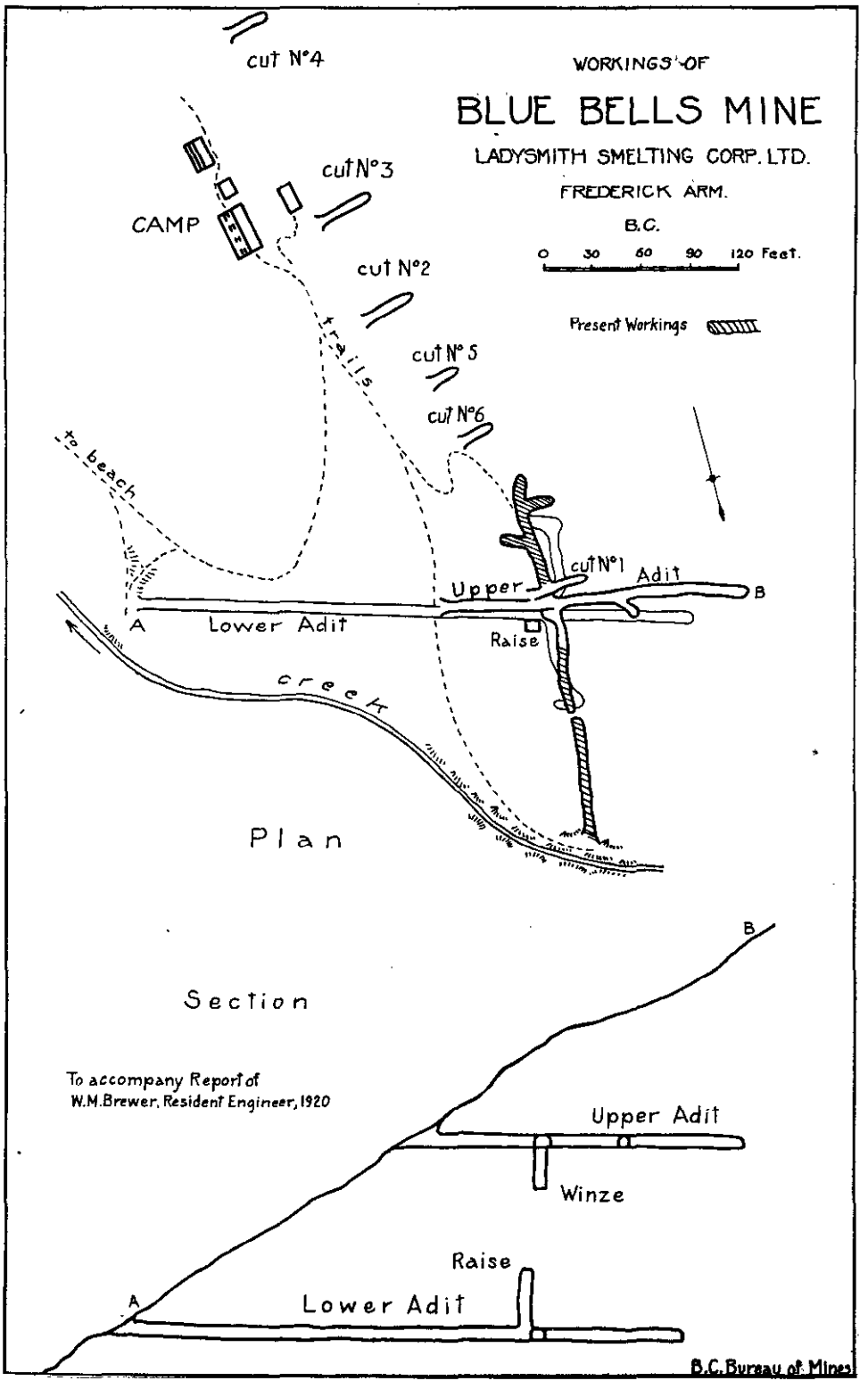
Development-work.—There are two adits each about 50 feet long; a deep open-cut made in benches, the lowest bench being from the entrance about 30 feet long and 18 feet deep; the next bench is about 9 feet above the floor of the lower one and is about 25 feet long; this is an approach to the No. 1 or lowest of the two adits, the other being about 20 feet higher. There is also an old shaft said to be about 30 feet deep, and there has been a connection made between the No. 2 adit and the west side of the shaft 18 feet below the surface.

Blue Bells Group.

This group consists of four mineral claims, named *Black Prince*, *Dashwood*, *Gold Bug*, and *Blue Bells*, containing 178.61 acres. The property was operated during 1920 by the Ladysmith Smelting Corporation, Limited, under the superintendence of R. F. Hill; the main object of the Smelter Company in securing this property being as a source of siliceous ore for fluxing. The group is located on the west shore of Frederick arm of Cardero channel. The boundaries of the mineral claims extend from the beach in a westerly direction in the order named above.

Geology.—The geologic formation on the *Blue Bells* group is made up of a zone of metamorphosed shale, schist, argillite, argillaceous limestone, tuff, and crystalline limestone, which form an inclusion in the Coast Range granodiorite batholith, and represents an example of a roof-pendant, as classified by the geologists, Daly, Camsell, and Bancroft, which was not destroyed at the time of the intrusion of the granodiorite nor removed by later erosion. The metamorphosed rocks are traversed by quartz veins.

Ore-deposits.—The occurrence of ore on the *Blue Bells* group is in a fissure filled with quartz carrying gold values, sometimes associated with iron pyrites, but usually on and near the surface as free gold in the quartz gangue. The quartz vein on the *Blue Bells* claim, on which all the


cut N°4
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BLUE BELLS MINE
LADYSMITH SMELTING CORP. LTD.
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A
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Raise
creek
Plan
B
Section
To accompany Report of
W.M. Brewer, Resident Engineer, 1920
Upper Adit
Winze
Raise
A
Lower Adit
B.C. Bureau of Mines

development-work has been done, has its line of strike about N. 35° W. and dips at an angle of 80° towards the south-west. It is exposed in both the upper and lower adits.

Development-work.—The mine-workings are about 5,000 feet from the beach at an elevation of 1,500 feet. The old workings date back from 1898–1902, but during 1920 these were reopened and extended. The camps at the beach and mine were rebuilt and the trail from the beach cleaned up and, where necessary, reconstructed.

The old workings consisted of six open-cuts and two crosscut adits, the upper one 75 feet below the apex of the outcrop and the lower one about 75 feet lower elevation. The upper adit is 190 feet long, with drifts driven 15 feet long to the north and 35 feet long to the south from a point 75 feet from portal of adit; also a winze sunk at the junction of the adit and north drift. The lower adit is 350 feet long, and at a point about 250 feet from the portal a raise is made to connect with the winze from the upper level. Drifts are driven, each about 50 feet long, to the north and south.

During 1920 five of the surface open-cuts were reopened; the drifts in the upper level were extended, the north drift 52 feet and south drift 45 feet; crosscuts were made from the south drift 17 feet to the east and 18 feet to the west. A new drift was driven 70 feet long on the upper level, with its portal in the steep bank of a creek about 150 feet northerly from the main adit. This drift is not yet connected with the north drift from the main adit.

Sampling.—The original workings were systematically sampled, as well as the new extensions by the Ladysmith Smelting Corporation, Limited. A total of about 200 samples, weighing from 10 to 90 lb. respectively, were taken during the operations, but the assay values have not been made public.

Alexandra.

This is one of the oldest locations in the Phillips Arm section of the Nanaimo Mining Division and is owned by the Phillips Arm Gold Mines Company, Limited, of Vancouver. The mineral claim is situated on the Mainland at Picton point, at the entrance to Phillips arm of Cardero channel. The property is very easily reached by any of the Union Steamship Company's steamers that call at Shoal Bay on Thurlow island, and from there by launch, rowboat, or canoe. The distance from Shoal Bay is only about 3 miles. The mine-workings are ideally situated on the shore, being from about 3 to 54 feet above high-tide mark.

History.—The *Alexandra* mineral claim was located previous to 1898, when the *Dorotha Morton* and *Douglas Pine* mines were being operated. In the Annual Report for 1898 there is a short report on the *Alexandra* claim made by the Provincial Mineralogist, but since then no reference is made to the claim in any of the reports. During 1919 the old workings were cleaned out, resurveyed, and systematically sampled by Henry Rhodes, of Vancouver; a copy of his map is included in this report.

Geology.—The prevailing rocks in the neighbourhood of the *Alexandra* claim are igneous, but there also occurs wide belts of metamorphosed shales, schists, and argillites, found as inclusions in the Coast Range granodiorite batholith. The band of metamorphosed sedimentaries is much fissured and sheared, as well as being intruded by some igneous dykes which usually cut it nearly at right angles. The fissures are filled with quartz and crushed country-rock. The general line of strike of the quartz veins is north-westerly and they dip at steep angles.

Ore-deposits.—The occurrence of ore is confined to the quartz veins, and on the *Alexandra* claim there occurs a main vein, so to speak, which apparently extends from the shore-line on the *Alexandra* claim in a north-westerly direction into the Pembroke range of mountains, the summit of which reaches an altitude of about 4,000 feet above sea-level at a comparatively short distance from Picton point.

The ore occurring in the quartz vein is either in the form of free gold or else as iron pyrites carrying values in gold and silver. From a list of 108 assays made from samples taken systematically by Henry Rhodes from adits Nos. 1, 3, and 4, evidence is given of the variable values contained in the quartz, ranging from about $25 a ton in gold and silver down to low values.

On account of the excess of silica in the vein or ledge, which is about 100 feet wide where it has been crosscut in two places in the underground workings, the property has become attractive to smelters as a source of fluxing-ore.

Development-work.—This consists of four adits; Nos. 1, 3, and 4 are driven as drifts along the quartz vein, while No. 2 is driven parallel to the vein in barren material with the idea of using it as a main haulage-adit whenever the property is worked on a commercial scale.

Adit No. 1 is driven from the shore about 3 feet above high-water mark; it is about 530 feet long, with three crosscuts, each about 100 feet long—one about 90 feet from the portal, the second 380 feet from the portal, and the third at the face of adit. Adit No. 2 is about 50 feet elevation above No. 1 and is about 260 feet long. Adit No. 3 is at an elevation of 298 feet above sea-level and is about 100 feet long. Adit No. 4 is at an elevation of 426 feet above sea-level and is about 150 feet long.

LASQUETI ISLAND SECTION.

Lasqueti is a small island about 12 miles long by 4 miles wide in the strait of Georgia about 18 miles northerly from Nanaimo. It is in the Nanaimo Mining Division, and although there are not any regular ports of call on the schedules of either the Canadian Pacific or the Union Steamship Companies, the island is easily reached by launch from Nanaimo or Union Bay.

Venus Group.

This group contains nine mineral claims and one fraction, called the *Mars*, *Venus*, *Venus Fraction*, *Hill 60*, *Big Dipper*, *Joan of Arc*, *L.S.*, *St. George*, *Blue Bird*, and *Reliance*. The group is owned by the Lasqueti Mining Company, Limited, of which Henry Lee is the managing director; office, Room 708 Birks Building, Vancouver. The property was examined on November 11th and 12th, 1920, by the writer in company with Mr. Lee, when mining had only been carried on for a short time.

Location.—The *Venus* group is staked from a small bay near the north-westerly end of Lasqueti island, with the north boundary of the *Mars* claim along the shore-line. The *Venus* claim is adjoining and south of the *Mars*, with the *Venus Fraction* adjoining it on the east and *Hill 60* adjoining the *Venus Fraction* on the east. The remainder of the mineral claims in the group are located in a solid block, two claims wide, southerly from the *Venus* and *Hill 60*, with their northerly boundary adjoining the southerly boundary of the two last-named claims.

Geology.—The rock formations on the *Venus* group are diorite porphyry and diorite with a basaltic phase. The diorite porphyry is apparently more recent than the diorite and occurs as an intrusion in the diorite, with the contact well defined, although there are several faults observable along the strike, which is in a general way in a N. 25° E. direction.

Ore-deposit.—A body of sulphide ore occurs in the *Mars* and *Venus* claims, carrying gold-silver-copper values, at or close to the contact of diorite porphyry with diorite, and is exposed on the beach near the mouth of a small creek. This vein is from 3 to 4 feet wide where it is exposed in a drift-adit about 100 feet long. The diorite porphyry is the hanging-wall and the dip of the ore is about 85° to the west. Samples taken from the dump representing shipping-ore assayed: Gold, 0.60 oz.; silver, 3.5 oz. a ton; copper, 17.2 per cent.; and: Gold, 0.38 oz.; silver, 1.8 oz. a ton; copper, 14.4 per cent.

On the surface it is shown by open-cut prospecting that the ore-body possibly extends for about 2,000 feet along the strike, with the peculiarity that there are no natural outcrops of ore exposed, and the only successful method of prospecting is by finding first the contact between the diorite porphyry and diorite and then making open-cuts and trenches.

On the *Hill 60* claim there is exposed by open-cuts a body of ore that appears to occur on a contact nearly parallel to that on the *Venus* claim. There is a possibility that the ore-deposit on the *Hill 60* claim may, if continuity is maintained in a south-westerly direction, intersect the *Venus* ore-body.

At the time the examination was made the writer was very favourably impressed by the systematic and businesslike manner in which the operations were being carried on. Previous to January 1st, 1921, a shipment of ore had been made to the Tacoma smelter for treatment.

Development-work.—This consists of a drift-adit about 100 feet long, with an upraise 20 feet high to within about 15 feet below the surface; also several deep open-cuts and considerable surface-stripping to locate the contact along the line of strike. A large log cabin for sleeping-quarters, a cook-house, office building, and blacksmith-shop, together with a building for compressor plant, comprise the mine camp proper.

St. Joseph Group.

This group, containing the *St. Joseph*, *St. Anthony*, and *Ajax* mineral claims, adjoins the *Mars* claim of the *Venus* group on the east. The group is owned by the Lasqueti Island Mining Company, of Vancouver. No work has been done on the *St. Joseph* group for about twelve years and the underground workings were not in such condition as to afford an opportunity for examination. A sample taken from a small dump of ore that had evidently been sorted assayed: Gold, 0.82 oz.; silver, 2.2 oz. to the ton; copper, 11.4 per cent.

Geology.—The rock formation on the *St. Joseph* group is apparently all diorite, which is very much sheared, and an ore-body occurs on the shore in the shear-zone in the diorite; this may possibly be an extension of that on *Hill 60* of the *Venus* group, for the reason that apparently the diorite-porphyry wedges out in a northerly direction from near its north boundary, and there are indications that the shear-zone in which the *Hill 60* ore occurs is continuous on to the *St. Anthony* claim to the north of and adjoining the *Hill 60*. The *St. Anthony* adjoins the *St. Joseph* on the south.

Development-work.—On the surface of the *St. Joseph* claim near the shore there has been very considerable cribbing-work done for dumpage purposes. There is a broken-down tramway, an ore-bunker built of logs, and cabins. It is reported that the underground workings consist of an adit 125 feet long, with an upraise 20 feet to the surface, and a winze of unknown depth from the adit, together with a drift from the bottom of the winze.

TATLAYOKO LAKE SECTION.

The Tatlayoko Lake section of the Nanaimo Mining Division includes all of that part of the Division on the Mainland which takes in the Klinaklini and Homathko rivers and Tatlayoko lake. This area makes up the northerly corner of the Division. At present this part of the Nanaimo Mining Division cannot be reached from the Coast unless the traveller is prepared to pack his supplies, etc., on his back through a practically unexplored country. The route now used is by wagon-road via the Fraser River valley to Alexis Creek, on the Chilcotin river. From Alexis Creek an automobile can be driven to the head of Tatlayoko lake, where a canoe can be used to reach the property of the Tatlayoko Gold Mines Company, Limited. In order to reach the headwaters of the Klinaklini and Homathko rivers pack and saddle horses can be used from the head of Tatlayoko lake.

The Tatlayoko Gold Mines Company, Limited, was operating its property near the outlet of Tatlayoko lake, and J. T. Morris, the manager, states that it is the intention of the company to instal a concentrating-mill during 1921.

During the summer of 1910 the Provincial Mineralogist visited the Tatlayoko Lake section of the Nanaimo Mining Division, and made a report which was published in the Annual Report for that year, from which the following excerpts are taken:—

"I have just returned from an inspection of the properties held by A. H. Sheppard and associates on Tatlayoko lake, and find they have some eleven or twelve mineral claims divided into two groups which they call *Copper Camp* and the *Gold Camp*. These groups adjoin and are situated on the eastern side of the valley in which Tatlayoko lake lies, some 2 miles south of the southern end of the lake and directly opposite the pass by which the Homathko river—the outlet of the lake—breaks to the westward through the Coast range of mountains and flows to the south-west into the head of Bute inlet, a distance of from 50 to 75 miles.

"Tatlayoko lake is at an elevation of about 2,700 feet above sea-level, and the mineral claims referred to are at an altitude of 5,900 feet, or 3,200 feet higher than the lake.

"The *Gold* group, of which the principal claim is the *Tyee* mineral claim, lies at an altitude of 5,900 feet and above timber-line. The country-rock here is a network of dykes, mostly basic, frequently cut by more recent acid dykes; these dykes are so numerous as to completely obliterate most signs of the original sedimentary formation.

"Cutting through this network of dykes there was seen outcropping on the surface a quartz vein having a strike of about S. 20° E. and dipping to the east into the hill at an angle of 37°—very persistent in its course, but of variable width, varying from a few inches to several feet. I took a rough sample of this outcrop at one of the wide parts where it seemed to be most heavily mineralized, and find it to assay: Gold, 3.50 oz.; silver, $26 to the ton, being ore worth about $85 to the ton.

"Associated with this quartz vein, apparently in lenses lying alongside the vein, were considerable quantities of stibnite—sulphide of antimony—mixed with quartz. These lenses assayed about the same in gold as did the main vein, and such experiments as I have been able to make did not indicate any increased gold values with an increasing percentage of antimony, from which I argue that the gold value is not associated with the stibnite, although it seems probable that the silver values are so carried.

"To strike this outcrop at a depth, a crosscut tunnel has been run, S. 55° E., for 60 feet without cutting the vein; a raise was then put up from the tunnel for 18 feet and the vein was

found, being here about 12 inches wide. I sampled it at this point and found it to carry: Gold, 0.28 oz.; silver, 2.60 oz.; about $7 ore. The raise indicated that the tunnel was too far to the right, so a deflection was made to the left for 30 feet, when the vein was struck at the tunnel-level, and subsequently this vein has been drifted on for 20 feet, but the last 12 feet only of the tunnel might be considered as in commercial ore.

"At the face of the tunnel the whole drift was in ore and apparently had not disclosed the full width of the ore-body. What was considered the 'hanging-wall' was quartz, which I had sampled, and it assayed: Gold, $8; silver, 16 oz. to the ton; below this the vein was exposed for a width of 90 inches, which I sampled, in three parts of 30 inches each, and assayed, as follows:—

	Gold. Oz.	Silver. Oz.
30 inches, next hanging-wall	Trace	0.4
30 inches, middle of vein	0.14	1.0
30 inches, bottom of vein	0.20	30.4

"The lower 30 inches of the exposure in the face of the tunnel contains a considerable percentage of sulphide of antimony; this part of the vein continued into the floor of the tunnel for a depth not determined, so that the 30 inches sampled does not represent the full thickness of this grade of ore.

"These samples were certainly encouraging, but not as yet commercial ore in this locality, and not nearly up to the indications of the surface outcrops.

"At an elevation some 100 feet lower than the upper tunnel, a lower tunnel has been driven in on another quartz vein, which vein is from 6 to 12 inches in width, having a strike of about S. 55° E. (mag.) and a dip to the north-east of 35°. This vein was followed in by the tunnel for 105 feet, when another vein, having a strike S. 32° E. and a flatter dip, was encountered, and the tunnel was deflected to the left along this for 54 feet, when a further deflection was made to the left—to S. 32° W.—and the tunnel continued for 90 feet; in which latter portion it could not be seen that any vein was followed or cut. The quartz in this lower vein was sampled and assayed, and contained: Gold, 2.90 oz., and silver, $1.50 a ton; equivalent to about $59 to the ton.

"The property stands as a prospect upon which they have driven 12 feet on an ore-body, as indicating by assays, of increasing and as yet undetermined size.

"As to the geology of the district, the granite and other plutonic rocks forming the Coast Range mountains extend eastward as far as Tatlayoko lake; on the east side of this lake are the sedimentary rocks of the Interior, and along this contact there is a strong probability that productive mineral-deposits occur, particularly where the dykes from the main Coast upheaval have struck off into the sedimentaries. It is on this contact that the mineral locations of Portland canal, the Telkwa, and of Lillooet are found."

Chromium Creek.—During 1920 prospectors staked and recorded about thirty mineral claims on Chromium creek, a tributary of the Klinaklini river. These claims were staked, according to the statements made by the prospectors on their return, on account of the occurrence of deposits of iron ore.

The writer had arranged with J. T. Morris, the manager of the Tatlayoko Lake Gold Mines Company, Limited, to make a trip into this part of the Nanaimo Mining Division during 1920, but was unable to do so owing to the fact that other duties occupied the season until it was too late to attempt to make the trip and be assured of a good opportunity for examinations; consequently this trip was postponed until next July, when a thorough examination will be made of all the mineral prospects.

TEXADA ISLAND SECTION.

Mining on Texada island during 1920 has not been as active as in past years; in fact, except that the annual assessment-work has been done on mineral claims that have not been Crown-granted, the record for the past year has been disappointing. It was anticipated early in the year that possibly the *Vananda* group of mineral claims, on which very active mining was done from 1898 to about 1906, would be acquired by the Tacoma Smelting Company and the old workings reopened, but apparently the negotiations failed.

Marble Bay.

For the first time since 1898 this mine failed to be a producer. Prospecting was carried on during the past year by diamond-drilling on and below the 1,700-foot level, but the problems as to the available tonnage that could be

extracted and the cost of extending the underground workings to make such extraction possible proved too difficult of solution, especially when the conditions of the copper market were considered; consequently the mine is idle at present.

Limestone-quarries. Texada island is fortunately situated with regard to the occurrence of very extensive deposits of limestone, usually highly crystalline and free from impurities, as well as being within a very short distance from deep-water transportation. Two quarries, one at Blubber bay, at the northerly end of the island, owned by the Pacific Lime Company, and the other at Stuart or Marble bay, owned by the Tacoma Steel Company, have been operated during 1920. The former shipped 196,312 barrels of burnt lime and 2,212 tons of lime rock for use in the paper-mills on the Coast; the latter shipped 4,655 tons of lime rock to the Powell River pulp and paper mills.

REDONDA ISLAND SECTION.

The deposits of magnetite on Redonda island were fully described in the Annual Report of the Minister of Mines for 1919, page 215. Since then no development other than the annual assessment-work has been done.

Limestone-quarries. Limestone-deposits occur on Redonda island close to the shore of Pryce channel and a short distance easterly from the group of mineral claims owned by the Redonda Iron-Copper Company, Limited. The limestone is highly crystalline and occurs in contact with the hornblendic granitic rocks which for the most part make up the rock formation on the northerly portion of the island, where the limestone occurs. During 1920 the limestone-quarries were operated by the Nickson Construction Company, Limited, when 8,450 tons of limestone rock was mined and shipped to the Whalen pulp and paper mills.

QUADRA ISLAND SECTION.

There was little activity in the mining industry on Quadra island during 1920. The usual assessment-work was done on mineral claims that have not been Crown-granted and some prospecting was carried on by the local pioneer prospectors.

Ingersoll Group. No copper ore was produced from this group of mineral claims, owned by the Valdes Island Copper Mining Company, during 1920. This was contrary to the expectations of the officials of the company, and was owing to the fact that the necessary capital required for further development-work could not be obtained.

Wanderer Group. This group of mineral claims contains the *Wanderer* and *Prospector*, owned by Ross & Hamilton, for whom Wm. Law, of Hyacinthe Bay, Quadra Island, is agent. The group is situated in the north-westerly part of Quadra island, about 1¼ miles in a north-easterly direction from Deep Water bay, Discovery passage. The *Wanderer* group was originally staked and recorded as the *Ajax* group and was partially developed several years since by T. J. Vaughan Rhys, but was later abandoned.

Geology.—The prevailing rock formation in the vicinity of the *Wanderer* group of mineral claims is the granodiorite of the Coast Range batholith, but southerly from that group there occurs a wide belt of limestone, which is regarded as belonging to the Marble Bay formation by J. Austen Bancroft in his Memoir No. 23, "Geology of the Coast and Islands," Canada Department of Mines, 1913. This belt of limestone extends nearly across Quadra island from Open bay on the easterly side to near Granite bay on the westerly side.

Ore-deposits.—On the *Wanderer* group of mineral claims, as well as on other claims in the neighbourhood, are occurrences of lenticular ore-deposits containing magnetite, pyrite, pyrrhotite, chalcopyrite, and some tetrahedrite or grey-copper. The ore-deposits may be considered as belonging to the contact-metamorphic type, although they occur some little distance from the actual line of contact between the granodiorite and limestone. The main ore-body has a width of about 50 feet, with its length unknown. This is a low-grade copper-sulphide ore which contains some lenses or shoots of higher-grade ore, presumably tetrahedrite.

Development-work.—This consists of an adit about 100 feet long, in addition to considerable surface-stripping.

GABRIOLA ISLAND SECTION.

Gabriola island is in the strait of Georgia a short distance easterly from the town of Nanaimo. The only work of a mining character carried on in this island is that of quarrying shale for the manufacture of red brick.

Gabriola Shale Products Co.—This company's brick-making plant is on the westerly side of Gabriola island near False narrows. The quarries from which the shale used for brick-making comes are near the shore-line close to the plant. During 1920 the company manufactured 3,578,600 red brick for building purposes. The chief market for this product is the city of Vancouver, to which the brick are transported by scows. The near proximity of the quarry and plant to shipping facilities is extremely advantageous and enables the company to operate at a minimum cost.

VANCOUVER MINING DIVISION.

The conditions in the mining industry in the Vancouver Mining Division during 1920 have been fairly satisfactory, at least until the latter end of November, when the bottom dropped out of the copper market and the *Britannia* mine temporarily suspended production. As this has been the only producing mine in the Division during 1920, the temporary suspension is a serious blow at this time.

During 1920 J. W. D. Moodie resigned as general manager of the Britannia Mining and Smelting Company, Limited, and was succeeded by E. J. Donohue, who had been secretary-treasurer of the company for several years past. The position of secretary-treasurer is being filled by G. E. Nettleton.

In addition to the operations carried on by the Britannia Mining and Smelting Company, Limited, during 1920, there has been development-work of a more or less extensive nature carried on at four other points on Howe sound, viz.: On the *Horseshoe* group of mineral claims on McDonald creek, on the westerly side of Howe sound, nearly opposite Britannia Beach; on the *Opporgol* group of mineral claims on Howe sound, about 5 miles from Whytecliff, the present terminus of the North Vancouver branch of the Pacific Great Eastern Railway; on the *Bowena* group of mineral claims on the south-easterly corner of Bowen island; and on the *Attorney* group of mineral claims near Alberta bay, Howe sound.

Other development-work done in the Vancouver Mining Division during 1920 is on the *Copper* group of mineral claims on Treasure mountain, Jervis inlet; on the *Lillie* group of mineral claims near Mount Diadem, on the westerly side of Jervis Inlet; on the *Sun* group of mineral claims near the head of Seymour creek; on the *Iron King* and other groups of mineral claims on the Pacific Great Eastern Railway near Alta lake; and on the *Radiant* and *Bruce* groups of mineral claims near the Stawamus river.

Prospecting for oil has been continued in an energetic manner near Burnaby lake by the Spartan Oil Company, which installed a standard drilling-rig that bores a hole 15 inches in diameter, and on December 1st last had reached a depth of 1,300 feet.

Prospecting for metalliferous minerals was carried on during the past summer in the mountains adjacent to both sides of Jervis inlet, also near the heads of Narrows and Salmon arms of Seechelt inlet and on the Tyzoone river, which empties into Narrows arm at its head.

Britannia.

For convenience this mine is now subdivided into five sections, known as the *Bluff*, *Fairview*, *Jane*, *Empress*, and *Victoria*. The last named has been prospected and opened up only since late in 1919. It is estimated that there is about 4,000,000 tons of copper-sulphide ore of commercial grade available in the *Victoria* section so far as is known to date, in addition to about 10,000,000 tons in other sections of the mine.

The *Britannia* mine retains its position as the most important copper-mining property not only in the Vancouver Mining Division, but in the Province, and during 1920 all of the copper-gold-silver production from this Mining Division came from the glory-hole and stopes above the 1,800-foot level in that mine. During 1920 the production from the *Britannia* mine of copper, silver, and gold shows a substantial increase over the production for 1919, notwithstanding the low price of copper since early in November last. The concentrating-mill at Britannia Beach was closed down on November 30th and the pay-roll of the company reduced to about 40 per cent. of the ordinary amount. At present the Britannia Mining and Smelting Company is carrying on development-work only in the mine, from which a small tonnage of ore is taken out during

that development-work. This ore is being brought to the stock-piles at the mill on the beach by the aerial tramway and electric railway, the incline tramway being tied up for the winter. The only work being carried on at the beach since November 30th last is continuing the raise from the main adit known as the 4,100-foot level. This adit is driven at an elevation of about 200 feet above high water, with its portal at a slightly higher elevation than the grizzly floor at the top of the mill. This adit is about 4,000 feet long, 9 feet high, and 13 feet wide, and is being driven to be utilized eventually as the main haulage-adit for the transportation of ore from the upper levels of the mine to the concentrating-mill.

Development-work.—During 1920 considerable development-work was completed in the *Bluff* section on the 1,400- and 1,600-foot levels, opening up the ore-body on those levels preparatory for actual stoping. On the 1,800-foot level a crosscut is being driven towards the *Bluff* ore-deposit from the main No. 1 shaft. In order to economize in handling the ore from the *Bluff* glory-hole a main transfer raise has been made, so that in future ore will be delivered to the underground crushers with one handling.

The No. 6 vein or ore-body in the *Fairview* section, which previously had only been exposed to the depth of the 1,200-foot level, or about 3,100 feet above sea-level, was developed down to the 1,600-foot level.

In the *Empress* section, easterly from the *Fairview*, development-work by crosscuts has been done on the 1,600-foot level and a raise is being driven to connect this level with the 1,200- and 1,000-foot levels above.

In the *Victoria* section, easterly from the *Empress*, an ore-body is being prospected on the 1,900-foot level by two adits, as well as by diamond-drilling on the 1,800-foot level.

The diamond-drilling done during 1920 is as follows: On the 1,000-foot level, 1,563 feet; on the 1,200-foot level, 728 feet; on the 1,600-foot level, 1,025 feet; on the 1,800-foot level, 2,380 feet; total, 5,696 feet.

The development in working-openings in the mine was extended during the past year as follows: Raises, 1,454 feet; drifts, 2,825 feet; crosscuts, 2,208 feet; chutes, 1,094 feet; total, 7,581 feet.

Among the improvements outside of the mine during 1920 were the construction of a new blacksmith-shop at the portal of the 2,200-foot level adit, following the abandonment of the older shop on the 1,000-foot level, and the addition of two 6-ton Exide Cell storage-battery locomotives to the previous equipment of twelve 3½-ton ones. That the installation of an Armstrong Shuveloader to assist the shovelling operations has proved very satisfactory is the report of Mr. Donohue.

The output for 1920 is as follows: Tons of ore mined, 697,897. Contents of product shipped: Gold, 6,013 oz.; silver, 90,672 oz.; copper after deducting slag loss, 16,201,266 lb.

Oppergol Group.

This group contains sixteen mineral claims on the east side of Howe sound, about 5 miles north of Whytecliff Station, the terminus of the North Vancouver branch of the Pacific Great Eastern Railway. The group is owned by the Oppergol Mines, Limited, of Vancouver; W. Thomas Newman, manager. The property was examined by the writer on October 29th, 1920.

Area and Accessibility.—The area comprised in the *Oppergol* group of mineral claims is approximately 800 acres. The claims are staked two tiers deep along the east shore of Howe sound from south to north for a distance of about 2½ miles. The survey-line of the Pacific Great Eastern Railway from North Vancouver is along the entire length of the property from south to north. There are several points along the length of water-front well adapted for the erection of wharves and bunkers in sheltered waters.

The *Oppergol* group of mineral claims is easily reached from Vancouver by travelling on the Pacific Great Eastern Railway from North Vancouver to Whytecliff, and from there by launch or rowboat 5 miles to the camp on the shore on the *Cal* claim, one of the group.

Geology.—The geologic formations on the *Oppergol* group are somewhat similar to those in the Britannia belt, which are reported on by S. J. Schofield in the Geological Survey Summary Report for 1918, and of which he says in part: "The Britannia sills and the Britannia formation, which may be considered as a unit, since they were affected by the same geological processes, are surrounded and underlain at some depth by granodiorite of the Coast Range batholith. This great batholith extends from the International Boundary-line on the south in a north-westerly

direction to Alaska. The main mass holds many inclusions of all sizes which are termed roof pendants or roof remnants and are more or less mineralized."

The conditions on the *Oppergol* group differ from those in the Britannia belt in respect to the extent of the mineralized zone, which is apparently very much less than in the Britannia, also in the fact that the schists which occur so prominently in the Britannia only occur on the *Oppergol* group in narrow bands. There are undoubtedly shear-zones on the *Oppergol* group which can be traced for some distance in a north-easterly direction from the shore of Howe sound. Beds of conglomerate occur within the boundaries of the shear-zones, but the prevailing country-rock is diorite porphyrite, in which occurs a system of fissuring, the fissuring varying very much in width, from a few inches to 3 or 4 feet.

Ore-deposits.—There is a remarkable absence of outcropping indicating the occurrence of ore-deposits on the *Oppergol* group of mineral claims, and it was only by persistent prospecting and faith that the geologic conditions were favourable for the deposition of ore that discoveries of copper-sulphide ore were made by W. Thos. Newman at an elevation of about 1,050 feet above sea-level in a deep canyon. From this point observations were made and followed down the mountain to a point about 30 feet above the shore-line, where some conglomerate occurs, and indications of fissuring being noted, a drift-adit known as "Zero" adit was driven 150 feet in a N. 40° E. magnetic course, which is the strike of the fissure. This adit follows a narrow persistent fracture, which dips about 80° to the north, with enlarged width in places for about 90 feet, beyond which the fissure varies from a few inches to 18 inches in width, with but little indication of the occurrence of ore in the roof or face. A sample from the face assayed: Gold, trace; silver, trace; copper, 0.2 per cent. Another sample taken about 70 feet from the portal of the adit, near the floor, on the hanging-wall side, assayed: Gold, trace; silver, 5.1 oz.; copper, 13.5 per cent. A sample of some ore on the dump at the portal of the adit assayed: Gold, trace; silver, 1.0 oz.; copper, 3.5 per cent.

About 400 feet in a southerly direction from the adit mentioned, and at an elevation of about 110 feet above sea-level, some conglomerate occurs, also another fissure which strikes nearly parallel to the fissure in the "Zero" adit. At this point a drift-adit has been driven 150 feet on the strike of the fissure, which varies from a few inches to 3 feet in width. A sample of sorted ore on the dump at the portal of the adit assayed: Gold, trace; silver, 5.4 oz.; copper, 4.8 per cent. The ore in both of the adits appears to occur irregularly in the fissures as lenses.

Development-work.—This consists of a crosscut adit 48 feet long at an elevation of 1,050 feet above sea-level, also a short drift from the crosscut; some open-cuts at a point about 150 feet lower than the crosscut adit; drift-adit known as "Zero" adit, 150 feet long; and the No. 2 drift adit, 150 feet long, at an elevation of 110 feet above sea-level. In addition to this work there has also been a very considerable time occupied in geological research-work and general prospecting.

Transportation.—The *Oppergol* group is admirably located with regard to transportation, for the reason that only a short tramway is necessary to connect the "Zero" adit with the shore, where bunkers and wharf can be erected and where vessels can lie at all seasons in safety.

During 1920, in addition to the operations already described, there has been development-work of a more or less extensive nature carried on at three other points on Howe sound, viz.: On the *Horseshoe* group of mineral claims on McDonald creek, on the westerly side of Howe sound nearly opposite Britannia Beach; on the *Bowena* group of mineral claims on the south-easterly corner of Bowen island; and on the *Attorney* group of mineral claims near Alberta bay, Howe sound.

Other development-work done in the Vancouver Mining Division during 1920 is on the *Copper* group of mineral claims on Treasure mountain, Jervis inlet; on the *Lillie* group of mineral claims near Mount Diadem, on the westerly side of Jervis inlet; on the *Sun* group of mineral claims near the head of Seymour creek; on the *Iron King* and other groups of mineral claims near the Stawamus river.

Prospecting for oil has been continued in an energetic manner near Burnaby lake by the Spartan Oil Company, which installed a standard drilling-rig that bores a hole 15 inches in diameter, and on December 1st last it had reached a depth of 1,300 feet.

Prospecting for metalliferous minerals was carried on during the past summer in the mountains adjacent to both sides of Jervis inlet, also near the heads of Narrows and Salmon arms of Seechelt inlet, and on the Tyzoone river, which empties into Narrows arm at its head.

Copper Group.

A full description of the *Copper* group of mineral claims on Treasure mountain, Jervis inlet, was published in the Annual Report of the Minister of Mines for 1917, page 283. Since then the development-work has been extended each year, resulting in exposing greater quantities of low-grade copper-sulphide ore associated with magnetite. It is considered unnecessary here to repeat the description made in the report referred to.

A good cabin was built near the mining-work in 1918; previous to then the miners had camped on the beach about 1½ miles from the workings.

NEW WESTMINSTER MINING DIVISION.

There has not been as much activity in the mining industry in the New Westminster Mining Division during 1920 as was anticipated would be the case at the beginning of that year, when it was considered probable that the *Lucky Four* group of mineral claims in the Cheam range of mountains, about 20 miles easterly from the town of Chilliwack, would be acquired by one of the leading copper-mining corporations of the United States. These negotiations, however, were not consummated and the property remained idle during the past year.

Some activity was noticeable in the Fire Mountain section of the Mining Division, near the head of Harrison lake, where some development-work was done in 1898 on the *Money Spinner* group, and a Huntington mill was erected on the property for treatment of the free-milling gold-bearing ore found at and near the surface. Operations were suspended during the same year and until during the past summer the camp has remained idle.

During 1920 a syndicate formed in Vancouver began to systematically prospect the *Money Spinner* group, as well as some of the abandoned mineral claims in the neighbourhood of that property, with a view of doing further development-work, provided prospecting resulted satisfactorily. As it was proposed to continue the prospecting during the winter of 1920–21, no report had been received to date.

Some prospecting was carried on in the Chilliwack Lake section of the New Westminster Mining Division, which it is the intention of the writer to visit during 1921 and make an examination of any mineral claims recorded.

Practically the only activity in the mining industry in the New Westminster Mining Division during 1920 was around Clayburn and Kilgard, near the Seattle branch of the Canadian Pacific Railway, where the Clayburn Company, Limited, is engaged in mining the Tertiary shales and clays for making brick, sewer-pipe, and firebrick. During the past year the Clayburn Company acquired the shale-deposits on the south-east side of Sumas mountain, known as the Kilgard deposits, and has been carrying on extensive operations continuously.

A very full description of these shale and clay deposits is contained in Memoir 24E, pages 125–138, Canada Department of Mines, 1912, "Preliminary Report on the Clay and Shale Deposits of the Western Provinces," by Heinrich Ries and Joseph Keele.

VICTORIA MINING DIVISION.

Continuous development on some of the groups of mineral claims in the Victoria Mining Division has marked the progress of the mining industry during 1920 in that Division, but there have been only a few prospectors in the field and no new discoveries of a spectacular nature have been reported.

The most important development-work carried on during 1920 has been done in the Jordan River, Leech River, Mount Sicker, and Saltspring Island sections of the district.

JORDAN RIVER SECTION.

Sunloch Group.

In the Annual Report of the Minister of Mines for 1917, pages 265–267; 1918, pages 300–303; and 1919, page 235, this group of mineral claims was reported on very fully; consequently in the present report the development during 1920 only will be mentioned. Prospecting carried on during the past season resulted in the staking of seven additional mineral claims, so that the Sunloch Mines Company, Limited, now owns thirty mineral claims and fractions having an area of approximately 1,300 acres.

The development-work during 1920 consisted of 1,802 feet of diamond-drilling and 995 feet of crosscutting and drifting, making the total work done on the *Sunloch* group of claims 3,470.5

feet of diamond-drilling and 3,776.3 feet of crosscutting and drifting. Most of the work done during 1920 was on the west side of the Jordan river in exploring for an extension of the River zone on that side of the river. Diamond-drilling demonstrated the downward continuation of the ore in that zone to a depth of 150 feet below the mine-workings.

Operations were suspended in October last and a caretaker left at the mine. This action was owing to the unsatisfactory condition of the copper market, as well as the high cost for labour, supplies, etc.

Early in 1920 it was anticipated that a concentrating plant would be erected on the *Sunloch* property, but owing to the high price of machinery and unsatisfactory conditions with regard to contracting for delivery, as well as the excessive cost for construction material, it was deemed advisable by the management to postpone the programme for completion of arrangements to place the property on a producing basis.

J. A. Hanna, who had been superintendent since the organization of the company, resigned on May 31st, and was succeeded by Geo. H. Kilbourne, one of the mining engineers on the staff of the Consolidated Mining and Smelting Company of Canada, who has been engaged most of the time since 1917 in studying the ore occurrences and geologic conditions on Vancouver island and the mainland coast for that company.

Gabbro Group.

There are twenty-three mineral claims and fractions in this group, named as follows: *Vulcan Nos. 1* to *6*, *Black Hornet*, *Yellow Jacket*, *Adaline*, *War Eagle*, *Mud Wasp*, *Queen Bee*, *Viking Nos. 1* to *4*, *Lucky Bunch*, *Bee Fraction*, *Hornet Fraction*, *Cliff Fraction*, *Vulcan Fraction*, *Gabbro*, and *Gabbro Fraction*. The group is owned by the Gabbro Copper Mines, Limited, of Victoria; head office, Sayward Building; George E. Winkler, managing director.

Location.—The *Gabbro* group is situated on both sides of the Jordan river, adjoining the *Sunloch* group on the south-west, and is staked in a solid block, approximately 10,000 feet in length, from south-east to north-west, and averaging about 4,000 feet in width from south-west to north-east. All of the mineral claims in the *Gabbro* group, except the *Gabbro*, *Gabbro Fraction*, *Vulcan Nos. 3*, *4*, and a part of *No. 2* and *Vulcan Fraction*, are on the westerly side of the Jordan river. The narrow-gauge tramway (on the easterly side of the river) of the Sunloch Mines, Limited, traverses the *Vulcan Nos. 2* and *4* mineral claims of the *Gabbro* group.

Geology.—The rock formations which prevail on the *Gabbro* group are similar in a general way to those on the *Sunloch* group, being classified by Clapp in his Memoir No. 13, "Southern Vancouver Island," Canada Department of Mines, 1912, as Metchosin volcanics made up of ophitic basalt flows, tuffs, and agglomerates, with intrusive diabase dykes; less metamorphosed than the Vancouver volcanics and not intruded by batholitic bodies, except of the Sooke Gabbro group.

Ore-deposits.—The occurrences of outcroppings of copper-sulphide ore occur along zones somewhat similar to the occurrences on the *Sunloch* group. As an example, the Cave ore-zone which has been developed on the *Sunloch* group should, if it maintains continuity along its line of strike, be found on the *Gabbro* group on the *Gabbro* mineral claim south-east of the *Sunloch No. 2* claim on that side of the Jordan river, also on the *Vulcan No. 6* claim west of the *Sunloch No. 5* claim on the westerly side of the river.

Other ore-bearing zones which have been partially developed on the *Gabbro* group are known as: Archibald zone, an apparent continuation of the Archibald ore-zone which occurs on the *Sunloch* property; also the Winkler and Turnbull ore-zones. The former is being developed on the *Vulcan No. 2* claim on the easterly side of the Jordan river, and the latter is being developed on the *Yellow Jacket* claim on the westerly side of the river on Sinn Fein creek, a tributary of the river.

Development-work.—The development-work on the *Gabbro* group consists principally of open-cuts and strippings for prospecting purposes, totalling several hundred feet in length. There are also two adits, one on the Winkler ore-zone 80 feet long, and another on the *Yellow Jacket* claim about 30 feet long.

LEECH RIVER SECTION.

During 1920 the Leech River section of the Victoria Mining Division has been brought into more prominence than it has occupied for several years past or since the era of placer-mining on Leech river. The reasons for the attention that has been paid to this section recently are:

First, because the completion of the Canadian National Railway has enabled that company to operate freight-trains, and consequently helped prospectors to haul in supplies to a main camp instead of being compelled to pack in on their backs; second, because of the operations by W. G. Dickenson, of Victoria, who has been mining talc on Wolf creek, about half a mile from the track of the Canadian National Railway, and shipping to his factory at Sidney, near Victoria, where the talc is prepared for the market.

Eagle. This mineral claim is owned by W. G. Dickenson, of Victoria, who has been operating it in mining a deposit of talc since early in 1919. The claim is situated about half a mile up Wolf creek from its confluence with the Sooke river and nearly directly across that river from the mouth of Leech river.

Geology.—The prevailing rocks on the *Eagle* claim and vicinity belong to the Leech River formation as classified by Clapp in Memoir No. 13, "Southern Vancouver Island." He describes the formation as a belt of slaty schistose rocks, probably the oldest on Vancouver island, possibly belonging to the Carboniferous period. The belt occupies a considerable area of Vancouver island, as it extends across the island from Goldstream river to Port Renfrew, on the west coast at the mouth of San Juan river, increasing in width towards the west, where it attains a width of approximately 10 miles, but is only about 3 miles wide in the vicinity of Wolf creek. The Leech River schists and slates have been attractive rocks to prospectors in search of gold-bearing quartz veins, because these schists and slates contain innumerable veins and veinlets, which were the source of the placer gold formed in the streams which either crosscut the belt or traverse it for varying distances, but Mr. Dickenson is the pioneer in the talc-mining industry.

Mineral-deposits.—In several places in the Leech River formation there occur deposits of talcose slates, but the occurrence of a deposit of talc of sufficient purity and desirable colour as is found on the *Eagle* mineral claim is rare. The extent of the deposit has not yet been fully determined, although the development-work has been extended very considerably since 1919, when the property was examined, and reported on in the Annual Report for 1919, pages 240, 241.

Manufacturing Plant.—The plant for preparing the talc for market is at Sidney, on the Saanich peninsula, about 20 miles from Victoria. This consists of a rock-crusher and hammer-bar grinder, by which about 30 per cent. of the crude material is crushed to 200-mesh for use as a pigment for paints and an ingredient of some soaps; about 20 per cent. is crushed to 150 mesh for use in roofing preparation. The remainder of the material is treated in an old flour-mill, where it is ground between French Burrh millstones to powder between 100 and 200 mesh and the finest separated from the coarse by air from a fan.

A proportion of the talc as mined is well adapted for firebrick, as has been proven by experiments of a practical character.

MOUNT SICKER SECTION.

The Mount Sicker section of the Victoria Mining Division has not been the scene of much activity during 1920; in fact, except for some annual assessment-work, practically all of the prospecting-work done there has been by the Ladysmith Smelting Corporation. The section is badly handicapped at present on account of distance from railroad transportation, although the wagon-road from Duncan is in fair condition for automobile-travel by light cars. The Victoria Lumber Company, of Chemainus, continues to extend its logging-railroad along the Chemainus river, so that should any discoveries of importance lead to activity in the mining industry railroad transportation could be secured to connect with the Esquimalt & Nanaimo Railway at Chemainus, or cargoes of ore could be transferred there to ocean-going vessels.

Scotch Group. This group contains the following fourteen mineral claims and fractions, known as: *Victoria, Little Nugget, Seattle, Independence, Joy, Shakespear, Lynx, Belle, International, Alida, Chemainus, Dunsmuir, Little Bantam,* and *Alliance.* The group is situated on Mount Sicker, in the near vicinity of the *Tyee* mine.

During 1920 the Ladysmith Smelting Corporation had a small crew of miners working during the months of March, April, May, and June, reopening old workings and making open-cuts on the *Belle, Seattle,* and *Dunsmuir* mineral claims of the *Scotch* group. This work was prospecting rather than development, and when the work was suspended it was the intention of the company to resume during 1921 in the event of resumption of operations at the Ladysmith smelter.

ALBERNI DISTRICT.

ALBERNI MINING DIVISION.

REPORT BY A. G. FREEZE, GOLD COMMISSIONER.

I have the honour to submit a brief annual report on mining in the Alberni Mining Division during the year ending December 31st, 1920.

Big I. Group.—This group of claims, situated about 10 miles by trail in a north-westerly direction from the head of Great Central lake, is held under bond by the Consolidated Mining and Smelting Company, Limited, of Trail, who during the year had a few men on the property, making a detailed survey of the surface of the mineral claims, also taking samples, and other work preparatory to diamond-drilling, which no doubt will be undertaken next year.

Monitor Group.—Nothing has been done on this group during the year.

The annual assessment-work has been done on a number of claims, but there have been no shipments from any of the mines in this district.

OFFICE STATISTICS—ALBERNI MINING DIVISION.

Mineral claims recorded	19
Certificates of work recorded	28
Free miners' certificates issued	27

Revenue.

Mining receipts, general	$223 75
Free miners' certificates	108 75
Total	$332 50

CLAYOQUOT MINING DIVISION.

REPORT BY J. F. JOHNSON, ACTING 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, 1920.

Assessment-work recorded as follows:—

Colorado mineral claim, owned by W. F. Poole and T. T. Gardhouse, situated at Head bay, Nootka. Considerable stripping-work and open-cuts.

L. Grant and *Wanderer* mineral claims, owned by Lachlan Grant and situated at Kennedy lake. Digging ditch to drain tunnel 16 feet by 4 feet deep and 24 feet long, stripping 2 feet 8 inches on face of the tunnel, and other prospecting-work.

Lucky Jim mineral claim, owned by William Spittal and situated at Elk river. Tunnelling, 5 feet; open-cut, 8 feet by 4 feet by 16 feet; stripping and other prospecting-work.

White mine group, including the following mineral claims owned by William Walton and Duncan McMillan: *Norman*, *Dunlop*, *Walton*, *Alpha*, and *Douglas* mineral claims. All work was done on the *White* mine; over 18 feet by 4 feet 6 inches rock tunnelling and other prospecting-work. These claims are situated at Tofino creek, Tofino inlet.

Northern Crown mineral claim, situated at Clayoquot river and owned by J. E. Martin. Drove 18½ feet tunnel, also crosscut about 2 feet; took out about 4 tons of ore and other work.

V.I. No. 2 mineral claim, situated on Vargas island, Clayoquot sound, and owned by Dorothy Evelyn Abraham. Open-cut 15 by 5 feet. This claim is grouped with the *V.I.* mineral claim.

Lucky Jim mineral claim, situated at Bedwell river and owned by J. D. McLeod. Surface-trenching 18 feet long by 2 feet deep along the vein at the south-west line of the claim.

Ivanhoe and *Double Standard* mineral claims, situated at Muchalet arm, Nootka, and owned by William Wilson. Certificates of improvement have been granted and recorded, and Crown grants of these claims are likely to be applied for.

Gordon, Solar No. 1, and *Great Central No. 7*. Certificates of work were granted to Wilbur Johnston for each of these claims under authority of the "Allied Forces Act, 1918," and amendments thereto.

OFFICE STATISTICS—CLAYOQUOT MINING DIVISION.

Free miners' certificates (individual)	33
Mineral claims recorded	19
Certificates of work recorded	21
Transfers, etc., recorded	8
Other receipts issued	4

Revenue.

Mining receipts	$163 50
Free miners' certificates	147 75
Total	$311 25

QUATSINO MINING DIVISION.

REPORT BY ED. EVENSON, MINING RECORDER.

I have the honour to submit the annual report on the mining operations in the Quatsino Mining Division for the year ending December 31st, 1920.

Except the regular assessment and some development-work on the *Old Sport* group, no work has been done on mineral claims in the Quatsino Mining Division.

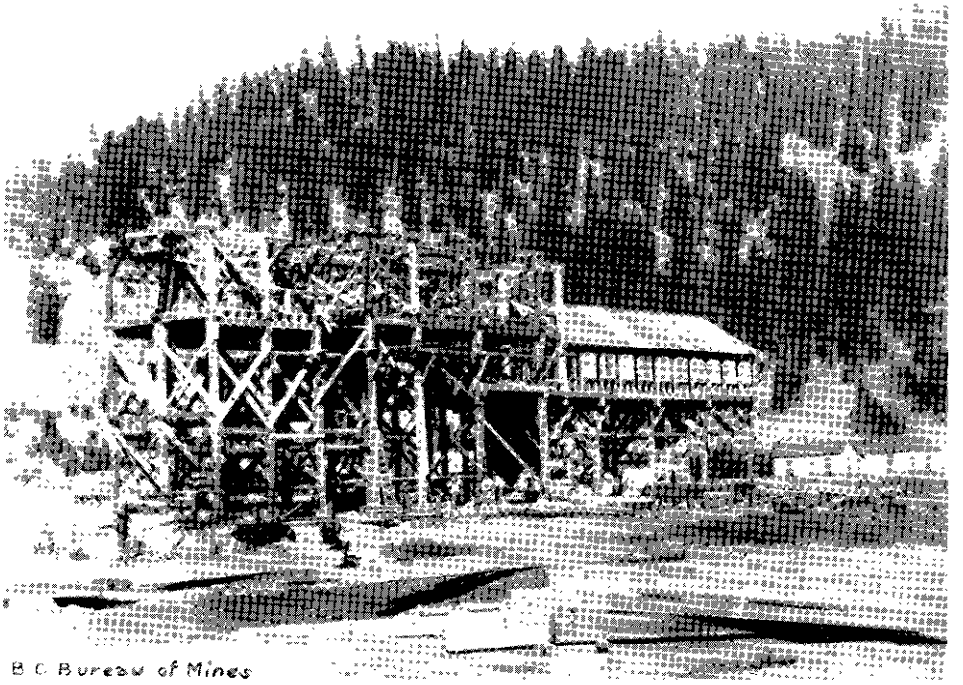
On the *Old Sport* group development-work has been vigorously carried on by the Coast Copper Company under the supervision of William Clancy. Some 1,500 feet of tunnel was driven for the purpose of developing the vein at a lower level; it is now in 2,100 feet. The tunnel is driven from foot-wall side and is 475 feet vertically below the outcrop, or 800 feet on the slope of the vein, which has a dip of 37°.

The only other work has been assessment-work; there has been no new construction.

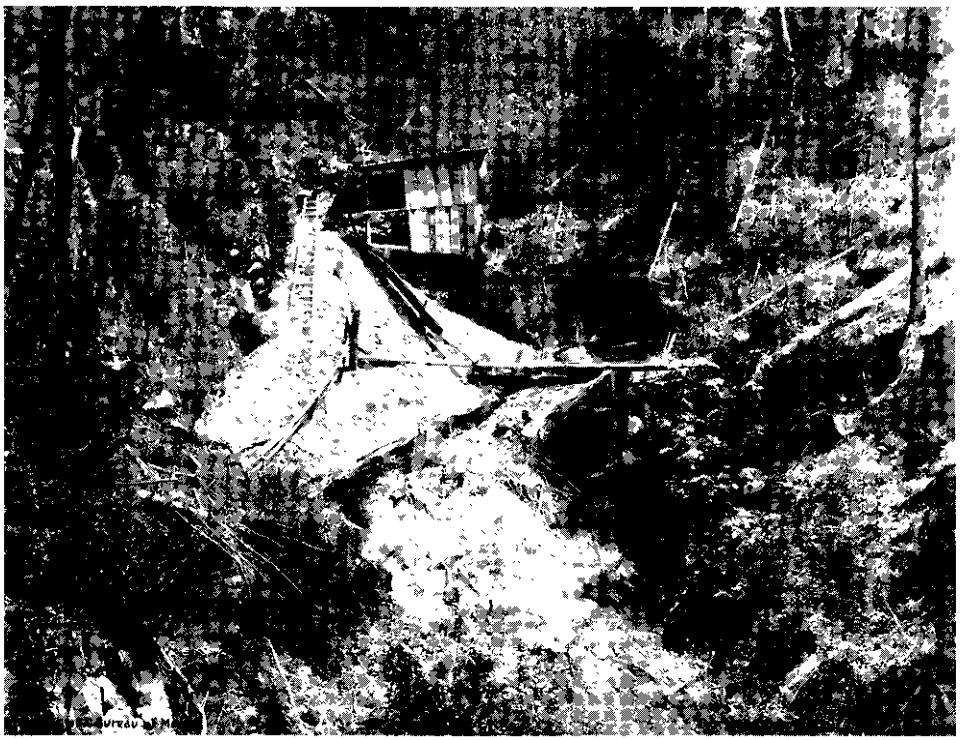
On the *Millington* group, located at Spruce river near Holberg, a road was built into the mineral claims and considerable prospecting-work was done.

OFFICE STATISTICS—QUATSINO MINING DIVISION.

Free miners' certificates (individual)	57
Free miners' certificates (special)	1
Mineral claims recorded	42
Certificates of work	157
Powers of attorney, transfers, etc.	53
Total revenue	$909.00



Coalmont Colliery—Tipple.



Oppergol Mine, Howe Sound.

NANAIMO DISTRICT.

NANAIMO MINING DIVISION.

REPORT BY 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, 1920.

There have been no shipments of ore from any of the metalliferous mineral claims in the Division during 1920.

Development-work with diamond-drills as well as by working-openings has been carried on at the *Marble Bay* mine on Texada island by the Tacoma Steel Company (D. C. Stephens, manager), and on the *Paw*, *Shot*, and *Cougar* groups of mineral claims on Myra and Price creeks, Strathcona Park, by Jos. Errington, manager of the Paramount Mining Company, of which J. D. Tolman is superintendent.

Development-work by working-openings only has been carried on at the *Blue Bells* group of mineral claims on Frederick arm, and the *Dawn* group on Thurlow island by the Ladysmith Smelting Corporation, Limited (R. F. Hill, superintendent of mining), and on the *Amethyst* group, Fanny bay, Phillips arm, by Thos. Golby, of Victoria, and associates. Near Tatlayoko lake the property of the Tatlayoko Gold Mines Company, Limited (J. T. Morris, manager), was developed more extensively and preparation made to build a concentrating-mill during 1921. On the *Venus* group, Lasqueti island, development-work was done and the construction of some large log buildings for camp purposes was finished early in December last; Henry Lee, M.E., Vancouver, is manager of the Vancouver syndicate which has bonded the claims.

Prospectors staked twenty-nine mineral claims in the extreme northerly part of the Nanaimo Mining Division on the Mainland, near the headwaters of the Klinaklini river.

Other popular portions of the Mining Division for prospectors in 1920, judging from the number of locations of mineral claims, were: Lasqueti island, with 38 locations; Powell lake, 41 locations; Texada island, 12 locations; Bute inlet, 14 locations; Quadra island, 5 locations; Rupert district in the vicinity of Kains and Quatse lakes, 14 locations; Maurelle island, 6 locations; Phillips arm, 8 locations; Cracroft island, 7 locations; Olson lake, 5 locations; Knight inlet, 6 locations; and near Ladysmith, 4 locations. There has been a total of 189 mineral claims located during 1920 in the Division, or sixty-seven more than in 1919.

Wm. M. Brewer, the Resident Engineer for the Western Mineral Survey District (No. 6), which includes the whole of the Nanaimo Mining Division, has examined many of the mineral claims on which development-work has been progressing during 1920, and will, I presume, give detailed descriptions in his annual report. Therefore it is only necessary for me to add the office statistics to this report, which are as follows:—

OFFICE STATISTICS—NANAIMO MINING DIVISION.

Mineral claims recorded	189
Certificates of work recorded	246
Bills of sale, etc., recorded	113
Free miners' certificates recorded	261

Revenue.

Free miners' certificates	$1,221 25
Mining receipts	3,036 65
Total	$4,257 90

VICTORIA DISTRICT.

VICTORIA MINING DIVISION.

REPORT BY 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, 1920.

As the Resident Engineer of the District, W. M. Brewer, has fully covered the mining activities of this Division for the past year, I will not attempt to further report on these matters, and beg to submit the office statistics of this Division for the year 1920.

OFFICE STATISTICS—VICTORIA MINING DIVISION.

Free miners' certificates issued	459
Free miners' certificates issued (special)	3
Mineral claims recorded	125
Placer claims recorded	1
Certificates of work recorded	107
Bills of sale recorded	15
Certificates of improvements issued	22

Revenue.

Free miners' certificates	$4,224 25
Mining receipts, general	781 81
Total	$5,006 06

VANCOUVER MINING DIVISION.

REPORT BY A. P. GRANT, MINING RECORDER.

I have the honour to submit herewith the following report on the mining operations in the Vancouver Mining Division for the year ending December 31st, 1920:—

The following is a list of the number of claims located in the different localities in this Division:—

McDonald creek	11
Halfmoon bay	5
Bear point	3
Seechelt and Porpoise bay	13
McNabb creek and valley	19
Along Pacific Great Eastern Railway	35
Mill creek	3
Narrows arm	8
Daisy lake	3
Brunswick mountain	6
Egmont	8
Salmon arm	7
Anvil island	1
Bowen island	3
Cypress and Lynn creeks	3
Mount Diadem, Brittain river	11
Total	139

Although there were fewer claims located, many more free miners' certificates were issued, and the revenue was nearly $3,000 larger than the previous year, this year's receipts being the largest of any year since this office was opened.

Wm. Savage, trustee for the Attorney Copper Gold Syndicate, whose claims are situated on Howe sound, states: "Practically no development-work was done in 1920 except the annual assessment. In doing this work on the south end of the property, about three-quarters of a mile south of former, ore discoveries were made which we expect to thoroughly investigate this year. The company intends to expend several thousand dollars in development this season and believes that will put the property in shape to turn over to some operating company. Our ore display at the Vancouver Exhibition in 1920 received two first prizes and three second prizes. On request of W. M. Brewer, Resident Engineer, we sent samples of our ore to Victoria to be forwarded to London, England, for exhibition there."

C. M. Oliver, secretary of the Bowena Copper Mines, Limited, situated on Bowen island, states: "Concentrating plant of 100 tons daily capacity was completed in April, and a trial run was made under the supervision of G. S. Eldridge, assayer and metallurgist. While it was found that the flotation process worked satisfactorily by the use of salt water, the power obtained from the boiler in use was not sufficient to keep the plant running at capacity, and it was recommended that a new boiler be installed before attempting to run steadily; also that additional wharfage would be necessary to provide accommodation for a supply of coal sufficient to meet the requirements of the plant. During the summer a wharf was constructed to accommodate 200 tons of coal, but owing to faulty construction was destroyed by the unusually severe storm of November 26th. The lessees of the property have secured an extension of their lease until 1930 and will install a new boiler and build a new wharf as soon as the necessary financial arrangements can be made."

Work on the Snug Cove Copper Company's claims situated on Bowen island was suspended early in the spring, but the company expects to resume operations early in 1921.

T. Grovum, part owner of the *Lilly Grovum* group of twelve claims, situated about 5 miles north-west of the mouth of Brittain river, Jervis inlet, states that their ore is galena, zinc, chalcopyrite, and pyrrhotite, carrying values in silver and copper from $60 to $140 and in one case $9 in gold. The ore is exposed on the surface in twelve different places. Work has been done on six of these showings by stripping off the capping. In every case solid ore was uncovered, varying in width from 3 to 10 feet, with still further enrichment of the enclosed rocks. With proper development there is every indication that another profitable mine has been added to the mineral wealth of British Columbia.

J. W. D. Moodie, who was general manager of the Britannia Mining and Smelting Company, Limited, for a long time, resigned during the year, and E. J. Donohue, who had been secretary-treasurer during Mr. Moodie's term of office, succeeded him as general manager. He has furnished me with the following information in regard to his company's work during the past year:—

"*Mining and Development Work.*—Underground shrinkage stope mining was carried on throughout the year and glory-hole mining during the open months. The operations were in the *Bluff*, *Fairview*, *Empress*, and *Victoria* sections of the mine. Considerable development-work was completed in the *Bluff* section on the 1,400- and 1,600-foot levels, opening up this body of ore for actual stoping. Also a working-face on the 1,800-foot level is advancing towards the *Bluff* deposit from the main No. 1 shaft. A main transfer raise was completed for the direct handling of *Bluff* glory-hole ore from the surface to the 1,600-foot level, where with one handling it is delivered to the underground crushers. In the *Fairview* section of the mine the sixth vein has been opened to the 1,600-foot level. Prior to 1920 this was known only to the 1,200-foot level. To the east of the *Fairview* the *Empress* section has been partially developed by crosscuts on the 1,600-foot level. A raise from this level is being driven for a connection with the 1,200-foot level and 1,000-foot level above. Going farther east into the *Victoria* section, the deposit is being prospected by the Amy and Crocker tunnels on the 1,900-foot level. Both of these adits have considerable hard-pan to encounter before reaching bed-rock. During the year some diamond-drilling was done in this section to prospect the deposit. In order to get down two of the holes a stand-pipe had to be driven to bed-rock before drilling could be started. In each case this stand-pipe was driven to a depth of 150 feet. Other diamond-drilling in the mine was done on the 1,600- and 1,200-foot levels, and outside the mine a 1,055-foot horizontal hole was drilled in the face of the Hillside tunnel, which is west of the *Jane* mine on the 1,000-foot level.

"This diamond-drilling was divided up as follows: 1,000-foot level, 1,563 feet; 1,200-foot level, 728 feet; 1,600-foot level, 1,025 feet; 1,800-foot level, 2,380 feet; total, 5,696 feet. The outside blacksmith and machine-shop which had been maintained on the 1,000-foot level

was abandoned, and a first-class shop constructed at the portal of the 2,200-foot level tunnel. This shop is commodious and first-class equipment is installed therein, which permits of the economical handling of our mine-work. During the year two 6-ton Exide Cell storage-battery locomotives have been added to our previous equipment of twelve 3½-ton ones. Included among the minor equipment additions was the purchase of an Armstrong Shuveloader to help out our shovelling operation. This unit is easy of operation and since being placed in service has worked most satisfactorily.

"Development-work consisted of 7,581 feet, made up as follows: Raises, 1,454 feet; drifts, 2,825 feet; crosscuts, 2,208 feet; chutes, 1,094 feet.

"As you know, the decline in price of copper necessitated our discontinuing operations the latter part of November, since when we have been employing in the neighbourhood of 250 men on a development programme. The railroad and tramway lines are being utilized for the transportation of a small tonnage daily to the stock-piles at the beach in order to maintain haulage facilities for the transportation of foodstuffs, etc., to employees residing at the Tunnel camp. We are also maintaining a force of twelve men on the work of driving a raise connection between the 4,100- and 2,700-foot level tunnels. This raise, when completed, will supplant the incline railway as an ore-carrier, and at December 31st had attained a distance of 600 feet."

While the revenue is the largest of any year since this office was opened, much more work and time were entailed than the list of statistics would represent.

Many prospectors locating claims or having business in other divisions make use of this office for forms and information, and when any mining strike is on this office is kept busy by the general public answering inquiries *re* same.

OFFICE STATISTICS—VANCOUVER MINING DIVISION.

Free miners' certificates issued	2,209
Free miners' certificates (special)	25
Free miners' certificates (company)	75
Claims recorded	139
Abandonments recorded	7
Certificates of work issued	320
Surveys recorded as work	7
Receipts issued for money in lieu of work	27
Grouping notices filed	31
Documents filed	2
Conveyances recorded	75
Certificates of improvements recorded	89

Revenue.

Free miners' certificates	$15,356 95
Mining receipts	4,604 80
Total	$19,961 75

NEW WESTMINSTER MINING DIVISION.

REPORT BY 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 December 31st, 1920:—

The claims recorded during the year were distributed as follows:—

Chilliwack river	9
Pitt lake	20
Kanaka creek	1
Deer lake	1
Harrison lake	42
Lillooet lake	3
Stave lake	3
Wahleach lake	4
Total	83

The office statistics show a slight decrease in revenue from the previous year, although the number of new claims recorded and certificates of work issued show an increase over last year.

As will be seen by the above list, more prospecting has been done in the Harrison Lake vicinity than formerly. Several new locations were made on Fire mountain, at the head of the lake, in which section there was quite a stampede in the years 1897 and 1898.

Considerable work was done on the *Anna* group, situated near Agassiz, and a car-load of ore was reported to have been shipped during the year.

The annual assessment-work has been performed on practically all the old claims in the district.

Prospecting for oil has been carried on during the year by several companies, a few of the important of which are : Boundary Bay Oil Company at Boundary bay; the Spartan Oil Company near Burnaby lake; the Monarch Oil Company and the Empire Oil and Gas Company near Aldergrove; and the Pitt Meadows Oil Company on Pitt Meadows. Although drilling operations have been carried on, in some instances to a depth of 2,000 feet or better, and favourable indications encountered, no report of a commercial well has yet reached me.

OFFICE STATISTICS—NEW WESTMINSTER MINING DIVISION.

Free miners' certificates issued (individual)	180
Free miners' certificates issued (special)	1
Mineral claims recorded	83
Certificates of work issued	106
Conveyances, etc., recorded	36
Grouping notices filed	10
Receipts issued for money in lieu of work	1
Abandonments recorded	3
Certificates of improvement issued	1

Revenue.

Free miners' certificates	$ 775 25
Mining receipts, general	857 90
Total	$1,633 15

INSPECTION OF MINES.

REPORT BY JAMES MCGREGOR, CHIEF INSPECTOR.

I have the honour to submit my annual report as Chief Inspector of Mines for the Province for the year 1920.

I append the District Inspectors' reports on the condition of the mines in their respective districts in regard to safety and sanitation, the number of persons employed in and around the coal-mines, the tonnage of coal mined, list of accidents and prosecutions, and the reports of the Instructors in Mine-rescue Work and First Aid.

PERSONNEL OF STAFF OF INSPECTORS AND INSTRUCTORS.

Inspectors.

James McGregor	Chief Inspector.
Robert Strachan	Senior Inspector, Fernie (Kootenay and Boundary Districts).
John MacDonald	Inspector, Fernie.
H. H. Johnston	Temporary Inspector, Rossland.
Henry Devlin	Inspector, Nanaimo.
T. R. Jackson	Inspector, Nanaimo.
J. G. Biggs	Inspector, Merritt.
Thomas J. Shenton	Inspector, Prince Rupert.

Instructors, Mine-rescue Stations.

J. T. Puckey	Instructor, Fernie.
John D. Stewart	Instructor, Nanaimo.
John Thompson	Instructor, Cumberland.
W. C. Stone	Instructor, Middlesboro.

By amendment to the "Coal-mines Regulation Act" during 1919 the Board of Examiners for coal-mine officials and miners was placed under the jurisdiction of the Inspection Branch. The personnel of the Board of Examiners for coal-mine officials is as follows:—

James McGregor, Chairman.

James Dickson, Secretary, Member of Board, and Acting Inspector of Mines.

Harry E. Miard, Member of Board and Acting Inspector of Mines.

Messrs. Dickson and Miard and the District Inspector for the district in which an examination is being held form the Board for granting certificates of competency to coal-miners. An Inspector of Mines is empowered to grant provisional certificates to miners for a period not exceeding sixty days between regular examinations.

The Inspection Branch suffered the loss of one of the staff by the death of William Lancaster on May 29th at Fernie. Mr. Lancaster was a faithful and efficient official. He was instantly killed when the automobile which he was driving left the road and ran off a bridge.

There have been changes in the inspection staff and new appointments made during the year. On May 10th George Wilkinson, Chief Inspector for the Province, resigned, and Inspector James McGregor was appointed Chief Inspector, with headquarters at Victoria. On July 16th John McDonald was appointed Inspector at Fernie to fill the vacancy caused by the death of William Lancaster. John G. Biggs was appointed Inspector, with headquarters at Merritt, to fill the vacancy caused by the promotion of James McGregor to Chief Inspector, who previously had been Inspector for that district.

TONNAGE OF COAL PRODUCED.

The gross tonnage mined by the coal-mines of the Province for the year 1920 amounted to 2,696,774 tons, being an increase over the previous year of 287,826 tons. This increase was mainly due to the steadier operations in the Crowsnest field.

The output would have been larger if the Crowsnest field had operated continuously during the year. There were a few days lost in March in that field and two weeks lost in November owing to labour trouble.

The Coast District, which includes Nicola-Princeton, Vancouver Island, and Telkwa, produced 1,849,385 tons, an increase compared with the previous year of 737 tons.

The Vancouver Island collieries produced during the year 1,698,254 tons, showing a decrease compared with the previous year of 1,094 tons.

The Telkwa mines in the Northern District produced 1,400 tons for the year, being a decrease of 352 tons.

The Crowsnest Pass District produced during the year 847,389 tons, being an increase over the previous year of 288,583 tons.

ACCIDENTS IN COAL-MINES AND METALLIFEROUS MINES.

The compilation of tables showing number and character of accidents in coal-mines and metalliferous mines in British Columbia is undertaken by the Workmen's Compensation Board under the "Workmen's Compensation Act."

The fatal accidents only will be dealt with in my annual report in connection with tonnages and persons employed, as shown by the following tables:—

FATAL ACCIDENTS IN AND AROUND COAL-MINES.

The fatalities in and around coal-mines during the year totalled seventeen. There were 6,349 men employed in and around the coal-mines.

The ratio of accidents per 1,000 persons employed was 2.67, compared with 2.013 in 1919; in 1918 the ratio was 5.159 and in 1917 it was 8.51. The ratio for the last ten years was 4.053.

The following table shows the collieries at which fatal accidents occurred during 1920, and their relation to accidents which occurred in 1919:—

Name of Company.	Name of Colliery.	1920.	1919.
Canadian Collieries (D.), Ltd.	Comox Colliery	3	5
Canadian Collieries (D.), Ltd.	Extension Colliery	2	2
Canadian Western Fuel Co.	Nanaimo Colliery	4	4
Pacific Coast Coal Mines, Ltd.	South Wellington Colliery	2	..
East Wellington Coal Co.	East Wellington Colliery	..	..
Nanoose Collieries Co., Ltd	Nanoose Colliery	..	..
Middlesboro Collieries Co.	Middlesboro Colliery	1	..
Fleming Coal Co.	Coal Hill Colliery	..	..
Princeton Coal & Land Co.	Princeton Colliery	..	..
Coalmont Collieries, Ltd.	Coalmont Colliery	..	..
Crow's Nest Pass Coal Co.	Coal Creek Colliery	2	1
Crow's Nest Pass Coal Co.	Michel Colliery	1	..
Corbin Coal & Coke Co.	Corbin Colliery	..	..
Telkwa Collieries, Ltd.	Telkwa Colliery	..	..
Granby Collieries	Cassidy Colliery	2	..
Totals		17	12

The following table shows the various causes of fatal accidents in coal-mines and the percentage of the whole, with corresponding figures for the previous year:—

Cause.	1920.		1919.	
	No.	Per Cent.	No.	Per Cent.
Fall of rock	8	47.06	4	33.00
Fall of coal	2	11.76	4	33.00
Haulage	5	29.42	4	34.00
Explosions	..	.....	..	....
Breaking of ropes and chains	..	.....	..	.....
Falling timber	..	....	..	....
Material falling in shaft	1	5.88	..	.....
Fell from scaffold	1	5.88	..	.....
Totals	17	100.00	12	100.00

The number of tons of coal mined for each fatal accident during the year 1920 was 158,633, compared with 200,745 tons in 1919.

FATAL ACCIDENTS IN METALLIFEROUS MINES.

There were five fatal accidents in and around the metalliferous mines during the year 1920, being a decrease of one compared with the year 1919.

There were 3,341 persons employed in and around the metalliferous mines, a decrease of 437 compared with the previous year.

The ratio of fatal accidents per 1,000 persons employed was 1.54, compared with 1.588 in 1919. The ratio for the last ten-year period was 3.31.

The mines at which the fatalities occurred are:—

Mining Division.	Mine.	No. of Accidents.
Osoyoos	Nickel Plate	1
Trail Creek	Centre Star	1
Fort Steele	Sullivan	1
Skeena	Belmont-Surf Inlet	1
Ainsworth	Whitewater	1
Total		5

The following table gives the cause and percentage to the whole of the fatal accidents in metalliferous mines, with the corresponding figures for 1919:—

Cause.	1920.		1919.	
	No.	Per Cent.	No.	Per Cent.
Fall of ground	2	40.00	..	.....
By falling into chutes, raises, winzes, &c	1	20.00	4	66.66
By mine-car and haulage	..	.....	..	.....
Material falling in shaft	..	.....	..	.....
By cage in shaft	1	20.00	1	16.66
By explosions of powder	..	.....	..	.....
By explosions of gas	..	.....	..	.....
Miscellaneous (surface)	1	20.00	1	16.66
Total	5	100.00	6	100.00

There were two fatal accidents from falling ground in the metalliferous mines during the year 1920, being an increase from the previous year, when there were none; one from falling down chute; one from falling down shaft; and one miscellaneous.

There were no fatal accidents from explosions of powder, making three years in succession without a fatal accident from that cause.

The output from the metalliferous mines for the year 1920 was 2,178,187 tons, compared with 2,112,975 tons in 1919, being an increase of 65,212 tons.

The number of tons of ore mined for each fatal accident during 1920 was 435,637, compared with 352,162 tons in 1919, an increase of 83,475 tons.

EXPLOSIVES.

During the year 1919 one additional explosive was added to the permitted list for British Columbia, known on the United States permitted list as Coalite "A" L.F. This powder is manufactured by the Giant Powder Company. One change was made by the Canadian Explosives Company, having changed the number only of Dynobel No. 2 to Dynobel No. 4. The full list of explosives now on the permitted list is as follows:—

Monobel A1 ..... British List.
Monobel No. 1 ..... "
Dynobel No. 4 ..... "
Polar Permitite ..... "

Monobel	United States List.
Coalite "A" L.F.	" "
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	" "
"Giant" Coal-mine Powder No. 9	" "
Polar Brushite	" "
Vigorite No. 1	" "
Vigorite No. 2	" "
Vigorite No. 3	" "
Vigorite No. 4	" "
Miner's Friend No. 1	" "
Miner's Friend No. 2	" "
Miner's Friend No. 3	" "
Miner's Friend No. 6	" "
Miner's Friend No. 7	" "
Viking No. 1	" "

The following table shows the quantity of explosives used in the coal-mines of the Province during the year 1920, together with the number of shots fired, how shots were fired, tons of coal produced by pound of explosive used, and the average pounds of explosive per shot fired:—

District.	Quantity of Explosive used in Pounds.	Tonnage for 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	521,261	1,698,254	670,270	...	670,270	3.25	0.77
East Kootenay	22,729	847,389	25,074	276	25,350	37.28	0.89
Nicola-Princeton	40,004	149,731	57,061	815	57,876	3.74	0.69
Northern District	.....	1,400	.....	...	.....	... ..	....
Totals	583,994	2,696,774	752,405	1,091	753,496	4.61	0.77

The production of coal per pound of explosive used is 0.10 more than that of the previous year.

The Crowsnest Pass District shows a decrease of 17.22 tons per pound of explosive used, the yield being 37.28 tons, compared with 54.5 tons for 1919.

The Nicola-Princeton District shows a decrease of 0.46 ton per pound of explosive used, the yield being 3.74 tons, compared with 4.2 tons in 1919.

The Vancouver Island mines show a decrease of 0.25 ton per pound of explosive used, the yield being 3.25 tons, compared with 3.5 tons for 1919.

The estimated yield at Telkwa is 4 tons per pound of explosive used.

MACHINE-MINED COAL.

During the year mining-machines produced 151,722 tons of coal, or 5.51 per cent. of the whole; this is an increase compared with the amount of machine-mined coal in 1919, when the percentage of machine-mined coal was 4.75 of the whole.

Of the total machine-mined coal, the Canadian Western Fuel Company produced 50,911 tons, or 33.55 per cent. of the whole; the Canadian Collieries (D.), Limited, produced 65,000 tons of machine-mined coal, or 42.82 per cent.; the Princeton Coal and Land Company produced 20,717 tons, or 13.65 per cent. of the total during the year, all of which was machine-mined; the Crow's Nest Pass Coal Company produced 11,819 tons, being 7.78 per cent.; Nanoose Collieries produced 3,000 tons, or 1.97 per cent.; and Chu Chua produced 275 tons, or 0.18 per cent. of the total machine-mined coal.

The following table gives the district, number of machines, how driven, tons of coal produced, and type of machine used:—

District.	Types of Machine in Use.		Tons of Coal produced by		Total Tons.
	Compressed Air.	Electricity.	Electricity	Compressed Air.	
Vancouver Island	16	5	65,000	53,911	118,911
Nicola-Princeton	7	..	.....	20,992	20,992
Crowsnest Pass	4	..	.....	11,819	11,819
Totals	27	5	65,000	86,722	151,722

Safety-lamps.

There were 4,719 safety-lamps in use in the coal-mines of the Province during the year 1920, a decrease of 296 as compared with the previous year. Of this number, 1,273 were flame-lamps of the Wolf type and 3,446 were electric cap-lamps, mostly Edison electric cap-lamps. There was a decrease of 147 in the number of electric lamps in use during the year.

The following table shows the distribution of lamps by districts, method of locking, and the illuminant used:—

District.	Magnetic.	Screw or Automatic Clip.	Naphtha.	Electricity.
Crowsnest Pass	120	1,096	120	1,096
Nicola-Princeton	76	190	76	190
Vancouver Island	1,077	2,160	1,077	2,160
Totals	1,273	3,446	1,273	3,446

The Edison cap safety-lamp after another year's trial or test is finding still greater favour with both operator and workmen, and has proven beyond any doubt to be a very efficient and safe lamp. As was stated in last year's Annual Report, it was beyond doubt the means of saving one life during the year 1919.

A bump occurred in No. 3 East mine, Coal Creek, caving the place and giving off a large quantity of explosive gas. A miner was imprisoned for a time. Inspector Robert Strachan is of the opinion it was owing to his having an Edison electric lamp he owes his life, as any other type of safety-lamp now in use would have been put out by the gas given off, leaving him in the dark and preventing him from finding his way over the caves.

Mine-air Sampling.

The same system of taking mine-air samples as was followed during the year 1919 was continued during the year 1920 throughout the Province. Careful checking has been made between the chemical analysis received from the laboratory at Ottawa and the results from the Burrell gas-detector in use in the different mines by the Inspectors. As found in 1919, the difference was less than one-tenth of 1 per cent., showing conclusively that the Burrell gas-detector is a very accurate and valuable instrument.

The Inspector of each coal-mining district is supplied with the Burrell detector, while the operating companies make use of them.

During the year 1919 the Hon. William Sloan, Minister of Mines, had a chart prepared in booklet form and issued to the officials and workmen, showing the length of flame-cap on a Wolf safety-lamp for the different percentages up to 2½ per cent. This chart was compiled from actual tests covering nearly two years.

The following table shows the data obtained from the mine-air samples in coal-mines during the year 1920:—

RETURNS FROM MINE-AIR SAMPLES TAKEN IN THE VARIOUS COAL-MINES OF THE CROWSNEST DISTRICT DURING THE YEAR 1920.

Sample No.	Date.	Mine.	Ventilating District.	Working or Idle.	Tonnage per Day.	Tonnage of Split per Day.	Chemical Analysis. CO_2.	O.	CH_4.	N.	Velocity of Air in Feet per Minute.	Quantity of Air in Cubic Feet per Minute.	Barometer.	Hygrometer. Wet Bulb.	Dry Bulb.	Humidity.	Cubic Feet of Methane per Minute.	Cubic Feet of Methane per Day.	Cubic Feet of Methane per Ton of Coal mined.
		Coal Creek.											"	°	°	%			
546	" 29	No. B. North	Main return	Working	200	....	0.15	20.53	0.95	78.37	560	39,200	25.904	7.00	47.0	100	372	535,680	2,267
547	" 22	No. 1 East	"	"	....	....	0.17	20.45	0.52	78.86	130	6,500	26.005	5.00	58.0	82	39	56,160	.....
551	" 22	"	"	"	400	....	0.22	20.30	1.16	78.32	900	108,000	26.00	52.0	53.0	93	1,252	1,802,880	4,507
552	" 26	No. 1 North	"	"	300	....	0.35	20.23	0.33	79.09	400	16,000	25.60	60.0	61.0	93	53	76,320	254
556	Feb. 6	No. 2 C.C.	"	"	300	....	0.15	20.56	0.55	78.74	320	32,000	25.90	50.0	51.0	93	176	707,000	1,767
557	" 9	No. 1 South	"	"	400	....	0.23	20.23	1.26	78.28	600	39,000	25.70	58.0	60.0	88	491	707,000	1,767
566	" 20	No. B. North	"	"	200	....	0.17	20.43	1.26	78.14	590	35,400	26.00	45.5	45.0	100	446	642,240	3,211
576	April 8	No. 1 East	"	"	400	....	0.15	20.37	1.11	78.37	1,100	121,000	25.60	51.0	53.0	86	1,343	1,933,900	4,834
584	" 14	No. 2 C.C.	"	"	250	....	0.25	20.28	0.88	78.59	970	38,800	25.50	56.0	57.0	98	341	491,000	1,964
619	June 15	"	"	"	200	....	0.30	20.20	0.95	78.55	450	31,500	25.15	64.0	64.0	100	300	432,000	2,160
617	" 15	No. 1 South	"	"	325	....	0.31	20.04	1.31	78.34	700	45,500	25.15	58.0	59.5	91	596	858,240	2,640
608	" 9	No. 1 East	"	"	400	....	0.14	20.36	1.14	78.36	1,000	120,000	25.50	53.0	55.0	87	1,368	1,969,990	4,924
292	" 10	No. 3 East	"	"	300	....	0.16	20.26	1.51	78.07	1,350	85,050	25.60	50.5	50.0	100	1,283	1,847,500	6,000
611	" 9	No. 1 East	South split	"	400	320	0.14	20.21	1.64	78.01	720	57,600	25.50	53.5	55.0	85	944	1,359,300	4,248
612	" 9	No. 9 C.C.	Main return	"	14	....	0.16	20.59	0.20	79.05	450	13,500	25.50	59.0	61.0	91	27	38,880	2,777
614	" 11	No. 3 East	South split	"	328	164	0.27	20.37	1.45	77.91	500	32,500	25.70	59.0	61.0	91	326	469,440	1,431
615	" 11	"	Main return	"	328	....	0.23	20.31	1.44	78.02	900	54,000	25.70	60.0	62.0	88	778	1,120,320	341
618	" 15	No. 2 C.C.	"	"	200	....	0.09	20.60	0.76	78.55	1,750	3,500	25.15	48.0	60.0	88	27	38,880	777
642	Aug. 12	No. 3 C.C.	Incline split	"	300	150	0.25	20.37	1.22	78.16	200	14,000	26.15	63.0	65.0	88	170	1,708,090	813
643	" 12	"	Slope split	"	300	150	0.30	20.34	1.45	77.91	600	24,000	26.15	60.0	63.0	83	348	501,120	328
644	" 12	"	Main return	"	300	....	0.27	20.32	1.37	78.04	850	55,210	26.15	62.0	64.0	88	756	1,088,640	3,628
...	Sept. 10	No. 1 South	"	"	350	....	0.33	20.00	1.37	78.30	600	39,000	25.65	64.0	65.0	94	534	767,960	2,194
307	" 8	No. 3 East	"	"	280	....	0.26	20.29	1.27	78.18	829	42,640	25.65	52.0	53.0	93	541	779,040	5,193
308	" 8	"	No. 6 East split	"	280	130	0.15	20.26	2.11	77.48	430	34,830	25.65	53.0	54.0	93	135	194,400	694
310	Oct. 12	"	West split	Idle	....	....	0.11	20.35	1.99	77.55	1,230	63,960	25.90	50.5	51.0	93	772	1,109,680	.....
311	" 12	"	Main return	"	...	....	0.17	20.31	1.83	77.69	1,660	104,583	25.90	52.5	52.0	100	1,913	2,754,720	.....
694	" 25	No. 1 East	No. 1 Slope split	Working	375	105	0.16	20.34	1.19	78.31	450	33,750	26.00	59.0	61.0	98	401	577,490	5,490
697	" 25	"	Main return	"	375	...	0.22	20.34	0.91	78.53	1,450	120,000	26.00	55.0	56.5	98	1,092	1,571,480	4,180
693	" 25	"	Tunnel split	"	375	120	0.12	20.59	0.57	78.72	350	16,800	26.00	51.5	53.0	86	96	136,800	1,140
703	" 27	No. 3 C.C.	Main return	"	325	....	0.23	20.38	1.12	78.27	800	52,000	26.00	62.0	63.0	94	528	838,080	2,581
701	" 27	"	Incline split	"	325	160	0.17	20.47	0.95	78.41	220	15,400	26.00	63.5	65.0	90	146	210,240	1,323
706	" 28	No. 1 South	Main return	"	325	....	0.31	20.07	1.29	78.33	600	36,000	25.56	64.5	65.0	93	463	666,720	2,050
710	Nov. 9	No. B North	"	"	200	....	0.13	20.54	0.85	78.48	900	58,500	26.50	48.5	49.0	97	579	720,000	360
709	" 9	"	Right side of slope	"	200	50	0.16	20.67	0.45	78.72	180	11,700	26.50	49.0	50.0	97	53	76,320	152
708	" 9	"	Left side of slope	"	200	150	0.20	20.39	1.53	77.88	110	8,800	26.50	49.0	50.5	93	135	153,900	126
744	Dec. 21	No. 1 South	Main return	"	350	....	0.11	20.25	0.80	78.84	840	45,360	25.80	62.0	63.0	93	362	521,280	1,488
743	" 21	"	"	"	350	..	0.14	20.36	0.72	78.78	560	36,960	25.80	61.0	62.0	93	266	383,040	1,094
742	" 21	"	"	"	350	....	0.08	20.61	0.50	78.81	120	16,800	25.80	54.0	55.0	93	84	16,800	346
330	" 22	No. 3 East	"	"	280	....	0.10	20.42	1.32	78.16	1,400	88,200	26.10	51.0	51.0	100	964	221,760	781
		Michel.																	
277	Jan. 8	Michel No. 3.	Main return	Working	300	...	0.25	20.32	0.85	78.58	540	54,000	26.20	48.0	50.0	93	459	660,960	2,203
295	June 14	Michel No. 3	"	"	300	....	0.32	20.16	0.91	78.61	500	50,000	26.00	60.0	60.0	100	455	655,200	2,184
312	Oct. 12	Michel No. 3.	No. 2 Slope split	Idle	....	....	0.16	20.38	1.00	78.46	50	4,500	25.90	55.0	55.0	100	45	64,800	.....

BUMPS IN COAL-MINES.

November 25th. In No. 1 mine, Coal Creek, in room 26, South split, a bump occurred giving off a large quantity of gas, differing from other bumps which have occurred. A very small quantity of coal was blown out. The gas-pressure had the effect of bulging out the coal-face in the room about 3 inches; no other damage resulted.

December 3rd. A slight bump occurred in No. 1 East mine, Coal Creek, in room 25, South split, causing a heavy flow of gas in the return airway; slight damage was caused at the face of room 25 by stringers being displaced, causing a small cave.

December 10th. A slight bump occurred in No. 1 East mine between 4.30 and 7.30 a.m. No one was working in that district at the time. No damage was done.

OUTBURSTS OF GAS.

Outbursts of gas have not been so frequent as last year, a few having occurred at the same time as the bumps in the Crowsnest mines already mentioned.

Drilling ahead of the advancing development-work has been carried on during the year with good results. This work has a tendency to reduce the gas-pressure in the face of the drifts or headings by allowing the gas to drain off through the drill-holes.

MINE FIRES.

There have been no serious new outbreaks of fire during the year. Those which had been walled off previously required careful supervision, and constant vigilance has been necessary to keep them under control.

EXPLOSIONS.

No explosions occurred during the year 1920. One slight ignition of gas occurred in East Wellington mine, in which one man was painfully burned, necessitating hospital treatment.

MINE-AIR SAMPLING.

There were a great many samples taken of the air in the coal-mines of the Province during the year 1920 and analysed at the Bureau of Mines at Ottawa. The results of these analyses are published with this report.

The Burrell gas-detector, which has proved a very valuable and accurate instrument in detecting very small percentages of methane in the mine-air, is constantly used by the Inspectors. One-tenth of 1 per cent. methane can be noticed in the air, a much lower percentage than could be detected by the use of any safety-lamp. The officials of the companies keep the Burrell gas-detectors constantly in use for testing purposes, and all the Coal-mine Inspectors are supplied with them by the Mines Department.

CARBON-MONOXIDE DETECTORS.

During the year 1920 the carbon-monoxide detector was perfected and approved by the United States Bureau of Mines. This will prove a very valuable instrument, especially in case of mine fires, in testing for the dangerous carbon-monoxide gas given off under such conditions. Formerly live canaries were used for this purpose, but were not very satisfactory. As soon as the instrument was approved by the Bureau of Mines of the United States the Hon. Wm. Sloan, Minister of Mines, ordered one for each rescue-station in the Province, where they are now installed.

I feel grateful to the Mines Department of Ottawa for the valuable information received from their Department, especially when this accurate work is done by them without charge.

MINE-RESCUE WORK.

Instruction in mine-rescue work has been actively and effectively maintained at the different rescue-stations throughout the Province during the year.

There were quite a number of men who took the course and qualified for certificates of competency; also a number who had qualified in previous years kept up their training during the year. At the present time there are 484 men who have qualified and secured certificates issued by the Mines Department.

The training course necessary to qualify for a certificate of competency consists of wearing the oxygen breathing apparatus for two hours a day for twelve days in an irrespirable atmosphere, performing considerable work while there, in addition to spending many hours familiarizing themselves with the many parts of the apparatus, testing of the apparatus for defects, and assembling it in the shortest time.

These volunteers deserve great credit for taking this course of training, as they do so without remuneration.

LIST OF PERSONS WHO HAVE RECEIVED MINE-RESCUE CERTIFICATES DURING 1920.

Name.	Certificate No.	Where trained.	Date.
Owens, Thomas	459	Fernie	Aug. 25
Horrocks, Thomas	460	"	" 25
Ferryman, Hy	461	"	" 25
Scales, Joseph	462	"	" 25
Almond, Alen	463	"	" 25
Davis, Alfred	464	"	" 25
McFagen, Robert	465	"	" 25
Devoy, William	466	Cumberland	" 25
McKinnon, Hugh J	467	"	" 25
Rutherford, Joseph	468	"	Sept. 8
Shield, Thomas	469	"	" 8
Bates, Hamilton	470	"	" 8
Somerville, Alexander	471	"	" 8
Thompson, Thomas	472	Nanaimo	" 24
Hogan, George Eastman	473	"	" 24
Lavin, Joseph	474	"	" 24
Clarkson, Hugh	475	"	" 24
Young, Samuel	476	Cumberland	Oct.
Brown, Alfred A.	477	"	"
Derbyshire, Alexander	478	"	"
Williams, Cadwalader	479	"	"
Whitehouse, William	480	"	Nov.
Lockhart, James G.	481	"	"
Nash, Charles	482	"	"
Taylor, Alexander John	483	"	"
Boffy, John Henry	484	"	"

The following table shows the number, distribution, and type of mine-rescue apparatus and oxygen resuscitating devices maintained at the coal-mines of the Province during the year 1920:—

Company.	Draeger Apparatus.		Proto or Fleuss Apparatus.		Gibbs.	Paul.	Total Apparatus.	Resuscitating Devices.			Total.
								Pulmotor.		Lungmotor.	
	2-hour.	4-hour.	2-hour.	4-hour.				Type A.	Type B.		
Canadian Western Fuel Co	4	..	4	2	6	..	16	2	.	2	4
Canadian Collieries—											
Extension	4	..	..	..	..	..	4	..	1	..	1
South Wellington	..	..	..	..	..	2	2	.	1	..	1
Comox	4	..	..	..	..	..	4	..	1	..	1
Vancouver-Nanaimo Coal Co	2	1	..	..	..	..	3	1	..	..	1
Pacific Coast Coal Mines, Ltd.	3	2	..	..	2	..	6	1	..	..	1
Granby C. M. S. & P. Co	4	..	..	..	..	..	4	..	..	1	1
Middlesboro Collieries	2	1	..	..	..	..	3	1	..	..	1
Fleming Coal Co	2	2	..	..	..	..	4	1	..	..	1
Merritt Colliery	..	2	..	..	2	..	4	..	..	..	..
Princeton Colliery	1	1	..	..	..	..	2	1	..	..	1
Crow's Nest Pass Coal Co—											
Coal Creek	5	6	.	..	..	..	11	2	..	..	2
Michel	5	5	..	..	..	..	10	1	..	..	1
Corbin Coal & Coke Co	2	1	..	..	..	..	3	1	..	..	1
B.C. Government	16	10	..	..	12	6	44	4	4	..	8
Totals	53	31	4	2	22	8	120	15	7	3	25

FIRST AID.

In this very important and valuable work great enthusiasm has been manifested throughout the Province, especially in the coal-mining centres, where exhibitions have been given at the different coal-mining companies' annual picnics, Labour Day celebrations, and on other occasions. Many flattering comments have been made by the doctors who have acted as judges at these demonstrations given in public.

This work requires constant practice to maintain proficiency. It is evident that hard and patient practice has been indulged in by Barton's team of the Canadian Western Fuel Company, of Nanaimo, which won first prize in the St. John Ambulance Association competition for miners, and also the Montizambert trophy, emblematic of the championship of Canada. The surface team of the No. 4 mine of Canadian Collieries at Cumberland won second place in the miners' contest.

It is gratifying to know we have such capable and conscientious workers in this important branch of relieving the injured in or about our mines and manufacturing plants.

EXAMINATIONS FOR COAL-MINE OFFICIALS.

The "Coal-mines Regulation Act," as now consolidated and amended, provides that all officers of a coal-mining company having any direct charge of work underground shall hold Government Certificates of Competency, which are to be obtained only after passing an examination before a duly qualified Board, appointed for the purpose of holding such examinations, and known as the Board of Examiners.

The certificates granted on the recommendation of such Board and the requirements shall be as follows:—

"(*a.*) If a candidate for a manager, that he is a British subject and has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-five years of age; or, if he has taken a degree in scientific and mining training, including a course in coal-mining at a university or mining school approved by the Minister of Mines, that he has had at least four years' experience in and about the practical working of a coal-mine:

"(*b.*) If a candidate for overman, that he has had at least five years' experience in and about the practical working of a coal-mine, and is at least twenty-three years of age:

"(*c.*) If a candidate for shiftboss, fireboss, or shotlighter, that he has had at least three years' experience in and about the practical working of a coal-mine, is the holder of a certificate of competency as a coal-miner, and is at least twenty years of age:

"(*d.*) A candidate for a certificate of competency as manager, overman, shiftboss, fireboss, or shotlighter shall produce a certificate from a duly qualified medical practitioner or St. John or other recognized ambulance society, showing that he has taken a course in ambulance-work fitting him, the said candidate, to give first aid to men injured in coal-mine operations.

"For the purposes of this section the experience demanded by such section shall be of such character as the Board shall consider of practical value in qualifying the candidate for the position to which such class of certificate applies.

"Experience had in a mine outside of the Province may be accepted should the Board consider such of equal value."

Any certificate is considered as including that of any lower class.

EXAMINATION FOR MINERS.

In addition to the examinations and certificates already specified as coming under the Board of Examiners, the Act further provides that every coal-miner shall be the holder of a certificate of competency as such. By "miner" is meant "a person employed underground in any coal-mine to cut, shear, break, or loosen coal from the solid, whether by hand or machinery."

Examinations of applicants for certificates of competency as coal-miners shall be conducted and certificates of competency granted by a Board of Examiners, which shall consist of the Inspector of Mines for the district in which the examination is held, and two other members to be appointed by the Minister, one of whom shall be appointed to represent the mine-owners and one to represent the coal-miners. The two appointed members of the Board shall have jurisdiction in all districts throughout the Province. The Minister shall appoint one of the appointed members to be Chairman and the other to be Secretary of the Board, and they shall hold office during the pleasure of the Minister.

Where any member of the Board of Examiners is unable to act at any examination by reason of illness, absence, or other cause, the Minister may appoint a person to act in the stead of that member for that occasion, or until the termination of the disability, and any person so appointed may complete any unfinished business of the Board in which he has taken part, even if the member in whose stead he has acted has become able to act.

The proceedings of the Board of Examiners shall be in accordance with the rules in the Third Schedule to the Act.

Examinations of applicants for certificates of competency as coal-miners shall be held on at least one day in every period of sixty days at each colliery designated by the Minister as a place for the holding of examinations under this section.

The work of the Board of Examiners in examining candidates for coal-miners' certificates has been carried on in all mining districts at intervals of less than sixty days, as required by the amendment of the Act.

No certificates have been granted in any case where the candidate failed to satisfy the Board as to his general fitness, experience in a coal-mine, and a working knowledge of the English language.

During 1920 eighty-three examinations were held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province and 545 certificates issued. In addition to above, a number of duplicate certificates were issued to coal-miners who had lost their original certificates of competency.

BOARD OF EXAMINERS FOR COAL-MINE OFFICIALS.

FIRST-, SECOND-, AND THIRD-CLASS CERTIFICATES.

Report of James Dickson, Secretary of Board.

I have the honour to submit herewith the annual report of the transactions of the above Board for the year ending December 31st, 1920.

The Board of Examiners, which was formed on July 1st, 1919, at present consists of James McGregor, Chief Inspector of Mines, as Chairman; Harry Ernest Miard, member; and James Dickson, member and Secretary of the Board.

The meetings of the Board are held in the office of the Board, Mines Department, Victoria. The first work was the drafting of the following rules for the conduct of examinations for certificates of competency as mine officials:—

RULES MADE BY THE PROVINCIAL BOARD OF EXAMINERS, JULY 16TH, 1919, AND APPROVED BY THE MINISTER OF MINES, JULY 16TH, 1919, UNDER SECTION 38 OF THE "COAL-MINES REGULATION ACT, 1911," AND AMENDMENT ACT, 1919, FOR THE CONDUCT OF EXAMINATIONS.

1. No application for examination will be considered from any candidate unless it is received by the Department of Mines at least fifteen days previous to the date on which the examination is to be held.

2. The examination sittings shall begin at 9 a.m. and continue until 12.30 p.m.; they shall resume at 2 p.m., and continue until 5.30 each day until the conclusion of the examination.

3. The examinations shall be conducted by the Presiding Examiners appointed by the Board.

4. The Presiding Examiners shall be present in the examination-room at least fifteen minutes prior to the time at which the examination commences.

5. Before each examination the question papers shall be prepared by the Examiners appointed by the Minister, and the necessary copies forwarded to the Presiding Examiners, each set of papers being in a separate sealed package.

6. At the time of the commencement of each session of the examination, when the candidates are in their respective places, the seal of the package shall be broken in the examination-room in the presence of the candidates and the papers distributed punctually in accordance with the time-table on the package.

7. Candidates must present themselves punctually at the hours appointed for the commencement of the examination, and no candidate will be allowed to enter the examination-room later than forty-five minutes after the time set for the commencement of the examination, nor will any candidate be allowed to leave the room during a sitting unless in case of extreme necessity.

8. When the time allotted to each paper has expired, the papers shall be collected by the Presiding Examiners and immediately placed in a package and sealed. At the completion of the examination these papers shall be forwarded to the office of the Board of Examiners for Coal-mine Officials, Victoria, B.C.

9. The examination shall be conducted strictly in accordance with these rules, and the papers of any candidate who does not comply with these rules may be cancelled at the discretion of the Board.

10. The Presiding Examiners shall see that the room is clear of all possible aid to the candidates, and that no persons other than the Honourable the Minister of Mines, the Deputy Minister of Mines, the Provincial Mineralogist, members of the Board, Inspectors of Mines, and Examiners be allowed in the examination-room during sessions.

11. All stationery required for the purpose of the examination shall be supplied by the Board. All surplus stationery shall be collected by the Presiding Examiners at the completion of the examination. Each candidate shall be supplied with pens, ink, pencils, and blotting-paper.

12. The papers shall be collected at the times indicated by the time-table. If from any cause a paper is not given out precisely at schedule time, the candidates must be informed of the fact and the exact time at which their work will be collected, and care must be taken that the exact time is allowed from the moment from which the paper was given out. The time consumed in collecting and giving out papers must not be included in the "full time" allowed for any paper. A candidate who attends late shall not be allowed any extension of time on that account.

13. Before proceeding to his seat in the examination-room a candidate shall lay aside his hat and overcoat, and any book, papers, or appliances the use of which is not expressly allowed to him. The candidate shall be allowed to bring with him a drawing-scale, slide-rule, protractor, a pair of compasses, and logarithmic and trigonometrical tables. Apart from such special articles, a candidate shall be at liberty to take to his place in the examination-room such ordinary appliances as pens, ink, penknife, chalks, and india-rubber; but the Presiding Examiners may, at their discretion, prohibit the use of any such articles.

14. If a candidate arrives late a note of the circumstances shall be made, and it shall always be stated whether any other candidate has already left the room.

15. The Presiding Examiners shall collect at the commencement of the examination the authorization obtained from the Department of Mines for appearing at the examination-room, and no candidate shall be allowed to enter the examination-room unless he presents such authorization.

16. Silence shall be observed in the examination-room while the examination is in progress.

17. The Presiding Examiners shall take every precaution to see that no candidate receives any improper assistance, either from books or papers or from any person. They shall check all disorderly or improper conduct in or about the room, enforce all rules for the conduct of the examination, and report to the Board any irregularity which may occur or any shortcoming in the arrangements for the examination.

18. Should it appear to the Presiding Examiners that a candidate has obtained improper assistance the papers of such candidate shall be cancelled. Any candidate giving assistance to another candidate shall be held to be equally guilty and shall be dealt with accordingly.

19. No candidate shall be allowed to leave the examination-room until the expiration of one hour after the time fixed for the commencement of the paper on which he is engaged.

A candidate obliged to leave the room through illness or other sufficient cause, and who wishes to return and continue work on the paper then in progress, shall leave the room in charge of a Presiding Examiner; a note as to the circumstances shall be made and the part of the paper at which the candidate was at work shall be endorsed by the Presiding Examiner, "The candidate left at this point."

Candidates shall not, without the express permission of the Presiding Examiners, remove from the examination-room any paper or other material supplied to them.

20. A candidate who asks a question as to any ambiguity in the papers shall be told to enter on his work any representation he may wish to make, but no further answer shall be given. The

Presiding Examiners shall, themselves, forward a report to the Board stating the candidate's name and the general nature of the question.

A candidate making a complaint of any other nature shall be directed to make his statement in writing, which shall be sent to the Board.

21. Candidates shall be allowed, unless there is any special directions to the contrary, to keep their work in any subject until the expiration of the time allotted to that subject.

Every book, plan, form, or separate sheet of paper used by the candidate shall have inserted on it the name of the subject. The number of each question shall be inserted in the margin which shall be left along the left side of each sheet. In no case shall the name of the candidate be placed on any book, plan, form, or separate sheet of paper upon which the candidate has written or worked the answer to any question; but for the purpose of identification of papers the following system shall be used: At the commencement of the examination each candidate shall choose a number; he shall place this number on a slip furnished for this purpose, together with his name, and place the same in an envelope supplied for the purpose. These envelopes shall remain sealed until the paper has been examined. The candidate shall number all his examination papers with the number he has chosen and placed on the slip with his name.

22. Not more than one answer shall be written on the same sheet of paper. All answers shall be written in ink (except necessary diagrams, which may be in pencil) and on one side only of the paper, and each candidate shall enclose his question paper with his answers in the envelope supplied for the purpose.

23. After the Examiners have received the papers they will correct them and mark on them the marks obtained by each candidate for each paper.

24. After the examination the candidate will be furnished with a list of the marks obtained by him in the different subjects, but not the marks for the individual questions.

25. The apparent or presumed results of the examination shall not be communicated to any person until the same have been officially announced.

26. All correspondence intended for the Board must be addressed to the "Office of the Board of Examiners for Coal-mine Officials, Victoria, B.C."

27. The Presiding Examiners must see that the candidate obtains the right paper of questions.

28. All the work by which the results are obtained shall be clearly shown in immediate connection with the answer, so as to enable the Examiners to satisfy themselves that the candidate has understood the question and to see by what process the results were obtained. Anything which the candidate does not wish the Examiners to notice should be crossed out with pen or pencil, but not erased.

29. In the case of any applicant producing a certificate from a medical practitioner instead of from a recognized ambulance society, as provided for in section 41, subsection (*c*), such certificate shall be in the following form:—

"I hereby certify that I have examined , of , in ambulance-work, and find him qualified to render first aid to persons injured in or about a mine.

"(Signed.).....
Medical Practitioner."

30. The nature of the practical experience shall be experience gained in one or other of the following capacities in a coal-mine, or in a capacity which may be considered by the Board to be equivalent to:—

(*a*.) An underground official of a coal-mine—
(1.) In actual practical work at the working-face and other parts of the underground workings of a coal-mine:
(2.) In direct supervision of such work; or
(3.) In both (1) and (2); or

(*b*.) As an underground workman of a coal-mine who has had direct practical experience in the work of getting minerals, and of stonework, timbering, and repairing:

(*c*.) As mine surveyor. In the case of a person employed as mine surveyor, the practical experience will be considered to be the time the applicant has been employed underground in a coal-mine.

31. Candidates for certificates must possess such knowledge as will enable them to answer promptly questions on the following subjects:—

For First-class Certificates—
(1.) Mining Act and Rules:
(2.) Mine Gases:
(3.) Ventilation:
(4.) General Work:
(5.) Mining Machinery:
(6.) Surveying and Levelling.

For Second-class Certificates—
(1.) Mining Act and Rules:

(2.) Mine Gases.
(3.) Mine Ventilation:
(4.) General Work, including questions on underground machinery and surveying.

For Third-class Certificates—
(1.) Mining Act and Rules and Mine Gases:
(2.) Mine Ventilation and General Work.

For Mine Surveyors' Certificates—
Surveying, levelling, and drawing; determination of magnetic declination; loose and fast needle surveying underground and on the surface; calculation of areas and volume; contour lines and levelling; connecting of surface and underground surveys; triangulation; plotting by protractor and latitudes and departures; mine plans and sections; the use, care, and testing of the instruments.

32. A candidate for First-class Certificate of Competency must obtain 70 per cent. of the maximum marks obtainable for the first three subjects, Mining Act and Rules, Mine Gases and Ventilation; and 60 per cent. of the marks obtainable on the fourth, fifth, and sixth subjects—namely, General Work, Mining Machinery, Surveying and Levelling; and 70 per cent. of the marks obtainable for the whole examination.

33. A candidate for a Second-class Certificate of Competency must obtain 70 per cent. of the marks obtainable for the first three papers, Mining Act and Rules, Mine Gases, and Mine Ventilation; and 60 per cent. for the fourth subject, General Work; and 70 per cent. of the marks obtainable for the whole examination.

34. A candidate for a Third-class Certificate of Competency must obtain not less than 65 per cent. of the marks obtainable on the first subject, Mining Act and Rules and Mine Gases; not less than 60 per cent. of the marks obtainable on the second paper, Ventilation and General Work; and not less than 65 per cent. of the marks obtainable for the whole examination.

35. A candidate for a Mine Surveyor's Certificate of Competency must obtain 70 per cent. of the marks obtainable for the whole examination.

In view of the following regulation made, pursuant to the provisions of the "Coal-mines Regulation Act," by the Lieutenant-Governor in Council, examinations for mine surveyors' certificates of competency were also held:—

REGULATION.

1. After the 1st day of October, 1919, all plans required to be kept in accordance with the provisions of the "Coal-mines Regulation Act" shall be made of durable material, and the surveying of mines and the preparation of mine-plans shall be done by a person or persons holding a certificate granted under the provisions of the "Coal-mines Regulation Act" and Amendment Acts.

2. In no case shall a certificate be granted to any applicant until he has satisfied the Board of Examiners that:—
(1.) He has had two years' practical experience in the surveying of mines, or is the holder of a diploma in scientific and mining training after a course of study of at least two years at an educational institute approved by the Minister of Mines, or has taken a degree in scientific mining subjects at a university so approved:
(2.) He is competent:—
(*a.*) To make an accurate survey of the workings of a coal-mine and to connect such survey with a surface survey:
(*b.*) To make accurate survey and levellings:
(*c.*) To plot accurately surveys and levellings:
(3.) He has given satisfactory evidence of his sobriety and general good conduct.

3. Each plan required to be kept in accordance with the provisions of the "Coal-mines Regulation Act" shall have inserted on it the date on which the last survey was made and the signature of the person making such survey.

4. A certificate authorizing any person to act as mine surveyor may be granted to such person without written examination if the Board of Examiners reports that he has the necessary experience, and provided application is made for such certificate before the 1st day of December, 1919.

5. Every person who violates any rule or regulation under the "Coal-mines Regulation Act" or Amendment Acts shall be guilty of an offence against the "Coal-mines Regulation Act," and liable to the penalties and obligations imposed by the said Act.

Two examinations for candidates for certificates of competency were held during 1920; the first being held on May 25th, 26th, and 27th, and the second on November 23rd, 24th, and 25th.

The total number of candidates at these examinations was as follows: For First-class certificates, 9 (1 passed, 8 failed); for Second-class Certificates, 15 (8 passed, 7 failed); for Third-class Certificates, 27 (19 passed, 8 failed); for Mine Surveyor Certificates, 11 (6 passed, 5 failed).

The work of the candidates, especially for the higher certificates, leaves much to be desired.

It is the intention of the Board to maintain a high standard, so intending candidates, to gain a certificate of competency of any class, must give themselves thorough preparation.

The following is a list of the candidates who successfully passed the examination in the various classes:—

First-class Candidates.—Arthur Newbury.

Second-class Candidates.—Michael Dalton McLean, William Park, William Beveridge, Louis Francesini, Benjamin Ball, John Gilham, Hugh Osborne, and William Hynds.

Third-class Candidates.—Joseph Lavin, Joseph Travis, Robert Drybrough, Robert McFagan, Edward Hardy, William Ross, Robert Taylor, Henry Ferryman, Robert Clarkson, Steve Klejko, Frederick Menzies, Thomas Smith, George A. Brown, John Hynd, Ernest Waites, Ralph H. Chambers, John Walls, James Sim, and Preston Bruce.

Mine Surveyor Candidates.—Robert Strachan, George W. Waddington, James T. Hepburn, Edward Hughes, Everard S. Bowerman, and Austin Wright.

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."

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
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
Browitt, Benjamin	Aug. 3rd, 1901
McEvoy, James	October 17th, 1902
Wilson, A. R	October 17th, 1902
Simister, Charles	October 17th, 1902
Budge, Thomas	October 17th, 1902
Mills, Thomas	October 17th, 1902
Faulds, Alexander	October 17th, 1902
Richards, James A	October 17th, 1902
McLean, Donald	January 21st, 1904
Wilkinson, Geo	January 21st, 1904
Wright, H. B	January 21st, 1904
Coulthard, R. W	January 21st, 1904
Roaf, J. Richardson	January 21st, 1904
John, John	January 21st, 1904
Manley, H. L	January 21st, 1904
Baxter, Andrew	June 10th, 1911
Battey, Richard	May 27th, 1913
Newbury, Arthur	June 21st, 1921

FIRST-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	NAME.	DATE.
Biggs, J. G	July 22, 1908	McGuckie, Thomas	July 22, 1908
Bonar, Robert	Oct. 28, 1911	McKendrick, Andrew	May 27, 1913
Brace, Tom	May 13, 1915	McMillan, J. H	Sept. 10, 1910
Bridge, Edward	July 22, 1908	McVicar, Samuel	May 1, 1909
Brown, David	May 21, 1914	Mazey, William John	Oct. 31, 1912
Brown, Robert Joyce	May 13, 1915	Miard, Henry Ernest	May 9, 1912
Caufield, Bernard	May 1, 1909	Michell, Dudley	Nov. 15, 1917
Church, James A. H	June 10, 1911	Millar, John K	Nov. 22, 1906
Cox, Richard	May 13, 1915	Miller, Andrew Anderson	Oct. 31, 1912
Crowder, James	June 10, 1911	Montgomery, John W	May 1, 1909
Cunningham, John Howard	May 9, 1912	Moore, Wm. H	May 17, 1917
Davidson, W. A	May 1, 1909	Mordy, Thomas	Sept. 10, 1910
Davies, David	June 10, 1911	Mottishaw, Sam. K	Nov. 15, 1917
Davies, Stephen	Nov. 15, 1917	O'Brien, George	May 21, 1914
Davies, Thos. Owen	May 21, 1914	Ovington, John	May 27, 1913
de Hart, J. B	May 17, 1917	Peacock, Frank David	Oct. 28, 1911
Derbyshire, James	Nov. 9, 1907	Penman, Hugh	May 21, 1914
Devlin, Henry	May 1, 1909	Phelan, Arthur	May 27, 1913
Dickson, James	Oct. 31, 1912	Powell, J. W	June 10, 1911
Elliott, Daniel	Nov. 9, 1907	Quinn, John Graham	July 8, 1916
Emmerson, Joseph	Nov. 9, 1907	Ramsay, Peter Millar	May 16, 1918
Fairfoull, Robert	June 10, 1911	Roper, William	May 13, 1915
France, Thos	Nov. 22, 1906	Russell, John	May 21, 1914
Fraser, Norman	Mar. 4, 1905	Shanks, John	May 1, 1909
Freeman, H. N	May 1, 1909	Shaw, William	May 9, 1912
Galloway, C. F. J	July 22, 1908	Shenton, T. J	Sept 10, 1910
Garman, Morris W	Nov. 15, 1917	Shone, Samuel	May 1, 1909
Gascoyne, Rowland B	May 21, 1914	Smith, A. E	Oct. 28, 1911
Glover, Francis	Oct. 31, 1912	Smith, Joseph	July 22, 1908
Graham, Charles	Nov. 14, 1905	Smith, Thos. Edwin	Dec. 19, 1918
Graham, Thomas	Nov. 9, 1907	Spicer, J. E	Oct. 28, 1911
Gray, James	Nov. 27, 1909	Spruston, T. A	Nov. 27, 1909
Henderson, Robert	Nov. 27, 1909	Stevens, L. C	Nov. 27, 1909
Hewlett, Howe	May 27, 1913	Stewart, R. T	Sept. 10, 1910
Higgins, Alexander	Dec. 19, 1918	Strachan, Robert	Mar. 4, 1905
Holden, James	May 1, 1909	Strang, James	June 10, 1911
Howden, Archibald	May 27, 1913	Taylor, James	May 16, 1918
Howells, Nathaniel	Oct. 28, 1911	Thomas, J. D	Sept. 10, 1910
Hughes, John C	May 17, 1917	Thorne, B. L	Sept. 10, 1910
Humphries, Clifford	June 10, 1911	Touhey, James	May 21, 1914
Hunter, Alex. B	July 8, 1916	Walker, William	May 16, 1918
Jackson, Thos. R	Nov. 9, 1907	Wallbank, J	Sept. 10, 1910
James, William	July 22, 1908	Warburton, Ernest Leonard	July 8, 1916
Jaynes, Frank	May 13, 1915	Wark, Samuel David	Oct. 3, 1919
Jemson, Jas. W	May 27, 1913	Wesnedge, William	Dec. 19, 1918
Kellock, George	June 10, 1911	Whittaker, John	Dec. 19, 1918
Knox, T. K	July 27, 1909	Williams, John Samuel	Dec. 19, 1918
Laird, Robert	Nov. 15, 1917	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
McDonald, John	Oct. 3, 1919	Wylie, John	July 22, 1908

SECOND-CLASS CERTIFICATES OF SERVICE.

NAME.	DATE.	Cer. No	NAME.	DATE.	Cer. No.
Lee, John S	March 4, 1905	B 9	Hunt, John	March 4, 1905	B 13
Millar, J. K	March 4, 1905	B 10	Walker, David	March 4, 1905	B 14
McCliment, John	March 4, 1905	B 11	Powell, William Baden	March 4, 1905	B 16
Martin, David	March 4, 1905	B 12	Bryden, Alexander	March 4, 1905	B 18

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904."

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Adamson, Robert	*Sept. 10, 1910*	B 120	*Garbett, Richard*	*Oct. 31, 1912*	B 161
Allan, Alex. McDairmid	May 27, 1913	B 167	Garman, Morris Wilbur	Oct. 31, 1912	B 155
Almond, Walter	Nov. 15, 1917	B 213	Gilham, John	June 21, 1920	B 237
Ball, Benjamin	June 21, 1920	B 235	Gillespie, Hugh	July 29, 1905	B 24
Barclay, Andrew	July 29, 1905	B 25	Gillespie, John	Oct. 23, 1906	B 36
Barlow, Benjamin Robert	Dec. 19, 1918	B 229	Gould, Alfred	May 13, 1915	B 190
Baybutt, Thomas	July 8, 1916	B 206	Gourlay, Robert	Dec. 19, 1918	B 227
Bell, John	May 17, 1917	B 212	Graham, Chas	Mar. 4, 1905	B 1
Beveridge, William	June 21, 1920	B 233	Gray, David	May 1, 1909	B 76
Bevis, Nathaniel	Sept. 10, 1910	B 123	Gray, George	July 8, 1916	B 207
Biggs, John	May 1, 1909	B 94	Greenwell, Archibald	May 16, 1918	B 220
Biggs, John G	Nov. 2, 1907	B 40	Hamilton, Robert N	May 21, 1914	B 175
Blair, *James*	*May 13, 1915*	B 197	*Hastings, Andrew Peacock*	Dec. 19, 1918	B 223
Brace, Tom	Nov. 27, 1909	B 96	Henderson, Robert	July 22, 1908	B 60
Bridge, Edward	Oct. 23, 1906	B 33	Holliday, William	Dec. 19, 1918	B 230
Brown, David	Sept. 10, 1910	B 108	Horrocks, Abner G	June 10, 1911	B 130
Brown, George	Dec. 19, 1918	B 225	Howells, Nathaniel	Nov. 27, 1909	B 97
Brown, James L	Oct. 28, 1911	B 136	Huby, Norman W	May 13, 1915	B 198
Brown, John C	Oct. 23, 1906	B 39	Hudson, George	Sept. 10, 1910	B 121
Brown, John Todd	May 9, 1912	B 150	Hughes, John C	Sept. 10, 1910	B 109
Brown, R. J	Oct. 28, 1911	B 134	Hutton, Isaac	May 21, 1914	B 185
Brown, Robert	May 21, 1914	B 183	Hutton, John	May 9, 1912	B 154
Brown, Robert Sneddon	May 13, 1915	B 196	Hynds, William	Dec. 14, 1920	B 240
Brown, William Gold	Dec. 19, 1918	B 228	Jackson, Thos. R	Mar. 4, 1905	B 5
Brownrigg, John H	May 17, 1917	B 124	James, David	Nov. 2, 1907	B 58
Bushell, J. P	May 1, 1909	B 81	Jarrett, Fred	May 1, 1909	B 84
Carroll, Henry	July 22, 1908	B 62	Jaynes, Frank	Sept. 10, 1910	B 111
Caufield, Bernard	Oct. 23, 1906	B 30	John, Francis	July 8, 1916	B 200
Caufield, John	July 8, 1916	B 199	John, Howell	Sept. 10, 1910	B 122
Cawthorne, L	May 1, 1909	B 93	Johnson, Moses	May 1, 1909	B 75
Challinor, Jno. Thomas	May 27, 1913	B 169	Jones, Samuel	May 16, 1918	B 221
Challoner, Jno. Arthur	May 21, 1914	B 178	Jones, William T	July 22, 1908	B 66
Churchill, James	July 22, 1908	B 65	Jordon, Thos	Nov. 27, 1909	B 104
Clarkstone, Wm. W	May 21, 1914	B 180	Joyce, Walter	May 27, 1913	B 168
Commons, Wm.	*Sept. 10, 1910*	B 115	*Kirkwood, John Robertson*	*Oct. 31, 1912*	B 160
Coupland, George	May 16, 1918	B 217	Knowles, James E	Oct. 28, 1911	B 137
Courtney, A. W	Oct. 28, 1911	B 138	Laird Robert	May 17, 1917	B 210
Cox, Richard	May 9, 1912	B 143	Lander, Frank	May 13, 1915	B 195
Crawford, David	May 1, 1909	B 88	Lane, Joseph	May 9, 1912	B 142
Cunliffe, Thomas	May 1, 1909	B 78	Lee, Robert John	Sept. 10, 1910	B 110
Dando, John	May 27, 1913	B 164	Littler, Matthew	Oct. 31, 1912	B 157
Daniels, David	Nov. 2, 1907	B 53	Luck, George	June 10, 1911	B 128
Derbyshire, James	Oct. 23, 1906	B 32	Manifold, Albert	May 9, 1912	B 145
Davidson, Hugh	May 27, 1913	B 165	Marsh, John	Nov. 15, 1917	B 216
Davies, Stephen	Sept 10, 1910	B 113	Mason, Joseph	May 13, 1915	B 193
Dennis, Fred. W	May 21, 1914	B 174	Massey, H	Nov. 27, 1909	B 99
Devlin, Ernest H	May 21, 1914	B 179	Mather, Thomas	June 10, 1911	B 127
Devlin, Henry	Nov. 2, 1907	B 44	Matusky, A	May 1, 1909	B 91
Dewar, Alexander	Oct. 31, 1912	B 162	Mayer, Ralph Waldo	May 9, 1912	B 144
Dickenson, Clifford	May 13, 1915	B 189	Mazay, W. J	Nov. 27, 1909	B 101
Dunsmuir, John	Nov. 14, 1905	B 26	Merryfield, William	July 22, 1908	B 61
Dykes, J. W	May 1, 1909	B 77	Miard, Hy. E	Sept. 10, 1910	B 107
Eccleston, Wm	May 1, 1909	B 87	Michek, John	May 17, 1917	B 188
Fairfoull, James	May 21, 1914	B 186	Michell, Dudley	May 13, 1915	B 187
Fairfoull, R	May 1, 1909	B 83	Middleton, Robert	July 22, 1908	B 72
Finlayson, James	July 29, 1905	B 21	Mitchell, Henry	July 8, 1916	B 201
Ford, Allan	*May 27, 1913*	B 171	*Monks, James*	*Nov. 2, 1907*	B 55
Foster, W. R	Nov. 27, 1909	B 102	Moore, Wm. H	May 21, 1914	B 173
France, Thos	May 14, 1905	B 27	Morgan, John	Nov. 2, 1907	B 43
Francesini, Louis	June 21, 1920	B 236	Morgan, William	Dec. 19, 1918	B 224
Francis, David M	May 21, 1914	B 182	Morris, John	July 22, 1908	B 67
Francis, Enoch	May 1, 1909	B 86	Morton, Robert W	July 22, 1908	B 59
Francis, James	July 22, 1908	B 63	Mottishaw, S. K	Oct. 28, 1911	B 135
Frater, George	July 8, 1916	B 204	Murray, George	Oct. 3, 1919	B 232
Freeman, Henry N	Nov. 2, 1907	B 45	Musgrave, J	May 1, 1909	B 90

SECOND-CLASS CERTIFICATES OF COMPETENCY ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Myers, Peter	May 9, 1912	B 149	Scarpino, Francis	Dec. 19, 1918	B 226
McLaughlin, Alex	May 13, 1915	B 191	Shanks, David	Oct. 31, 1912	B 159
McDonald, J.A	Oct. 28, 1911	B 133	Shaw, Thomas John	May 27, 1913	B 166
McDonald, John	May 27, 1913	B 172	Smith, John	Oct. 3, 1919	B 231
McFegan, W	Nov. 31, 1909	B 106	Somerville, Alex	Mar. 4, 1905	B 4
McGarry, Martin	Oct. 31, 1912	B 156	Spruston, Robert Lecce	July 8, 1916	B 202
McGuckie, Thomas M	Oct. 23, 1906	B 35	Spruston, Thos. A	Nov. 2, 1907	B 46
McKelvie, J	May 1, 1909	B 92	Stafford, Matthew	June 10, 1911	B 131
McKendrick, And	Sept. 10, 1910	B 112	Stewart, J. M	May 1, 1909	B 95
McLean, Michael D.	June 21, 1920	B 234	Stobbart, Jacob	May 9, 1912	B 153
McMillan, D	June 10, 1911	B 125	Stockwell, William	Nov. 2, 1907	B 56
McNay, Carmichael	May 9, 1912	B 151	Strang, Thomas	Oct. 31, 1912	B 158
McPherson, James E	July 22, 1908	B 73	Sutherland, John	May 16, 1918	B 218
Neen, Joseph	June 10, 1911	B 129	Taylor, James	May 13, 1915	B 194
Newbury, Arthur	May 21, 1914	B 184	Taylor, Thomas	July 8, 1916	B 203
Newton, Wm	Sept. 10, 1910	B 116	Thomas, J. B.	Nov. 27, 1909	B 105
O'Brien, Charles	May 9, 1912	B 148	Thomas, Joseph D	Oct. 23, 1906	B 38
O'Brien, George	May 1, 1909	B 82	Thompson, Joseph	Sept. 10, 1910	B 114
Osborne, Hugh	Dec. 14, 1920	B 239	Touhey, James	May 9, 1912	B 147
Ovington, John	Nov. 2, 1907	B 52	Touhey, William	July 8, 1916	B 205
Park, William	June 21, 1920	B 238	Tonge, Thomas	July 22, 1908	B 71
Parkinson, T	May 1, 1909	B 80	Tully, Thomas	Nov. 15, 1917	B 214
Parnham, Charles	Nov. 2, 1907	B 49	Vanbulle, Peter	Nov. 2, 1907	B 54
Quinn, James	May 21, 1914	B 181	Virgo, John	May 1, 1909	B 89
Quinn, John	May 9, 1912	B 146	Walker, William	May 13, 1915	B 192
Ramsay, Peter Millar	May 17, 1917	B 209	Warburton, Ernest L.	May 27, 1913	B 170
Rankin, Geo.	Nov. 27, 1909	B 103	Watson, Adam G	Nov. 14, 1905	B 28
Raynes, M. T	Oct. 28, 1911	B 139	Watson, Arthur W.	May 17, 1917	B 211
Reid, Wm	Oct. 28, 1911	B 132	Webber, John Frank	Mar. 4, 1905	B 3
Renny, James	Oct. 28, 1911	B 140	Wesnedge, William	Nov. 27, 1909	B 98
Richards, Thomas	Nov. 2, 1907	B 57	White, John	Nov. 2, 1907	B 48
Richards, Samuel	May 9, 1912	B 152	Whitehouse, William	Oct. 31, 1912	B 163
Rigby, John	July 29, 1905	B 29	Williams, John Samuel	Nov. 15, 1917	B 215
Roberts, Ebenezer	Sept. 10, 1910	B 117	Williams, Watkin	Sept. 10, 1910	B 118
Robinson, William	July 22, 1908	B 69	Wilson, Robinson	May 21, 1914	B 177
Rogers, George	May 1, 1909	B 79	Wilson, Thomas	July 22, 1908	B 74
Roper, William	May 9, 1912	B 141	Wilson, William	July 22, 1908	B 70
Rowbottom Thomas	May 16, 1918	B 222	Wood, Thos. James	May 21, 1914	B 176
Russell, John	Nov. 2, 1907	B 47	Worthington, Joseph	May 1, 1909	B 85
Rutherford, Jasper	May 16, 1918	B 219			

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	Ball, Benjamin	May 21, 1914	C 583
Ainsworth, Edward	May 16, 1918	C 674	Barker, Robert	June 10, 1911	C 415
Allan, Alexander	Oct. 28, 1911	C 430	Barlow, B. R.	May 1, 1909	C 337
Almond, Alex	Oct. 1, 1907	C 252	Bateman, Joseph William	Oct. 28, 1913	C 551
Almond, Walter	July 22, 1908	C 286	Bauld, Wm	June 10, 1911	C 422
Anderson, John	Oct. 28, 1911	C 437	Baxter, Robert	Oct 28, 1911	C 450
Anderson, Peter Blane	Nov. 15, 1917	C 660	Baybutt, Thomas	May 27, 1913	C 548
Anderson, Robt.	Oct. 14, 1914	C 599	Beeton, D. H.	May 1, 1909	C 338
Angell, William	May 21, 1914	C 591	Bell, Fred	May 27, 1913	C 514
Arbuckle, John	May 13, 1915	C 622	Bell, John	May 9, 1912	C 477
Archibald, Geo	May 21, 1914	C 569	Bennett, Andrew M.	Nov. 15, 1917	C 661
Archibald, Thomas	Oct. 28, 1911	C 454	Bennett, John	Oct. 14, 1914	C 597
Ball, Alfred	May 17, 1917	C 635	Bennie, John	June 10, 1911	C 411
Bann, Thomas	Oct. 31, 1912	C 494	Beveridge, Wm.	June 10, 1911	C 396
Baggaley, J	July 22, 1908	C 300	Biggs, John	Mar. 4, 1905	C 210
Bain, James	May 27, 1913	C 546	Biggs, Thomas	Oct. 28, 1911	C 449

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Birchell, Richard	Oct. 1, 1907	C 266	Davis, William	May 1, 1909	C 339
Blair, James	Oct. 31, 1912	C 502	Dean, Andrew	Dec. 19, 1918	C 688
Blewett, Ernest	July 22, 1908	C 298	Dean, Joseph	May 13, 1915	C 611
Blinkhorn, Thomas	Dec. 19, 1918	C 681	Derbyshire, A	June 10, 1911	C 401
Bradley, William	July 22, 1908	C 291	Dewar, Alex	Sept. 10, 1910	C 369
Bridge, Edward	July 29, 1905	C 223	Devlin, Edward	Oct. 23, 1906	C 241
Briscoe, F	July 22, 1908	C 309	Devlin, Ernest Henry	May 27, 1913	C 538
Broderick, Matthew	Jan. 21, 1913	C 525	Devlin, John	Oct. 3, 1919	C 693
Brown, Arthur A	Oct. 14, 1914	C 596	Devoy, William	May 17, 1917	C 638
Brown, David	Nov. 1, 1909	C 348	Dickenson, Clifford	May 27, 1917	C 532
Brown, George	July 8, 1916	C 626	Dingsdale, Geo	Oct. 28, 1911	C 459
Brown, George A	Dec. 14, 1920	C 706	Doherty, J. J	May 1, 1909	C 340
Brown, James	Sept. 10, 1910	C 364	Doney, John	Mar. 4, 1905	C 211
Brown, James	June 10, 1911	C 412	Donnachie, John	June 10, 1911	C 425
Brown, James	July 8, 1916	C 625	Doodson, Robert	Oct. 28, 1911	C 455
Brown, Jas. Millie	May 13, 1915	C 615	Dorrance, Orlin William	Jan. 21, 1913	C 517
Brown, John	Sept. 10, 1910	C 392	Douglas, D. B	Oct. 23, 1906	C 235
Brown, Robert	Oct. 28, 1911	C 451	Dow, And. Y	May 21, 1914	C 587
Brown, Robert D	June 10, 1911	C 423	Drybrough, Robert	June 21, 1920	C 701
Brown, Robert S	June 10, 1911	C 408	Dunn, Wm	Oct. 14, 1914	C 606
Brown, Wm. A	May 21, 1914	C 576	Dykes, Isaac	June 10, 1911	C 409
Brown, William Gold	July 8, 1916	C 629	Dykes, Joseph W	Oct. 1, 1907	C 248
Bruce, Preston	Dec. 14, 1920	C 712	Eccleston, Thomas	May 17, 1917	C 482
Bullen, Thomas	Sept. 10, 1910	C 379	Edwards, John	May 27, 1913	C 542
Bushell, Jas. P	Oct. 1, 1907	C 264	Elliott, John	May 27, 1913	C 541
Bysouth, Thomas	May 16, 1918	C 673	Elmes, George	Oct. 31, 1912	C 511
Cairns, Andrew	June 10, 1911	C 420	Evans, D	July 22, 1908	C 284
Cairns, Robert	May 27, 1913	C 539	Ewing, Robert	May 13, 1915	C 608
Caldwell, Daniel	May 17, 1917	C 639	Fairfoull, James	Oct. 28, 1911	C 453
Calverly, Joseph	Sept. 10, 1910	C 375	Farrow, John William	Dec. 19, 1918	C 683
Camamile, Hollis	Oct. 28, 1911	C 443	Ferryman, Henry	June 21, 1920	C 697
Campbell, Samuel	Nov. 15, 1917	C 662	Fitzpatrick, T. J	Oct. 2, 1911	C 452
Campbell, Andrew	Nov. 27, 1917	C 651	Flockart, David	Jan. 21, 1913	C 531
Carr, Peter	Oct. 31, 1912	C 497	Ford, Allen	Oct. 28, 1911	C 445
Carson, George	Mar. 17, 1917	C 663	Fowler, Robert	Oct. 31, 1912	C 495
Catchpole, Charles	July 29, 1905	C 227	Francescini, Louis	May 16, 1918	C 672
Caufield, Edward	May 16, 1918	C 670	Francis, David Morgan	Oct. 28, 1913	C 558
Caufield, John	May 1, 1909	C 321	*Francis, James*	Oct. 1, 1907	C 250
Challoner, Arthur	Oct. 28, 1911	C 433	Frater, George	May 13, 1915	C 616
Chambers, Ralph H	Dec. 14, 1920	C 709	Freeman, H. N	Nov. 14, 1905	C 230
Charnock, John	Nov. 15, 1917	C 653	Frew, Andrew	Nov. 27, 1909	C 360
Cheetham, Ben	July 22, 1908	C 311	Frodsham, Vincent	July 22, 1908	C 282
Chester, John	Oct. 28, 1911	C 440	Furbow, John	Jan. 21, 1913	C 528
Clark, Lewis	June 10, 1911	C 405	Garbett, Richard	Sept. 10, 1910	C 377
Clark, Walter Pattison	May 9, 1912	C 480	Gascoyne, Rowland B	Jan. 21, 1913	C 513
Clarkson, Robert	June 21, 1920	C 696	Geater, Jas. Gordon	May 21, 1914	C 573
Clarkstone, Wm. W	Oct. 28, 1911	C 431	Gemmell, James	Oct. 31, 1912	C 505
Cleaves, Walter	May 9, 1912	C 475	Gillham, John	May 13, 1915	C 623
Clifford, William	July 22, 1908	C 313	Gillies, William	May 16, 1918	C 668
Colgrove, Charles Henry	Dec. 19, 1918	C 679	Glenn, James	Oct. 28, 1911	C 435
Commons, William	July 22, 1908	C 304	Gordon, Davis John	May 9, 1912	C 474
Cooke, Joseph	Mar. 4, 1905	C 209	Gourley, Robert	May 9, 1912	C 470
Coomb, Alexander	May 27, 1913	C 533	Gray, George	May 9, 1912	C 467
Cooper, John Andrew	Dec. 19, 1918	C 689	Green, William	Nov. 15, 1917	C 659
Cope, Frank	Oct. 28, 1913	C 549	Greenhorn, John	May 21, 1914	C 575
Coulthard, James	June 10, 1911	C 407	Griffiths, Edward	Oct. 31, 1914	C 508
Crawford, David	Mar. 4, 1905	C 208	Gunniss, Matthew	May 9, 1912	C 460
Cunningham, G. F	Nov. 11, 1905	C 229	Hallinan, William	May 1, 1909	C 343
Cunliffe, Thos	Oct. 1, 1907	C 265	Halsall, J	July 22, 1908	C 307
Dabb, Owen	May 21, 1914	C 578	*Hamilton, John*	Oct. 28, 1911	C 444
Dando, John	May 9, 1912	C 465	Hamilton, Robert Nesbitt	Oct. 28, 1913	C 550
Davidson, Hugh	May 9, 1912	C 464	Hampton, Samuel	Nov. 15, 1917	C 650
Davies, Alfred	Oct. 3, 1919	C 691	Hancock, Arthur	Nov. 15, 1917	C 656
Davies, Evan Thomas	May 9, 1912	C 463	Hardy, Edward	June 21, 1920	C 694
Davis, John David	May 16, 1918	C 669	Hartley, Thomas	Oct. 31, 1912	C 510

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Harwood, Fred	Sept. 10, 1910	C 384	Lynch, Stewart	Oct. 28, 1911	C 432
Harvey, Thomas	May 9, 1912	C 466	Mackie, John	June 10, 1911	C 421
Harvie, George	Sept. 10, 1910	C 378	Makin, J. Wm	Sept. 10, 1910	C 385
Heaps, Robert	Sept. 10, 1910	C 373	Malone, John	May 21, 1914	C 585
Hemer, Herbert	Oct. 14, 1914	C 595	Malone, Patrick	Oct. 1, 1907	C 247
Henney, Jonathan	June 10, 1911	C 424	Maltman, James	Oct. 31, 1912	C 501
Hendry, James	May 9, 1912	C 471	Mansfield, A	May 1, 1909	C 336
Herd, William	Dec. 19, 1918	C 682	Marrs, John	May 17, 1917	C 640
Heyes, Edward	May 1, 1909	C 320	Marsh, Daniel Parks	May 27, 1913	C 543
Hill, Isaac	Nov. 15, 1917	C 664	Marsh, John	Oct. 1, 1907	C 270
Hilley, Fred	July 22, 1908	C 290	Martin, James	June 10, 1911	C 398
Hilton, Mathias	Dec. 19, 1918	C 677	Mason, Joseph	July 22, 1908	C 297
Hilton, R. G	Sept. 10, 1910	C 376	Massey, Henry	May 1, 1909	C 317
Hodson, R. H	Mar. 4, 1905	C 216	Mather, Thomas	July 22, 1908	C 293
Holdsworth, William	May 16, 1918	C 671	Matusky, Andrew	Oct. 1, 1907	C 259
Holliday, William	July 8, 1916	C 634	Mawson, J. T	Nov. 27, 1909	C 359
Horbury, Joseph W	June 10, 1911	C 406	Maxwell, Geo	May 21, 1914	C 571
Horrocks, A. G	May 1, 1909	C 324	McAlpine, John	Mar. 4, 1905	C 217
Horwood, S	July 22, 1908	C 312	McArthur, John Malcolm	May 17, 1917	C 648
Houston, Robert	July 8, 1916	C 631	McBroom, Al	July 2, 1908	C 287
Howells, Nathaniel	May 1, 1909	C 316	McCourt, John	Oct. 14, 1914	C 605
Huby, Norman	June 10, 1911	C 394	McCulloch, James	May 1, 1909	C 315
Hutchison, Ben	Nov. 14, 1905	C 232	McDonald, John	Oct. 28, 1911	C 448
Hutchison, Fred	Nov, 27, 1909	C 358	McFagen, Alexander	May 9, 1912	C 490
Hynd, John	Dec. 14, 1920	C 707	McFegan, Robert	June 21, 1920	C 698
Hynds, William	July 8, 1916	C 632	McFegan, W	May 1, 1909	C 319
Ireson, John	Oct. 31, 1912	C 507	McGarry, Martin	May 1, 1909	C 326
Irvine, David	June 10, 1911	C 413	McGrath, James	July 8, 1916	C 630
Jack, John	May 21, 1914	C 582	McGuckie, Jno. M	May 21, 1914	C 562
James, Thos	May 21, 1914	C 588	McGuckie, Thomas	July 29, 1905	C 226
Jardine, George Edward	Jan. 21, 1913	C 521	McGuire, Thomas	Oct. 28, 1913	C 553
Jarrett, Fred. J	Oct. 1, 1907	C 256	McIntyre, Neil	May 21, 1914	C 574
Jaynes, Frank	July 22, 1908	C 277	McKelvie, J	July 22, 1908	C 285
Jemson, J. W	Mar. 4, 1905	C 205	McKenzie, Peter	June 10, 1911	C 427
Jenkins, John	Sept. 10, 1910	C 390	McKibben, Matthew	May 21, 1914	C 580
John, Howel	July 22, 1908	C 305	McKinley, John	Oct. 28, 1914	C 442
Johnson, Moses	Oct. 1, 1907	C 258	McLaughlin, James	May 9, 1912	C 485
Johnston, Robert	May 9, 1912	C 479	McLachlan, Alex	June 10, 1912	C 419
Jones, Alf. Geo	May 21, 1914	C 584	McLean, M. D	Sept. 10, 1910	C 389
Jones, Samuel	May 27, 1913	C 518	McLellan, William	Mar. 4, 1905	C 219
Jones, William C	Jan. 21, 1913	C 556	McLeod, James	July 22, 1908	C 296
Jones, William Ernest	Oct. 28, 1913	C 221	McLeod, John	May 13, 1915	C 609
Jones, W. T	Mar. 4, 1905	C 544	McMeakin, James	May 13, 1915	C 612
Joyce, Walter	Nov. 27, 1909	C 361	McMillan, D	Sept. 10, 1910	C 363
Judge, Peter	Sept. 10, 1910	C 391	McMillan, Edward	Oct. 31, 1912	C 493
Keenan, Wm. James	June 10, 1911	C 426	McMillan, Neil	Nov. 15, 1917	C 654
Kelly, Ernest	May 17, 1917	C 646	McNay, Carmichael	July 22, 1908	C 306
Kemp, Wm	Oct. 14, 1914	C 594	McNeill, Adam L	July 22, 1908	C 281
Kingham, Alfred	Oct. 28, 1913	C 559	McNeill, Robert	Sept. 10, 1910	C 387
Kirkeberg, H. S	Nov. 27, 1909	C 350	Meck, Matthew	May 9, 1912	C 484
Klejko, Steve	Dec. 14, 1920	C 703	Meikle, Harry Alexander	July 8, 1916	C 627
Lane, Joseph	Oct. 1, 1907	C 254	Menzies, Frederick	Dec. 14, 1920	C 704
Lavin, Joseph	June 21, 1920	C 700	Merrifield, George	Oct. 23, 1906	C 239
Leeman, T	May 1, 1909	C 345	Merrifield, William	Oct. 23, 1906	C 236
Lewis, Benj. J	Sept. 10, 1910	C 386	Michek, John	May 21, 1914	C 563
Leynard, Paul	May 17, 1917	C 637	Miles, John	June 10, 1911	C 414
Liddle, John	July 29, 1905	C 228	Mitchell, Charles	May 1, 1909	C 322
Lindsay, William	May 17, 1917	C 642	Mitchell, Henry	Sept. 10, 1910	C 366
Littler, John	June 10, 1911	C 440	Monks, James	Nov. 14, 1905	C 234
Littler, Matthew	June 10, 1911	C 417	Moore, George	Oct. 23, 1906	C 242
Littler, Robert	June 10, 1911	C 418	Moore, John	May 1, 1909	C 335
Livingstone, Alex	Oct. 28, 1911	C 436	Moreland, Thomas	July 22, 1908	C 299
Loxton, George	June 10, 1911	C 428	Morgan, John	July 29, 1905	C 224
Loxton, John	June 10, 1911	C 416	Morgan, William	May 17, 1917	C 636
Luck, George	May 1, 1909	C 318	Morris, David	May 9, 1912	C 472

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Mottishaw, Samuel K.	Oct. 23, 1906	C 237	Rutherford, Jasper	May 17, 1917	C 644
Murdock, Jno. Y.	May 21, 1914	C 564	Rutledge, Edwin	July 22, 1908	C 302
Myers, Peter	Oct. 28, 1911	C 446	Scott, Henry	July 22, 1908	C 294
Nanson, T. H.	July 22, 1908	C 280	Saunders, Eustace L.	Jan. 21, 1913	C 520
Nash, George William.	May 17, 1917	C 565	Scarpino, Francis	May 17, 1917	C 649
Neen, Joseph	Nov. 27, 1909	C 352	Seddon, James	Oct. 3, 1919	C 692
Nelson, Horatio	Oct. 1, 1907	C 263	Shanks, David	Sept. 10, 1910	C 372
Neilson, William	May 9, 1912	C 481	Sharp, James	May 1, 1909	C 325
Newman, John	Oct. 14, 1914	C 603	Sharples, J. T.	Sept. 10, 1910	C 380
Nicholson, James	May 9, 1912	C 469	Shearer, L	May 1, 1909	C 330
Nimmo, James	May 9, 1912	C 461	Shields, Thomas	May 16, 1918	C 667
Norris, Joshua	Oct. 28, 1913	C 557	Shipley, John W.	Oct. 28, 1911	C 456
Oakes, Robert	Oct. 31, 1912	C 498	Shooter, Joseph	Oct. 1, 1907	C 261
O'Brien, Charles	Nov. 27, 1909	C 349	Shortman, J	May 1, 1909	C 331
Odgers, Alfred	Jan. 21, 1913	C 529	Simister, J. H.	Nov. 27, 1909	C 353
Odgers, Eli	Jan. 21, 1913	C 523	Simister, W	May 1, 1909	C 334
Orr, Alexander	Oct. 28, 1911	C 434	Sim, James	Dec. 14, 1920	C 711
Osborne, Hugh	Oct. 28, 1913	C 555	Simms, Hubert Allan.	Jan. 21, 1913	C 526
Oswald, Geo. L.	Sept. 10, 1910	C 370	Sinclair, William	Jan. 21, 1913	C 527
Owen, Thomas	May 1, 1909	C 347	Skelton, Thos	May 1, 1909	C 344
Park, William	Dec. 19, 1918	C 684	Smith, A. E.	Sept. 10, 1910	C 367
Parks, Alexander	Jan. 21, 1913	C 519	Smith, John Watterson	May 16, 1918	C 665
Parker, L.	May 1, 1909	C 341	Smith, Joseph	Mar. 4, 1905	C 207
Parkinson, James William	Nov. 15, 1917	C 655	Smith, Richard Beveridge	Oct. 28, 1913	C 561
Parkinson, T.	July 22, 1908	C 289	Smith, Thos. J.	Oct. 1, 1907	C 271
Parrott, Jas. E.	May 21, 1914	C 590	Smith, Thomas	May 9, 1912	C 486
Parson, Herbert	May 13, 1915	C 621	Smith, Thomas	Dec. 14, 1920	C 705
Pearson, Jonathan	May 9, 1912	C 473	Snow, Aubrey	June 15, 1918	C 675
Penman, Hugh	Oct. 28, 1913	C 552	Sopwith, Reginald Scott.	Jan. 21, 1913	C 512
Perry, George Harewood.	May 17, 1917	C 643	* Sparks, Edward.	Oct. 1, 1907	C 255
Phillips, Richard Stephen.	May 17, 1917	C 620	Spencer, G.	May 1, 1909	C 329
Pickup, A.	July 22, 1908	C 310	Spruston, R. L.	Nov. 27, 1909	C 355
Picton, W.	May 1, 1909	C 333	Spruston, Thomas A.	Mar. 4, 1905	C 206
Plank, Samuel	Nov. 14, 1905	C 233	Stafford, M.	Sept. 10, 1910	C 382
Poole, Samuel	May 27, 1913	C 536	Starr, Wallace	May 9, 1912	C 488
Price, Walter	Sept. 10, 1910	C 371	Staton, Edward	May 21, 1914	C 581
Puckey, John Thomas.	Dec. 19, 1918	C 687	Steele, Walter.	Oct. 28, 1911	C 439
Quinn, James	Oct. 28, 1911	C 441	Stewart, George	May 27, 1913	C 534
Quinn, John	Oct. 28, 1911	C 429	Stewart, James M.	Oct. 23, 1906	C 240
Radford, Albert	May 21, 1914	C 579	Stockwell, William	Oct. 23, 1906	C 238
Rallison, R.	July 22, 1908	C 279	Strachan, John	Oct. 14, 1914	C 604
Rankin, George	July 22, 1908	C 275	Strang, James	May 13, 1915	C 614
Rankin, Wm. Shaw	May 9, 1912	C 489	Strang, Thomas	June 10, 1911	C 400
Ratcliffe, Thomas	Oct. 1, 1907	C 253	Strang, Wm.	June 10, 1911	C 395
Raynor, Fred	Oct. 1, 1907	C 257	Sutherland, John	May 27, 1913	C 545
Reid, Robert	Sept. 10, 1910	C 383	Taylor, Charles M.	Mar. 4, 1905	C 213
Reid, Thos.	May 21, 1914	C 592	Taylor, Hugh	Jan. 21, 1913	C 530
Reid, Wm.	June 10, 1911	C 403	Taylor, James	May 21, 1914	C 567
Reilly, Thomas	July 22, 1908	C 303	Taylor, Jonathan	Dec. 19, 1918	C 680
Renney, Jas.	Nov. 27, 1909	C 354	Taylor, J. T.	Oct. 28, 1911	C 447
Richards, James	Nov. 1, 1907	C 249	Taylor, Leroy	Sept. 10, 1910	C 381
Richards, Samuel	Oct. 23, 1906	C 244	Taylor, Robert	June 21, 1920	C 695
Richardson, J. H.	Oct. 28, 1911	C 458	Taylor, Thomas	May 21, 1914	C 577
Rigby, John	July 29, 1905	C 225	Thacker, Geo.	May 27, 1913	C 537
Roberts, Ebenezer	May 1, 1909	C 327	Thomas, Thomas	Sept. 10, 1910	C 365
Robinson, Michael	May 1, 1909	C 332	Thomas, John B.	Nov. 14, 1905	C 231
Robson, Thomas	May 21, 1914	C 566	Thomas, Joseph.	Mar. 4, 1905	C 220
Rogers, Ellis.	May 13, 1915	C 624	Thomas, Warriett	Oct. 1, 1907	C 273
Roper, William	July 22, 1908	C 274	Thomason, Charles	Nov. 15, 1917	C 657
Ross, William	June 21, 1920	C 702	Thompson, Thomas	Oct. 1, 1917	C 267
Rowan, Alexander	Oct. 31, 1912	C 500	Thompson, John.	Oct. 31, 1912	C 509
Rowan, John	Oct. 14, 1914	C 602	Thompson, Joseph	Oct. 1, 1907	C 269
Rowbottom, Thomas	Oct. 31, 1914	C 492	Thomson, Duncan	Mar. 4, 1905	C 218
Royle, Edward	Oct. 31, 1912	C 506	Tolley, John	Dec. 19, 1918	C 678
Russell, Robert	Nov. 27, 1909	C 351			

* C 314 issued in lieu of C 255 destroyed by Fernie fire.

THIRD-CLASS CERTIFICATES ISSUED UNDER "COAL-MINES REGULATION ACT FURTHER AMENDMENT ACT, 1904"—*Continued.*

NAME.	DATE.	Cer. No.	NAME.	DATE.	Cer. No.
Touhey, William	May 27, 1913	C 547	Weeks, John	Mar. 4, 1905	C 214
Travis, Joseph	June 21, 1920	C 699	West, James Gloag	May 16, 1918	C 676
Tully, Thomas	May 9, 1912	C 468	Whalley, William	Dec. 19, 1918	C 686
Tune, Elijah	May 9, 1912	C 476	White James	Oct. 31, 1912	C 499
Turnbull, Matthew	Oct. 14, 1914	C 598	White, John	Oct. 22, 1906	C 245
Vardy, Robt	May 21, 1914	C 570	Whitehouse, Wm	June 10, 1911	C 402
Vaughan, John Henry	Oct. 28, 1913	C 560	Wilkinson, Edward	Oct. 28, 1911	C 438
Walker, George	July 8, 1916	C 633	Williams, John Sam	June 10, 1911	C 404
Walker, Jas. Alexander	Oct. 31, 1912	C 496	Williams, Watkin	June 22, 1908	C 301
Walker, Wm	May 21, 1914	C 586	Wilson, Robinson	June 10, 1911	C 397
Wallace, Fred	Oct. 1, 1907	C 260	Wilson, Thomas M	Oct. 1, 1907	C 272
Walls, John	Dec. 14, 1920	C 710	Wilson, William	Oct. 1, 1907	C 262
Warburton, Ernest Leonard	June 10, 1911	C 399	Wilson, William	May 17, 1917	C 674
Ward, Ernest Hedley	May 17, 1917	C 641	Winstanley, H	July 22, 1908	C 283
Wardrop, James	Oct. 31, 1912	C 504	Wintle, Thomas A	July 29, 1905	C 222
Watson, Adam G	Mar. 4, 1905	C 212	Witherington, George	Oct. 28, 1913	C 554
Watson, Arthur W	May 27, 1913	C 535	Wood, Thos. James	Oct. 31, 1912	C 491
Watson, George	July 22, 1908	C 288	Worthington, J	July 22, 1908	C 295
Watson, Joseph	Jan. 21, 1913	C 515	Wright, John	May 21, 1914	C 593
Watson, William	Oct. 22, 1906	C 246	Wright, Robert	May 21, 1914	C 589
Watson, William	May 17, 1917	C 645	Wright, William	Jan. 21, 1913	C 522
Webb, Herbert	Oct. 28, 1911	C 457	Young, Alexander	May 16, 1918	C 666
Webster, James Stewart	Dec. 19, 1918	C 685			

COAL-MINE OFFICIALS.

Third-class Certificates issued under "Coal-mines Regulation Act Further Amendment Act, 1904." sec. 38, subsec. (2), in exchange for Certificates issued under the "Coal-mines Regulation Act Amendment Act, 1901."

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Adam, Robert	Oct. 12, 1904	C 42	Dudley, James	March 22, 1905	C 114
Addison, Thos	Dec. 10, 1904	C 52	Duncan, Thomas	Aug. 29, 1906	C 128
Aitken, James	Oct. 24, 1904	C 44	Dunlap, Henry	Nov. 21, 1904	C 51
Allsop, Harry	Oct. 11, 1904	C 34	Dunn, Geo	Dec. 19, 1904	C 56
Ashman, Jabez	Feb. 5, 1907	C 131	Dunsmuir, John	March 29, 1905	C 90
Auchinvole, Alex	March 29, 1905	C 89	Eccleston, Wm	March 15, 1905	C 80
Barclay, Andrew	April 27, 1904	C 19	Fagan, David	April 6, 1905	C 109
Barclay, James	April 27, 1904	C 20	Farquharson, John	April 27, 1904	C 17
Barclay, John	April 17, 1905	C 111	Findlayson, James	June 6, 1904	C 25
Bickle, Thos	Oct. 11, 1904	C 37	Fulton, Hugh T	April 3, 1905	C 105
Bowie, James	May 13, 1905	C 116	Gibson, Edward	May 30, 1905	C 118
Briscoe, Edward	Oct. 10, 1906	C 129	Gilchrist, Wm	March 29, 1905	C 85
Campbell, Dan	March 29, 1905	C 93	Gillespie, Hugh	April 6, 1904	C 8
Carr, Jos. E	Oct. 11, 1904	C 36	Gillespie, John	April 6, 1904	C 5
Carroll, Harry	March 29, 1905	C 98	Gould, Alfred	April 17, 1906	C 112
Clarkson, Alexander	April 27, 1904	C 18	Green, Francis	Oct. 11, 1904	C 38
Collishaw, John	Feb. 7, 1905	C 68	Handlen, Jas	June 16, 1904	C 122
Comb, John	March 23, 1904	C 2	Harmison, Wm	Feb. 3, 1905	C 65
Cosier, Wm	March 29, 1905	C 86	Hescott, John	Jan. 16, 1905	C 62
Courtney, A. W	Nov. 2, 1904	C 45	Hoggan, Wm	June 6, 1911	C 134
Crawford, Frank	April 6, 1904	C 7	John, David	Nov. 8, 1904	C 49
Daniels, David	April 27, 1904	C 12	John, Evan	July 25, 1916	C 140*
Davidson, David	April 3, 1905	C 106	Johnson, Geo	May 9, 1904	C 124
Davidson, John	March 29, 1905	C 87	Johnson, Wm. R	March 1, 1905	C 75
Devlin, Henry	Oct. 12, 1904	C 41	Jones, Evan	April 30, 1913	C 136
Dobbie, John	Nov. 27, 1905	C 126	Kerr, Wm	March 29, 1905	C 91

COAL-MINE OFFICIALS—*Continued.*

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Lander, Frank	Jan. 9, 1905	C 61	Ross, John	April 3, 1905	C 101
Lanfear, Herbert	Jan. 27, 1905	C 63	Roughead, George	Jan. 30, 1907	C 130
Lewis, Thos	Oct. 11, 1904	C 35	Ryan, John	Dec. 28, 1904	C 59
Malpass, James	Nov. 7, 1904	C 113	Sanders, John W	April 3, 1905	C 107
Marsden, John	May 3, 1904	C 21	Shenton, Thos. J	July 25, 1904	C 30
Miard, Harry E	March 3, 1905	C 76	Shepherd, Henry	June 13, 1904	C 26
Middleton, Robt	Feb. 11, 1905	C 71	Smith, Geo	March 29, 1905	C 84
Miller, Thos. K	Feb. 21, 1905	C 74	Somerville, Alex	March 24, 1904	C 3
McKenzie, John R	Oct. 12, 1904	C 40	Stauss, Chas. F	Feb. 9, 1905	C 69
McKinnon, Arch'd	April 3, 1905	C 102	Steele, Jas	March 29, 1905	C 92
McMillan, Peter	March 29, 1905	C 94	Steele, John	June 4, 1913	C 4
McMurtrie, John	March 29, 1905	C 96	Stewart, Duncan H	March 28, 1904	C 137
Moore, Wm. H	June 17, 1905	C 119	Stewart, John	April 3, 1904	C 104
Morris, John	Dec. 27, 1904	C 57	Stewart, Daniel W	May 16, 1904	C 23
Myles, Walter	April 3, 1905	C 100	Stoddart, Jacob	Feb. 21, 1905	C 73
Nash, Isaac	June 1, 1904	C 120	Strachan, Robt	April 27, 1904	C 15
Neave, Wm	Oct. 12, 1904	C 43	Strang, James	April 27, 1904	C 10
Nelson, James	April 27, 1904	C 16	Sullivan, John	July 4, 1916	C 139
Nimmo, Jas. P	April 3, 1905	C 103	Summers, Joseph	May 17, 1920	C 141
Nimmo, Richard E	April 18, 1911	C 133	Thomas, John	March 29, 1905	C 97
O'Brien, Geo	Feb. 6, 1905	C 66	Vass, Robt	Dec. 12, 1904	C 53
Pearse, Thomas W. H	April 14, 1916	C 138	Vater, Charles	April 6, 1904	C 66
Perrie, James	March 15, 1905	C 81	Webber, Chas	Sept. 13, 1904	C 32
Power, John	Sept. 8, 1920	C 142	Webber, Charles F	Sept. 13, 1904	C 33
Price, Jas	Nov. 8, 1904	C 50	Whiting, Geo	May 29, 1905	C 117
Rafter, Wm	March 29, 1905	C 95	Wilson, Austin	Feb. 7, 1905	C 67
Reid, James	March 23, 1904	C 1	Wilson, Thos	April 27, 1904	C 11
Richards, Thos	April 27, 1904	C 14	Woodburn, Moses	March 29, 1905	C 83
			Yarrow, Geo	Nov. 3, 1904	C 46

* Issued in lieu of No. C 132, lost.

MINE SURVEYOR CERTIFICATES ISSUED UNDER THE "COAL-MINES REGULATION ACT AMENDMENT ACT, 1919."

Name.	Date.	Certificate No.	Name.	Date.	Certificate No.
Baile, Wynne Jeffreys	Oct. 3, 1919	16	Reger, Frederick William	Oct. 3, 1919	7
Bowerman, Everard S	Dec. 14, 1920	39	Richards, Charles Clifton	Oct. 3, 1919	19
Boyce, Joseph Patrick	Oct. 3, 1919	5	Richards, James A	Oct. 3, 1919	15
Davis, Gerald D	Oct. 3, 1919	28	Ridley, James	Oct. 3, 1919	18
Daniell, George W. B	Oct. 3, 1919	29	Roaf, Joseph Richardson	Oct. 3, 1919	14
Delaney, James	Oct. 3, 1919	21	Scott, Thomas Wright	Oct. 3, 1919	4
Dickson, James	Oct. 3, 1919	3	Strachan, Robert	June 21, 1920	36
Garman, Maurice Wilbur	Oct. 3, 1919	11	Townsend, Neville F	Nov. 17, 1919	31
Gregory, P. W	Nov. 17, 1919	32	Vallance, William Dixon	Oct. 3, 1919	8
Hargreaves, James	Nov. 29, 1920	33	Waddington, George W	June 21, 1920	35
Hepburn, James T	Dec. 14, 1920	37	Wark, Samuel David	Oct. 3, 1919	20
Holdsworth, William	*Oct. 3, 1919*	9	*White, Harold*	*Oct. 3, 1919*	25
Hughes, Edward	Dec. 14, 1920	38	Wilson, R. Robinson	Oct. 3, 1919	12
Hunter, George	Oct. 3, 1919	30	Wilson, Arthur Rupert	Oct. 3, 1919	13
King, Alfred George	Oct. 3, 1919	27	Wilson, Charles James	Oct. 3, 1919	22
Lancaster, Peter	Oct. 3, 1919	23	Wilson, Hartley Paul	Oct. 3, 1919	24
Lynn, Albert Crompton	Oct. 3, 1919	17	Wilkie, Octavius B N	Oct. 3, 1919	26
Miard, Harry Ernest	Oct. 3, 1919	2	Wilkinson, George	Oct. 3, 1919	1
McCulloch, Robert	Oct. 3, 1919	6	Wright, Austin	Dec. 14, 1920	40
Owen, William Arthur	Oct. 3, 1919	10			

INSPECTION OF METALLIFEROUS MINES.

KOOTENAY AND BOUNDARY DISTRICTS.

REPORT BY ROBERT STRACHAN, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the Kootenay and Boundary Districts for the year 1920.

The following mines were in active operation at some period during the year, but owing to the drop in the prices for metals the conditions were such that at the end a great many of the mine operators curtailed their working forces, and in many cases closed down the mines for the present. In the early part of the year labour troubles caused a very considerable reduction in the production of minerals, especially in the Slocan district.

NELSON DISTRICT.

In this district the *Eureka*, *California*, and *Molly Gibson* were worked during the early part of the year, but owing to unfavourable conditions operations were discontinued.

The *Mountain Chief*, *Yankee Girl*, and the *Nugget* mines were operated until the end of the year, but only in a small way.

TRAIL DISTRICT.

The *Le Roi* and *Centre Star* mines, owned by the Consolidated Mining and Smelting Company of Canada were operated all year, as well as the *Le Roi No. 2*, but, like the others, curtailed their forces in the latter part of the year.

The *Velvet-Portland* was reopened and operated until the end of the year by a small force of men who have an option.

SLOCAN DISTRICT.

The *Sovereign*, *Wonderful*, *Slocan Star*, *Van Roi*, *Meteor*, *McAllister*, *Noble Five*, *Queen Bess*, *Rambler-Cariboo*, *Ivanhoe*, *Bosun*, *Standard*, *Hewitt*, and *Ottawa* mines were working during the year, but, as previously mentioned, labour troubles interfered with the operations during the summer, and in the latter part, with the exception of the *Noble Five* and the *Slocan Star*, conditions were very quiet.

AINSWORTH DISTRICT.

In this district at the end of the year only the *Blue Bell* at Riondel was operating, and here the working force was reduced, while the *Highland*, *Florence*, and *Beatrice* were shut down for the time. The *Silver Bell*, *Index*, and *Silver Bear* were closed down and only a few men were at work on the *Whitewater*.

BOUNDARY DISTRICT.

The *Bell*, *Sally*, *Providence*, *Emma*, and *Rock Candy* mines were working during the year, the first three in a small way, while the *Emma*, owing to the demand for the ore as a flux, operated very steadily, and the *Rock Candy*, mining fluorspar, was very active during the entire year.

EAST KOOTENAY DISTRICT.

The *Sullivan* mine, the largest producer of minerals in the district, worked steadily during the whole year, both in the upper workings and in the new tunnel, and a small force was employed on the *St. Eugene* and the *North Star* mines.

During the year 170 visits of inspections were made and forty-two mines were visited, of which twenty-five had over twelve men employed underground and seventeen had less than that number. In the case of the mines employing the larger number of workmen inspections are made almost monthly.

There were a great many small mines operating, generally by parties who had obtained leases of the same, but owing to having received no notice of opening or reopening and the scattered nature of the district we were unable to visit them.

The conditions in and around the mines inspected were found fairly good, and where any defects or omissions were pointed out these were immediately remedied.

The explosives, which include all the various percentages of the Giant powders and Canadian Explosive Company's products, have generally been found to be kept in proper magazines, at suitable temperatures, and not more than sufficient for a day's work kept out. Both the main and temporary magazines at the mines are kept in very good condition, with proper tools for opening the containers, and no candles, matches, or open lights near. At the larger mines electric lights are used for illumination, which eliminates the use of open lights near the explosives. No accidents due to either the use or handling of explosives have been reported during the year, and this is good evidence that the regulations governing explosives are well complied with.

Cook and bunk houses have been found in very good condition, and in the case of some of the larger mines the provisions made for the comfort and convenience of the workmen are exceptionally good.

At the *Sullivan* mine during the year a new change-room has been provided, with steel lockers, showers, and up-to-date sanitary arrangements. Two new bunk-houses have also been built, with the view to having the workmen on one shift occupy one and the opposite shift the other; this arrangement reduces to a minimum the disturbance created when the change of shift occurs, an arrangement which could be copied with advantage in a great many camps.

Four fatal accidents were investigated during the year, of which three occurred in this district. The fourth occurred in Yale District, and as there was no Inspector convenient it was investigated from this office on receipt of your instructions. Coroners' inquests were held on three of the accidents, but in that which occurred in the rock-house at the *Sullivan* mine the Coroner decided that no inquest was necessary.

The causes of the accidents were: Deceased caught between the belt and driving-pulley in the rock-house at the *Sullivan* mine; falling down the shaft; cave of ground at the face; and run over by skip. In the case of the first no person saw the accident, and when one of the workmen in the rock-house visited the place he found the deceased caught between the belt and the pulley. Whether he fell from the floor above, where he was engaged in attending to a feed-chute, or whether he had gone down to obtain a crowbar and reached over across the pulley, is not known. Although in doubt as to whether the rock-house comes within the "Metalliferous Mines Inspection Act," I suggested that a better system of fencing off pulleys and belts should be adopted, and I am pleased to report that this course was followed.

The second accident occurred in the shaft at the *Centre Star* mine when one of the workmen came to the station where the skip was standing. The tender warned him that the skip was signalled away, but despite this the deceased attempted to get aboard, and while doing so the skip lifted away and he fell down the shaft. I think that some improvement along the lines of having more rigid gates, either on the skip or at the entrance to the shaft, would in some degree prevent this kind of accident.

The third accident occurred in the *Whitewater* mine and was due to the ground caving at the face of the entry. This mine was leased by a few workmen who were working it themselves and the place seemed to be fairly well timbered. I would like to point out that in this class of mine we have very little opportunity of making an inspection, unless after a fatal accident, owing to there being no notice given as to either opening, closing, or reopening, and no reports as to the minerals produced.

The fourth accident, which occurred in the *Nickel Plate* mine at Hedley, in the Yale district, was due to the skip coming down and running over skip-tender who had brought the other skip down and was crossing the incline for some purpose.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my annual report as Inspector of Metalliferous Mines for the Nicola-Princeton District for the year ending 1920.

The mines operating during the year were: The *Iron Mask*, situated near the city of Kamloops, owned and operated by the Kamloops Copper Company, Limited; the *Copper Mountain* mines, situated near the town of Princeton, owned and operated by the Canada Copper Corporation; the *Nickel Plate* mine at Hedley, owned and operated by the Hedley Gold Mining Company, Limited; the *Horn Silver* mine, situated 15 miles south of Keremeos, owned and operated by Powell and Condit Bros.

Metalliferous mining in this district has not been active during the year owing to the unsettled condition of the market and the high cost of production, which has caused several of the mining companies to suspend operations. There has been a considerable amount of development during the year, and I refer more especially to the *Copper Mountain* property, and as soon as conditions warrant this district will be an important factor in the production of minerals.

There was one fatal accident reported during the year, which occurred at the *Nickel Plate* mine at Hedley in May, a report of which has been forwarded to the Department.*

Following is a brief description of the various mines in operation during the year:—

Iron Mask. A. Wallinder, superintendent. This property, consisting of the *Iron Mask*, *Erin*, and other claims, is situated about 7 miles south-east of the city of Kamloops at an elevation of 3,600 feet. Two shafts have been sunk which have been connected for ventilation purposes, the ore being hoisted through the Iron Mask shaft by means of skips by a 125-horse-power electrical hoist with a 1-inch steel cable, the lower level being reached at a depth of 750 feet. The mineral is copper in the form of sulphides and carbonates. The method of work is pillar and stope, the pillars being reduced to a minimum required to support the roof, and the ore is hauled from the ore-pockets along the levels by horse-haulage to the shaft; then hoisted to the surface and taken to the concentrator by a belt-conveyor.

The mine is well timbered, generally by square sets and stulls, and every precaution is taken to ensure the safety of the workmen. There is a good current of air circulating in this mine and it is kept in a good sanitary condition.

The power used is all electric, being transmitted to the mine over high-tension wires at a voltage of 11,000 from the city of Kamloops, and is transformed to 440 volts for use in and around the mine. Two compressors with a joint capacity of 1,100 cubic feet of free air a minute supply the power for the drills, and an electrical 3-ram force-pump is situated near the foot of the shaft on the 750-foot level for draining the mine.

Owing to the unsettled condition of the copper market this company suspended operations in April, and during the remainder of the year there has been a staff of workmen employed in renewals and improvements to the plant.

During the year a large concrete tank 50 feet in diameter was built at the mill, the mine frame was renewed and raised 9 feet, and a 2-compartment ore-bin, 12 by 20 feet, and a large storage water-tank were built.

There has been a large amount of work done to the *Iron Mask* shaft, which has been practically retimbered from the 100- to the 400-foot levels with 14-inch square sets.

Great trouble has always been experienced in having a good supply of pure water at this mine, which had to be hauled from Cherry creek by teams. During the year a 4-inch pipe-line was laid from the Thompson river and a 3-ram force-pump installed which will be used for pumping water into a storage-tank at the mine to be used for domestic and other purposes.

At the time of my inspections of this mine I have found the conditions to be good and the provisions of the "Metalliferous Mines Inspection Act" well complied with.

Horn Silver. Operated by Condit Bros. and Powell Bros., of Similkameen and Victoria. E. W. Condit, mine foreman. This mine is situated about 15 miles south of Keremeos and is reached by a fairly good wagon-road which is used for

* Described in Inspector Strachan's report.

transporting the ore from the mine to Similkameen Station. The mine is situated on the side of the mountain at an elevation of about 2,400 feet and 1,100 feet above the mine camp. The method of mining is pillar and stope. The roof being somewhat fragile necessitates a careful system of timbering, which is by posts and stulls, all the waste material being thrown into the gob and used as packing. The ore is brought out of the mine in small cars, dumped over a screen and sorted, where it is loaded into buckets attached to an aerial tramway 3,000 feet in length and transported to the foot of the tramway and dumped into a hopper, where it is loaded into wagons and teamed to Similkameen Station for shipment.

During my inspections I have generally found this mine to be well ventilated and timbered. The explosive used is 50-per-cent. Polar Forsite, which is stored in a magazine and only sufficient taken out for a day's supply. The only power used is a 50-horse-power gasolene-engine which is used for driving a compressor having a capacity of 102 cubic feet of free air a minute for running power-drills.

The cook-house, bunk-houses, office and other buildings, which are situated at the foot of the mountain, are maintained in a good and sanitary condition, water of a good quality being piped from a spring.

On account of the market conditions resulting in the reduced price of silver this company had curtailed its output, and on my last visit to this mine there were only eight men employed underground.

Copper Mountain.

J. A. McLaughen, superintendent. This mine, which is by far the largest and most important in this district, is situated on Copper mountain, in the Princeton district. It is owned and operated by the Canada Copper Corporation. During the year there has been a large staff of workmen employed in the construction of surface plant and the installation of modern and up-to-date machinery and equipment preparatory to commencement of operations for producing a large output of ore. The mine is well developed with enlarged haulage levels and the installation of dumping-stations and loading-chutes. During the year the railroad from Princeton to Copper mountain and the power-line from Greenwood have been completed, which have been large and costly undertakings.

The compressor plant has a capacity of 6,900 cubic feet of free air a minute, electrically driven. The head-frame, air-lines, hoist-room and hoist, concrete powder-magazine, large dining-hall, large rooming apartments, machine-shops, etc., comprise some of the construction during the year. At Allenby the large concentrating plant, which is capable of treating 2,000 tons of ore a day, has been completed and all machinery installed.

Owing to the unsettled condition of the copper market, resulting in the low price of copper, it has unfortunately been found necessary to suspend operations for the present.

This mine was only operated for a very short period during the year, and upon inspecting the same I found the ventilation to be good and the provisions of the "Metalliferous Mines Inspection Act" well complied with.

Nickel Plate.

G. P. Jones, general manager; Wallace Knowles, superintendent. This mine is situated at the top of Nickel Plate mountain at an altitude of 5,500 feet. It has been developed by means of tunnels driven through the country-rock until the ore-bodies have been reached. The No. 4 tunnel is the lowest of these and during the year all the ore has been handled through it. A large and well-timbered incline is driven off this level, termed the "Dixon incline," following the ore-body a distance of about 2,000 feet. Levels have been set off each 200 feet and air-shafts connecting these levels with the upper workings, thereby effecting a good current of air by natural ventilation.

The method of work is pillar and chamber, and due to the thickness of the ore, which is about 35 feet, it is necessary to commence on the foot-wall and work upwards, using the broken ore for the workmen to stand on. When the top is reached it is well barred down; the roof is extremely hard and very little timber is used.

All the ore mined during the year has been taken from the Dixon slope, which is fitted with a double track so as to deal with large quantities of ore. Two-ton skips are used, which are dumped into ore-pockets at the top of the incline, from which the cars are loaded and hauled in trips by trolly motors to the top of the gravity-tram, where the ore is again dumped into bunkers and loaded into skips on the gravity-tram and taken to the mill at Hedley. All the ore goes to the mill and no sorting is done either at the mill or the mine. The explosive used

is 60-per-cent. Polar Forsite and blasting is done by means of fuse and caps after the workmen leave the mine.

Unfortunately, owing to the high cost of production and gold having a standard value, this company decided to suspend operations in the latter part of the year until conditions become normal.

During my inspections of this mine I have always found the provisions of the "Metalliferous Mines Inspection Act" strictly adhered to and every endeavour being made to protect the workmen.

Good accommodation is provided for the employees, and the cook-house, bunk-house, and a large and commodious reading-room and wash-rooms are in a good and sanitary condition.

COAST INSPECTION DISTRICT.

REPORT BY JAMES DICKSON, INSPECTOR.

I have the honour to submit my annual report as Inspector of Mines for the above district during the year ending December 31st, 1920.

Britannia.

E. J. Donohue, general manager; G. Nettleton, secretary-treasurer; C. P. Browning, superintendent. These mines, the property of the Britannia Mining and Smelting Company, are situated on Howe sound, about 28 miles from Vancouver, and are reached by a daily steamship service. Underground shrinkage stope mining was carried on throughout the year and glory-hole mining during the open months. The operations were in the *Bluff*, *Fairview*, *Empress*, and *Victoria* sections of the mine.

Considerable development-work was completed in the *Bluff* section on the 1,400-foot and 1,600-foot levels, opening up this body of ore for actual stoping; also a working-face on the 1,800-foot level is advancing towards the *Bluff* deposit from the main No. 1 shaft. A main transfer raise was completed for the direct handling of *Bluff* glory-hole ore from the surface to the 1,600-foot level, where with one handling it is delivered to the underground crushers.

In the *Fairview* section of the mine the sixth vein has been opened to the 1,600-foot level. Prior to 1920 this was known only to the 1,200-foot level. To the east of the *Fairview* the *Empress* section has been partially developed by crosscuts on the 1,600-foot level. A raise from this level is being driven for a connection with the 1,200- and 1,000-foot levels above.

The outside blacksmith and machine shop which had been maintained on the 1,000-foot level was abandoned and a first-class shop constructed at the portal of the 2,200-foot level tunnel. This shop is commodious and first-class equipment is installed therein, which permits of the economical handling of the mine-work. During the year two 6-ton Exide Cell storage-battery locomotives have been added to the previous equipment of twelve 3½-ton motors.

Included among the minor equipment additions was the purchase of an Armstrong Shuveloader to help out the shovelling operation. This unit is easy of operation and since being placed in service has worked most satisfactorily.

Development-work consisted of 7,581 feet, made up as follows: Raises, 1,454 feet; drifts, 2,825 feet; crosscuts, 2,208 feet; chutes, 1,094 feet.

The decline in price of copper necessitated the discontinuing of operations in the latter part of November, since when 250 men have been employed on a development programme. The railroad and tramway lines are being utilized for the transportation of a small tonnage daily to the stock-piles at the beach in order to maintain haulage facilities for the transportation of foodstuffs, etc., to employees residing at the Tunnel camp.

There is also maintained a force of twelve men on the work of driving a raise connection between the 4,100- and 2,700-foot level tunnels. This raise, when completed, will supplant the incline railway as an ore-carrier, and at December 31st it had attained a distance of 600 feet.

These mines are well ventilated; the 4,100-foot level and raise by means of two small exhaust-fans, in tandem, while the larger operation has natural ventilation, which in this case is very efficient. The mines are well timbered where required and strict attention is paid to bar down all loose rock after blasting. The powder used is low freezing and is handled with systematic care.

There were no fatal accidents during the year and very few serious ones, which says much for the supervision exercised by those in charge.

Clayburn.—During the year the mines at Clayburn, the property of the Clayburn Company, were inspected. The ventilation, which is natural, was good and the roadways and working-faces were well timbered and in safe condition. There were no accidents during the year.

NORTHERN INSPECTION DISTRICT.

REPORT BY T. J. SHENTON, INSPECTOR.

I have the honour to submit my annual report for the Northern Inspection District, consisting of the Portland Canal, Nass River, Skeena, Queen Charlotte, and Atlin Mining Divisions.

ATLIN MINING DIVISION.

This section was visited by me during the month of July, and I found the following conditions to obtain:—

At the Ruby Creek underground and open placer mines, under the management of T. Daulton, the work was accomplished by a system of hydraulicking in the surface operation, and in the underground the material mined was taken out in small cars to the sluice-boxes. In both operations there were employed thirteen men, this number being less than the previous year, the reason for which, I was advised, was inability to get men. I found the prevailing conditions, both in operations and general arrangements of plant, to be quite in keeping with the requirements of safety and sanitation.

Boulder Creek Placers.—There are five small mines in operation on this creek—three open placers and two underground placers. At the head of the creek is situated the property of J. Black and J. Fraser, on which two large monitors were in operation washing down the gravel-bed, which is 30 feet thick. During the early part of the year five men had been employed, but at the time of my visit only two were employed.

Bumper Group.—This group of claims was next inspected, this being an open placer owned and operated by Gus Anderson. Five men were employed and the mining was accomplished by hydraulicking, one 7-inch monitor being in operation.

Immediately next in order down-stream I found F. Rich and his partner, A. Beatty, washing tailings in the old river-bed, and in the operation a 6-inch monitor was employed.

The next property inspected was that of Hill, Sanstrom & Co. It is an underground placer and is entered by a shaft 65 feet deep. Drifting along the river-bed had been done, amounting in all to 90 feet, and the hoisting of material was accomplished by a water-wheel geared to a small drum. Three men were employed and the timbering and ventilation were fair.

At the foot of Boulder creek is situated the underground placer owned by C. Miller & Co., which is entered by a slope to the old river-bed of 150 feet. Hoisting is done by a 12-horse-power oil-engine. The timbering of the slope was in fair condition, but the ventilation was inadequate. Three men are usually employed, but at the time I visited the mine it was idle.

Otter Creek Open Placer.—There is one mine only on this creek, which is owned by the Mines d'Otter Company. Three large monitors were in use in the operation at the time of my inspection. The placer is in charge of H. Maluin, general manager, and ten men were employed in the operation. I found the accommodation for living purposes to be sanitary and all other conditions to be satisfactory.

Pine Creek Open Placer.—This property is owned and operated by the Discovery Mining and Power Company. The operations are carried on under "lays" by three different groups of men employed, numbering at the time fourteen men. At the time of my visit two of the groups were engaged in mining virgin ground and the third was employed in washing tailings in the old river-bed. Eight large monitors were employed in the undertaking. Conditions relative to sanitation and matters of safety were reasonably satisfactory.

Spruce Creek.—The mines on this creek are chiefly underground placers, entered either by slope or shaft. At the time I visited these underground placers six different companies were in operation. These companies are as follows, beginning at the head of the creek:—

The property of J. Brown and J. McPherson, called the *Discovery* claim; it is entered by a shaft 60 feet deep and the workings possess about 200 feet of drifting. Timbering in shaft and roadways are very fair; ventilation is aided by a small fan. Three men were employed.

The next property was that of Isaac Matthews, called the *Lovel* group of leases. It is operated on "lay" by Beaton Bros. The mine is entered by a shaft 64 feet deep; the main drift from foot of shaft is 340 feet, and drifting parallel to the river-bed of 285 feet has been done. Six men were employed and I found the condition of timbering to be satisfactory, but the ventilation was sluggish and foul.

The next inspection was that of the *Croker* lease. Three men were employed; the mine is entered by a slope 80 feet long; drifting parallel to the old river-bed for 50 feet had been done. Timbering here was satisfactory and the ventilation, being natural, was fair.

The *Poker* claim was next inspected; it is entered by a shaft of 35 feet depth. The face of the pay-streak was in a distance of 600 feet from the foot of the shaft, where a drift at right angles had been driven 220 feet. Two men were employed; while the timbering was found to be fair, the ventilation was sadly foul and sluggish.

The *Peterboro* lease, owned by H. O. Morse and L. Shulz, was next visited; the slope is 300 feet in, and drifting at right angles along the river-bed both up and down the creek, a distance of 150 feet and 125 feet respectively, had been done. Two men were employed. In my examination I discovered a dangerous condition with respect to a portion of the main drift, where marked signs of extraordinary movement of the gravel-bed was seen in the breaking and shifting of the timbers. I immediately called the attention of Mr. Morse and his partner to it and gave orders that until this dangerous place had been made safe by taking out the broken timbers and reinforcing the others at this point, making it reasonably safe, no work at the face should be done.

The next and last underground placer was that of the *Chicago Bill* group. It is entered by a slope 85 feet in length and two men were employed. The ventilation, which is natural, I found to be fair and the timbering and other conditions fairly satisfactory.

Engineer.—I inspected this property on July 27th. Four men were employed at the time in keeping the property in repair and doing development-work. The work is in charge of Reggie Brooks, foreman, and I was advised by him that the property was under bond to the Ecla Copper Company, a corporation from the State of Nevada, U.S.A. I found all conditions having reference to the mine-workings, sanitation, ventilation, timbering, etc., also conditions of bunk-houses, cook-houses, etc., to be in strict keeping with the "Metalliferous Mines Inspection Act."

PORTLAND CANAL MINING DIVISION.

Salmon River Section.

About 16 miles in a northerly direction from tide-water of Portland canal is located the *Premier* mine, owned by the Premier Gold Mining Company, Limited. The company continued the work of development of the mine all through the year, and in addition employed a large number of men in work of construction. The mine is in charge of D. McDonald, foreman, and the whole operation is under the managership of L. Pitt, the general manager. A hydro-electric plant has been installed and is now in operation, and a mill, compressor-house, and other additional works of construction are nearing completion. Relative to the conditions in the mine and upon the surface, I may say that the company is rapidly moving in the direction of complying with all matters reasonably called for by the law, and I was advised that, as requested by me, provision with respect to medical aid and first-aid work would be properly provided for by the company.

Big Missouri and Joker.—At the time of my visit these properties had temporarily ceased operation, awaiting the putting-in of the new road now being built by the Government.

Bear River Section.

At the time of my visit in the fall of the year, through excessive fall of rain and melting snow from the hills, the river had swollen to the extent of overflowing its banks, and the torrent of water had carried away both the foot-bridge and the railroad-bridges across the Bear river, so that, except a visit to the *Bay View* group, I was unable to reach farther up the river. This property is situated in the range of hills immediately to the rear of the town of Stewart, a distance of about 2 miles. It is managed by F. Stanford and four men were employed doing development-work. All conditions of the operation from a standpoint of the law were satisfactory.

Swamp Point.—This mine is owned and operated by the Granby Consolidated Mining, Smelting, and Power Company and is situated about 30 miles south from Stewart, on the Portland canal. Operations of this mine from the beginning of the year continued until the month of August, when the mine ceased work because of an oversupply of lime that would be sufficient to meet all demands until the spring of the incoming year of 1921, when it is expected that operations will again commence. During the last three months of the year the operations were under the supervision of Bert Wing, and all conditions were carried on in strict recognition of the "Metalliferous Mines Inspection Act."

NASS RIVER MINING DIVISION.

OBSERVATORY INLET.

At the head of the Observatory inlet and in the locality of Anyox are situated the following mines of the Granby Consolidated Mining, Smelting, and Power Company: *Hidden Creek*, *Rambler*, and *Granby Point*. The *Hidden creek* mine was operated continuously during the present year. J. Tuttle, Jr., is superintendent and J. Swanson is foreman of the mine.

This is the largest operation of the Northern Inspectorate, and with reference to the work of safety first in the prevention of accident it may be said that owing chiefly to the unwavering attention of the management no serious accident or fatality has occurred during the current year in connection with the mine's operation. During the year a large electric hoist has been installed in the mine at the head of the new shaft on the 385-foot level; the skips, of 6 tons capacity, are already put in and the shaft is now ready for hoisting.

Rambler.—This is a quartz mine and the product is used for fluxing at Anyox. The mine is managed by T. Oxley and employs on an average twenty men a day. All conditions with reference to safety, sanitation, etc., have been carefully observed by the management.

Granby Point.—This mine ceased operations temporarily at the end of January of the present year, as the company did not need the product at the time, which is used for fluxing purposes. The mine up to the time of the cessation was under the management of J. Lee. The prevailing conditions of operation were in recognition of the law.

Sylvester Bay.—Within this harbour and upon its shore, a distance of 3 miles in a southerly direction, is situated the property of the Golskeish Mines, Limited. Work on this property was commenced in May, 1920, and was in charge of W. H. Heidman. The product is quartz carrying some gold and silver and is shipped by the company to the smelter at Anyox, where it is used for fluxing. Thirteen men were employed and I found the conditions of the operation to be in accord with the "Metalliferous Mines Inspection Act."

ALICE ARM SECTION.

From the head of this arm up the Kitsault river a distance of 18 miles are the mines operated by the Taylor Mining Company, Limited, consisting of the *Dolly Varden* and the *Wolf*. The mines began operation, including shipment of ore, about the month of May, and for the previous winter months the operation was simply that of development of the mines and making ready for operation when the heavy snows were cleared from the railway, hindering operation during these months.

The *Dolly Varden* mine is in charge of C. B. North as general manager for the company, with D. Tatrie as foreman. The number of men employed during the period of operation was as follows: Underground, 50; at mine surface, 25; on railway, 80; on construction-work, 20; hydro-electric contract, 50; making a total of 225. In the early part of December the railroad closed down owing to heavy falls of snow and a large number of the men were paid off. The first decision of the company with respect to continued operation of the mine after the stoppage of the railway was to proceed as they did the previous year to develop the mine; however, subsequently the property was closed down entirely. Great improvements have taken place with respect to the plant during the year and the output has been greatly increased. Large ore-bins have been erected near the wharves, at delivery terminal of railway, and two new bunk-houses have been constructed at the *Dolly Varden* mine.

Wolf.—A new hydro-electric plant was installed during the fall of the year near the *Wolf* mine, 3 miles from the *Dolly Varden* property in a northerly direction along the Kitsault river. The installation was completed in the month of December, when operation ceased. The plant

is capable of 500-horse-power development. Development of the *Wolf* mine proceeded until the end of November, when this was stopped. During this period twelve men were employed at the mine. In my inspections of both mines I found the conditions to be in accord with the "Metalliferous Mines Inspection Act."

North Star.—This mine joins the *Dolly Varden* mine along its north-eastern boundary and is owned by D. Zarelli and J. McAleenan. During the year a 3-drill compressor was installed, and at the time of my inspection six men were employed in developing the property. Conditions having reference to mine buildings, sanitation, and safety I found to be in accord with the "Metalliferous Mines Inspection Act."

OMINECA MINING DIVISION.

The *Blue Grouse* mine, owned by the Cassiar Crown Copper Company, was operated on a small scale during the present year for a period of eight months and closed down temporarily early in the month of November. The work consisted chiefly in drifting. No shipment of ore was made during the year and the average number of men employed a day was three. For present purposes the ventilation, timbering, etc., of the mine, and other conditions of plant, etc., are in accord with the requirements of the law.

HUDSON BAY MOUNTAIN.

During the year I visited the different properties situated on this hill, including the *Victory* group of claims owned by Donald Simpson. Since the cessation of work on these claims in the fall of the year of 1919 nothing has been done.

Empire Group.—This group of claims, owned by Donald Simpson, is situated on the eastern slope of the hill. The owner has been engaged during the greater portion of the year in development-work, and a good trail is being built to the property by the Government.

HAZELTON DISTRICT.

Silver Standard.—Excepting for a period of about three weeks in the month of January, this mine operated continuously until November 20th, when it closed down. During the period of operation thirty-five men were employed. W. G. Norrie-Lowenthal is superintendent and R. J. Wall is foreman of the mine. In all my visits of inspection I found the prevailing conditions to be in full accord with the "Metalliferous Mines Inspection Act."

SKEENA MINING DIVISION.

COAST SECTION.

Drum Lummon.—I visited this mine during the early part of the present year, and at that time the operations were under the charge of J. Thom, acting-foreman. The mine is situated within Miskatlah harbour and is owned by the Drum Lummon Copper Mines, Limited. The locality is reached from Hartley Bay by launch, a distance of 25 miles, running east towards the head of Douglas channel. In all, nine men were employed, four in the mine and five on the surface.

A small amount of stoping had been done; a raise from the face of one of the old stopes was being driven to connect with the surface to aid the ventilation; it was up a distance of 60 feet at the time of my visit and was expected to reach the surface in a further distance of 20 feet. The plant consists of a Gibson mill of 40-ton capacity, one compressor driven by a 25-horse-power gasolene-engine, and a second gasolene-engine of 10 horse-power that operates the mill. In addition, fairly comfortable quarters were provided for the employees, a cook-house, and eating accommodation. All other conditions were in fair keeping with the law.

Surf Inlet.—This mine is situated on Princess Royal island and is owned and operated by the Belmont-Surf Inlet Mines, Limited. It was operated continuously throughout the year, but in the early months the fullest progress of the mine was interfered with by the scarcity of practical miners. A large number of houses and a new large modern building for bunk-house, together with a large hall for entertainment purposes, have been erected by the company during the year, and the camp now in every way is up to date in its accommodation.

The population of the camp is now about 300 and the average number of men employed by the company during the year was about 200. W. H. Holler is superintendent and the underground operations are in charge of C. P. Seale. The mine in its operation throughout is in accord with the "Metalliferous Mines Inspection Act."

QUEEN CHARLOTTE MINING DIVISION.

I made an inspection of the different operations on the Queen Charlotte islands early in the present year. On Moresby island and on the coast of Ikeda bay is situated the *Lily* mine of the Ikeda Mines, Limited. At the time of my visit only three men were employed and the mine was closed down. Operations, although only upon a very small scale, were very unsystematic. Of this I had on both occasions of my inspection advised the man in charge of the operations, J. Togunaga, the tendency being to increased hazard to life. A promise to remedy matters was offered as soon as Mr. Ikeda, the owner, came in, whom I had never been able to see.

Producer.—This mine is situated upon Jedway harbour and is owned by Ike Thompson. Five men had been employed in the mine until the end of March, when operations ceased, and at the time of my visit the property was still idle.

COAL-MINING IN BRITISH COLUMBIA.

By Wm. Fleet Robertson, Provincial Mineralogist.

During the year 1920 there was mined in the various collieries of the Province 2,696,774 tons (2,240 lb.) of coal, an increase from the preceding year of 287,826 tons, equivalent to about 11.9 per cent.

The output of coke was 67,792 tons as compared with 91,138 tons in 1919, a decrease of 23,346 tons or 26 per cent.

The following table shows, for the past ten years, the output and the *per capita* production of the various districts:—

Output and Per Capita Production of Various Districts.

Year.	District.	Gross Tons of Coal mined during Year.	Total No. of Employees at Producing Collieries.	Tons of Coal mined per Employee for Year.	Number of Men employed Underground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
1911	East Kootenay District	442,057	2,197	201	1,585	272
	Coast District	1,855,661	4,676	397	3,627	511
	Whole Province	2,297,718	6,873	334	5,212	440
1912	East Kootenay District	1,261,212	2,410	523	1,780	708
	Coast District	1,764,497	4,720	374	3,495	504
	Whole Province	3,025,709	7,130	424	5,275	574
1913	East Kootenay District	1,331,725	2,666	500	1,965	678
	Coast District	1,239,035	3,777	328	2,865	433
	Whole Province	2,570,760	6,443	399	4,830	532
1914	East Kootenay District	955,183	2,397	399	1,749	547
	Coast District	1,211,245	3,335	363	2,518	481
	Whole Province	2,166,428	5,732	379	4,267	508
1915	East Kootenay District	852,572	1,748	488	1,183	721
	Coast District	1,120,008	3,230	347	2,512	446
	Whole Province	1,972,580	4,978	396	3,695	534
1916	East Kootenay District	882,270	1,674	527	1,125	784
	Coast District	1,603,310	3,386	474	2,569	624
	Whole Province	2,485,580	5,060	491	3,694	673
1917	East Kootenay District	551,751	1,481	372	944	584
	Coast District	1,846,964	3,689	501	2,816	656
	Whole Province	2,398,715	5,170	463	3,760	638
1918	East Kootenay District	732,864	1,327	552	814	900
	Coast District	1,845,860	4,100	450	2,844	645
	Whole Province	2,578,724	5,427	475	3,658	705
1919	East Kootenay District	558,806	1,369	409	1,000	559
	Coast District	1,850,142	4,597	402	3,145	588
	Whole Province	2,408,948	5,966	404	4,145	581
1920	East Kootenay District	847,389	1,582	536	1,062	798
	Coast District	1,849,385	4,767	388	3,129	591
	Whole Province	2,696,774	6,349	425	4,191	643

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.

The *per capita* production varies from year to year and this variation is very often caused by different conditions which last for a longer or shorter time. For example, explosions, new developments, and the opening-up of new mines or closing of old ones are variable factors which affect the *per capita* production from year to year.

It will be seen from the foregoing table that the production *per capita* was high in 1912, but that the years 1913, 1914, 1915, and 1919 show a decrease, especially in the Coast District. This decreased effectiveness, during the last few years, of the labour employed is largely due to the extension of the workings of the mines, causing a greater length of haulage and greater extent of old workings to be taken care of, but some of the increased labour is undoubtedly on account of the greater number of men employed in safeguarding the mine and workmen. In the year 1917 it will be observed that while the *per capita* output of the Coast collieries also shows an increase, the 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.

It is gratifying to note the increased *per capita* production for 1920 shows a substantial increase over that of 1919, particularly in the East Kootenay District.

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 to some extent owing to increased prices of fuel-oil.

Coke, a product of the coal-mines, is sold in the same markets, with the difference that the local consumption—chiefly by the smelter at Trail—took about 53 per cent. of the product, while 47 per cent. was exported to the States mentioned.

As regards the marketing conditions in this field, the East Kootenay collieries are, however, brought into direct competition with the collieries of Alberta, just over the Provincial boundary-line, all these collieries being in the same coalfield, with practically the same grade of coal and working under similar conditions.

The Coast District may be subdivided into two fields—the Nicola-Princeton field and the Vancouver Island field—in which the markets differ considerably.

The new coalfield on the Telkwa river, in Omineca Division, produced 1,400 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, are to some extent reverting to the use of coal, which will mean an 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, these last two operating on Vancouver island.

In addition to these large collieries, shipments have been made by the Corbin Coal and Coke Company, in East Kootenay; by the Middlesboro Collieries, Fleming Coal Company (operating Coal Hill Colliery), Coalmont Collieries, Limited, in the Nicola Valley, and the Chu Chua Colliery, on the North Thompson river; by the Princeton Coal and Land Company, of Princeton, on Vancouver island; by the Pacific Coast Coal Mines, Limited, East Wellington Coal Company (formerly British Columbia Coal Mining Company, which was the Vancouver Nanaimo Coal Company), and Nanoose Collieries, Limited, 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 1920 about 63 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 60 per cent. was consumed in British Columbia, and the remaining 40 per cent. was exported to the United States.

COLLIERIES OF THE COAST DISTRICT.

The gross output of the Coast District collieries, including the Nicola valley and Telkwa, for the year 1920 was 1,849,385 tons (2,240 lb.) of coal actually mined, while some 58,769 tons was taken from "stock," making the actual consumption of coal 1,908,154 tons.

Of this gross consumption, 1,499,527 tons was sold as coal, 202,515 tons was consumed by the producing companies as fuel, and 206,112 tons was lost in washing. No coke was made this year by the Coast collieries but coal mined at some of the Vancouver Island collieries was sold to the Granby Company's Anyox smelter, where it was subsequently made into coke in by-product ovens by the Smelting Company for its own use.

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 was sold 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.

In 1918, 66 per cent. was sold for consumption in Canada, 30 per cent. exported to the United States, and 4 per cent. to other countries.

In 1919, 72 per cent. was sold for consumption in Canada, and the balance, 28 per cent., was exported to the United States.

In 1920, 79 per cent. was sold for consumption in Canada, 20 per cent. exported to the United States, and 1 per cent. to other countries.

COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1920 was 847,389 tons (2,240 lb.) of coal actually mined, while 2,525 tons was added to stock, making the actual consumption of coal 844,864 tons. Of this gross consumption of coal, 684,418 tons was sold as coal, 58,797 tons was consumed as fuel by the producing companies, while 101,649 tons was converted into coke, producing 67,792 tons of coke; 269 tons of coke was added to stock, making the coke sales for the year 67,523 tons.

The East Kootenay collieries exported to the United States about 70 per cent. of the coal sold and about 47 per cent. of the coke.

The following table gives complete details of the coal and coke production of the Province for 1920, with the output figures for each colliery and district totals:—

COLLIERIES OF BRITISH COLUMBIA—PRODUCTION, 1920.

Mine.	Sold.			Total Sales.	Lost in Washing.	Used in making Coke.	Used under Co.'s Boilers, etc.	Total for Colliery Use.	Stocks.		Difference.		Output for Year 1920.
	In Canada.	In U.S.	Other Countries.						First of Year.	Last of Year.	Added to.	Taken from.	
Vancouver Island.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Canadian Collieries (D), Ltd—													
South Wellington	60,488	.....	.....	60,488	25,970	.....	3,851	29,821	.....	.....	.....	.....	90,309
Extension	92,611	46,717	.....	139,328	42,488	.....	15,557	58,045	2,426	1,458	.....	968	196,405
Cumberland	278,489	93,277	.....	371,766	79,186	.....	11,347	90,533	11,357	4,972	.....	6,385	455,914
Canadian Western Fuel Co.—													
No. 1, Nanaimo	176,577	62,447	3,488	242,512	.....	.....	48,078	48,078	24,096	3,946	.....	20,150	270,440
Harewood	93,708	33,140	1,851	128,699	.....	.....	42,492	42,492	21,080	7,170	.....	13,910	157,281
Reserve	80,483	28,463	1,590	110,536	.....	.....	25,468	25,468	435	.....	.....	435	135,569
Wakesiah	36,368	12,862	718	49,948	.....	.....	13,395	13,395	.....	.....	.....	.....	63,343
Nanoose-Wellington Collieries, Ltd.—													
Wellington	17,923	9,480	.....	27,403	.....	.....	4,200	4,200	113	1,010	897	.....	32,500
Pacific Coast Coal Mines, Ltd.—													
Morden	61,031	14,278	.....	75,309	13,479	.....	16,020	29,499	11,228	1,199	.....	10,029	94,779
Suquash	.....	.....	.....	.....	.....	.....	125	125	.....	.....	.....	.....	125
Granby Cons. M. S. & P. Co.—													
Cassidy	144,656	8,121	.....	152,777	44,989	.....	11,511	56,500	12,966	5,278	.....	7,688	201,589
East Wellington Coal Co	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals, Vancouver Island	1,042,334	308,785	7,647	1,358,766	206,112	.....	192,044	398,156	83,701	25,033	.....	58,668	1,698,254
Nicola-Princeton District.													
Middlesboro Collieries, Ltd	83,059	.....	.....	83,059	.....	.....	4,445	4,445	36	134	98	.....	87,602
Fleming Coal Co., Ltd	30,487	.....	.....	30,487	.....	.....	1,635	1,635	100	100	.....	.....	32,122
Princeton Coal & Land Co.	15,616	1,464	.....	17,080	.....	.....	3,836	3,836	232	33	.....	199	20,717
Coalmont Collieries, Ltd	5,801	2,702	.....	8,503	.....	.....	480	480	1,000	1,000	.....	.....	8,983
Chu Chua Mine Syndicate	232	.....	.....	232	.....	.....	75	75	.....	.....	.....	.....	307
Totals, Nicola-Princeton District	135,195	4,166	.....	139,361	.....	.....	10,471	10,471	1,368	1,267	.....	101	149,731
Telkwa	1,400	.....	.....	1,400	.....	.....	.....	.....	.....	.....	.....	.....	1,400
Totals, Coast District	1,178,929	312,951	7,647	1,499,527	206,112	.....	202,515	408,627	85,069	26,300	.....	58,769	1,849,385
Crowsnest Pass District.													
Crow's Nest Pass Coal Co., Ltd—													
Coal Creek	58,546	338,466	.....	397,012	.....	.....	34,749	34,749	98	120	22	.....	431,783
Michel	74,354	70,130	.....	144,484	.....	101,649	18,459	120,108	.....	.....	.....	.....	264,592
Corbin Coal & Coke Co., Ltd	72,176	70,746	.....	142,922	.....	.....	5,589	5,589	4,019	6,522	2,503	.....	151,014
Totals, Crowsnest Pass District	205,076	479,342	.....	684,418	.....	101,649	58,797	160,446	4,117	6,642	2,525	.....	847,389
Coal.													
Total for Province	1,384,005	792,293	7,647	2,183,945	206,112	101,649	261,312	569,073	89,186	32,942	.....	56,244	2,696,774
Coke.													
Total for Province (from Crowsnest Pass)	35,805	31,718	.....	67,523	.....	.....	.....	.....	312	581	269	.....	67,792

The following table shows the men employed at each colliery in the Province during 1920 and district totals:—

COLLIERIES OF BRITISH COLUMBIA—MEN EMPLOYED, 1920.

Mine.	White Men.																		Indians.			Japanese and Chinese.									Total Men employed.		
	Supervision and Clerical.			Miners.			Helpers.			Labourers.			Mechanics and Skilled.			Boys.			Labourers.			Miners.			Helpers.			Labourers.					
	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.	U.	A.	T.			
Vancouver Island.																																	
Canadian Collieries (D), Ltd.—																																	
South Wellington	8	2	10	149	..	149	..	..	..	38	15	53	3	10	13	..	8	8	..	..	..	..	..	..	..	..	..	1	21	22	199	56	255
Extension	24	14	38	237	..	237	9	..	9	90	57	147	14	32	46	..	19	19	..	..	..	..	..	..	..	..	..	6	49	55	380	171	551
Cumberland	57	34	91	186	..	186	..	..	..	98	100	198	46	145	191	13	14	27	..	..	..	165	..	165	162	.	162	101	191	292	828	484	1,312
Canadian Western Fuel Co.—																																	
No. 1 Nanaimo	22	19	41	159	..	159	..	..	..	160	72	232	74	61	135	20	11	31	..	..	..	..	..	..	.	..	..	..	54	54	436	217	652
Harewood	8	14	22	91	..	91	..	..	..	38	55	93	17	42	59	6	11	17	..	..	..	..	..	..	..	..	..	..	21	21	160	143	303
Reserve	12	10	22	107	..	107	..	..	..	54	49	103	14	27	41	18	7	25	3	..	3	..	..	..	..	..	..	..	21	21	208	114	322
Wakesiah	6	5	11	53	..	53	..	..	..	24	28	52	14	10	24	8	4	12	..	..	..	..	..	..	..	..	..	..	11	11	105	58	163
Nanoose-Wellington Collieries, Ltd.—																																	
Wellington	1	5	6	102	..	102	40	..	40	18	28	46	2	29	31	..	.	..	..	..	..	..	..	..	..	..	..	..	15	15	163	77	240
Pacific Coast Coal Mines—																																	
Morden	10	5	15	86	..	86	18	..	18	70	9	79	..	31	31	12	4	16	..	..	..	..	..	..	..	..	..	..	35	35	196	84	280
Suquash	..	1	1	2	..	2	1	..	1	..	1	1	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	3	6
Granby Cons. M. S. & P. Co.—																																	
Cassidy	4	10	14	125	..	125	..	..	..	68	51	119	7	25	32	.	10	10	..	..	..	..	..	..	..	..	..	..	..	..	204	96	300
East Wellington Coal Co	..	1	1	....	..	....	..	..	..	..	..	....	..	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	7
Totals, Vancouver Island	152	120	272	1297	..	1297	68	..	68	658	465	1123	191	419	610	77	88	165	3	..	3	165	..	165	162	..	162	108	418	526	2881	1510	4,391
Nicola-Princeton District.																																	
Middlesboro Collieries, Ltd.	12	5	17	48	..	48	20	..	20	42	22	64	..	16	16	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..	122	51	173
Fleming Coal Co., Ltd.	4	2	6	24	..	24	..	..	..	6	20	26	4	5	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	38	27	65
Princeton Coal & Land Co	4	5	9	14	..	14	5	..	5	15	7	22	..	7	7	.	2	2	..	..	..	..	..	..	..	..	..	..	..	..	38	21	59
Coalmont Collieries, Ltd.	4	4	8	22	..	22	2	..	2	6	14	20	..	6	6	2	..	2	..	..	..	..	..	..	..	..	..	..	..	..	36	24	60
Chu Chua Mine Syndicate	2	..	2	7	..	7	2	..	2	..	2	2	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	11	5	16
Totals, Nicola-Princeton District	26	16	42	115	..	115	29	..	29	69	65	134	4	36	40	2	10	12	..	..	..	..	..	..	..	..	..	..	1	1	245	128	373
Telkwa	..	..	..	3	..	3	..	..	..	..	..	....	..	..	....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	3
Totals, Coast District	178	136	314	1415	..	1415	97	..	97	727	530	1257	195	455	650	79	98	177	3	..	3	165	..	165	162	..	162	108	419	527	3129	1638	4,767
Crowsnest Pass District.																																	
Crow's Nest Pass Coal Co—																																	
Coal Creek	32	10	42	338	..	338	..	..	..	90	79	169	180	101	281	8	11	19	..	..	..	..	..	..	..	..	..	..	..	..	648	201	849
Michel	16	11	27	202	..	202	..	..	..	26	139	165	91	84	175	3	9	12	..	..	..	..	..	..	..	..	..	..	..	..	338	243	581
Corbin Coal & Coke Co	6	5	11	56	..	56	14	..	14	..	41	41	..	29	29	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	76	76	152
Totals, Crowsnest Pass District	54	26	80	596	..	596	14	..	14	116	259	375	271	214	485	11	21	32	..	..	..	..	..	..	..	..	..	..	..	..	1062	520	1,582
Total for Province	232	162	394	2011	..	2011	111	..	111	843	789	1632	466	669	1135	90	119	209	3	..	3	165	..	165	162	..	162	108	419	527	4191	2158	6,349

NOTE.—U=underground; A=above ground; T=total.

CLASSIFICATION OF COAL.*

In Western Canada there is a great variety in the quality of the coals found, varying from a poor lignite, that goes to powder on exposure to the air, to a coal that approaches the Eastern anthracite, and great difficulty has been found in arriving at a classification which would properly cover such a wide range of fuels.

The United States Geological Survey some years ago made most extensive experimental investigations as to fuels, and has adopted a scale of classification, probably the most perfect known, based upon the relation between the total carbon and the total hydrogen in a coal; but this classification necessitates an ultimate analysis of each sample, a matter that can only be attempted in a very well-equipped laboratory, and but few records are available upon which to base a classification.

In a paper read before the Canadian Mining Institute, in March, 1908, D. B. Dowling, of the Geological Survey of Canada, suggested a scale of classification, which approximates the same relative scale, and is based upon the proximate analysis of a coal, by fast coking, on an air-dried sample, and combining both the fuel ratio and the moisture contents, and which he called the "Split Volatile Ratio."

$$\text{Split Volatile Ratio} = \frac{\text{Fixed Carbon} + \frac{1}{2}\text{ Vol. Combustible.}}{\text{Moisture} + \frac{1}{2}\text{ Vol. Combustible.}}$$

The resultant numerical value for the ratio as above indicated, if applied to the following scale, gives the class to which the coal belongs:—

Dowling's Scale of Split Volatile Ratio.

Anthracite	15 up.	Bituminous	3.5 to 6
Semi-anthracite	13 to 15	Low-carbon bituminous	3 to 3.5
Anthracite coal	10 to 13	Lignitic coal	2.5 to 3
High-carbon bituminous	6 to 10	Lignite	1 to 2.5

This ratio has been adopted in the Canadian Geological Survey Bulletin, "The Coalfields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia," and, as it appears to be the classification best suited to our present requirements, it has been adopted in this Report, and serves to give a standard definition to the many terms in use in describing coals.

In the accompanying Table of Analyses the source of the analysis is designated by a reference letter, and these references are given in the following table:—

Reference Letter.	Authority for Analysis.
A	Minister of Mines' Report, 1902, p. 262; sampled by Inspector.
B	Geol. Survey Report, Vol. XVI.
C	Chief Engineer, Crow's Nest Pass Coal Co.
D	E. J. Roberts, Gen. Manager, Corbin Coal and Coke Co.
E	B.C. Bureau of Mines.
F	Report by Dr. A. W. G. Wilson, McGill University, to C.P. Ry. Syndicate in 1905.
G	Can. Geol. Survey: Dowling's "Coalfields of Manitoba, Saskatchewan, Alberta, and Eastern British Columbia"
H	Prof. Milner Roberts, Washington Univ.; private letter.
I	Paper by Castleman, Can. Mining Inst.; analysis by Hersey, of Montreal.
J	Analysis by Bryant & Co., Vancouver.
K	B.C. Minister of Mines' Report, 1901, p. 1176.
L	Geological Survey Summary, 1907, W. W. Leach.
M	B.C. Minister of Mines' Report, 1905, p.p. 119 and 121.
N	Unpublished Analyses, B.C. Bureau of Mines.
O	B.C. Minister of Mines' Report, 1904.
P	Analysis by J. O'Sullivan, Vancouver.
Q	Memoir No. 26, G.S.C., Tulameen District.
R	Minister of Mines' Report, 1918, p. 125.
S	" " 1917, p. 124.
T	" " 1914, pp. 208 and 209.
U	" " 1912, p. 136.
V	" " 1912, pp. 90, 97, and 98.
W	G.S.C., Summary Report, 1912, p 98.

* This chapter was originally published in the Minister of Mines' Annual Report for 1909. As the 1909 Report is now out of print and as, since then, some new coalfields have been more or less developed, it seems advisable to reprint the chapter with the Table of Analyses revised and brought up to date.

TABLE OF ANALYSES OF BRITISH COLUMBIA COALS WITH CLASSIFICATION ACCORDING TO DOWLING'S "SPLIT VOLATILE RATIO."

Designation No.	Locality.	Seam.	Authority or Reference.	Prox. Analy. by Fast Coking.				Sulphur.	Coking Quality.	British Thermal Units.	Expanded Analysis Calc. on Clear Coal.			Split Vol. Ratio.	Classification by Split Vol. Ratio.	Remarks.
				Moist.	V.C.M.	F.C.	Ash.				Moist.	V.C.M.	F.C.			
	Crow's Nest Pass Coalfield.															
1	No. 1 mine, Morrissey (Carbonado)	18 ft. thick	A	0.90	22.19	70.99	5.6	0.32	.....	14,346	0.97	23.60	75.43	6.8	High-carbon bit...	Highest seam worked, dip, 21° N.
2	No. 4 mine, Morrissey (Carbonado)	18 ft.	"	0.82	11.73	71.50	15.75	0.20	.....	12,858	0.98	13.96	85.06	11.5	Anthracitic coal..	
3	No. 1 mine, Coal Creek	8 "	"	0.84	23.59	67.40	7.85	0.32	....	14,036	0.91	25.69	73.40	6.8	High-carbon bit...	
4	" 1 " " "	9 "	"	0.92	18.85	64.42	15.65	0.16	.....	13,757	1.10	22.40	76.50	7.1	" " "	
5	" 2 " " "	6 "	"	0.84	22.38	73.17	3.15	0.46	.....	14,935	0.88	23.21	75.91	7.0	.....	Dip 15° to E.
6	" 3 " " "	.....	"	0.92	20.63	72.05	6.00	0.40	.....	14,284	0.98	22.04	76.98	7.3	High-carbon bit...	
7	" 4 " " "	22 ft.	"	0.96	13.46	61.92	23.50	0.16	.....	12,114	1.25	17.63	81.11	8.9	" " "	
8	" 3 Michel	15 to 30 ft. thick	"	1.00	20.57	72.00	6.15	0.28	.....	14,656	1.07	21.99	76.94	7.3	" " "	Highest seam worked.
9	" 4 " 80 feet below 3	10 to 30 " "	"	1.00	18.93	70.13	9.50	0.44	Good	13,350	1.10	21.00	77.90	7.6	" " "	
10	Marten Creek, Jubilee seam	30 feet thick	B	1.89	30.41	63.33	4.37	.....	....	14,447	1.98	31.80	66.22	4.6	Bituminous.....	
11	" " Peter "	.....	"	1.79	33.04	61.55	3.62	.....	.....	14,490	1.86	34.28	63.86	4.3	"	
12	" " Cannel "	.....	"	2.10	57.71	30.33	9.86	.....	.....	.....	2.34	64.00	33.66	1.9	Cannel coal.....	
13	No. 1 mine, Coal Creek	9 ft. to 12 ft. thick	C	1.37	25.95	61.66	11.02	.....	.....	.....	1.54	29.17	69.29	5.2	Bituminous.	Av. of 9 samples from N. levels off incline.
14	" 1 " " "	" " "	"	1.37	27.22	63.02	8.39	.....	.....	.....	1.50	29.71	68.79	5.1	"	Av. of 11 samples from S. levels off incline.
15	" 2 " " "	6 ft. thick	"	1.00	21.85	73.30	3.85	.....	.....	.....	1.05	22.72	76.23	7.0	High-carbon bit...	No. 3 West entry deeps.
16	" 2 " " "	5 ft. and 6 ft.	"	1.00	24.30	69.70	5.00	.....	...	.....	1.05	25.58	73.37	6.3	" " "	Av. 13 samples No. 2 & 3 W. ent.
17	" 5 " " "	5 "	"	0.98	21.94	64.40	12.68	.....	.....	.....	1.12	25.12	73.76	6.3	" " "	Av. 31 samples. Av. of mine.
18	" 9 " " "	4 " and 6 ft	"	0.75	25.65	69.39	4.21	.....	.....	.....	0.78	26.78	72.44	6.0	" " "	Av. 11 samples from main levels.
19	" 5 " Michel	5 " 6 in	"	1.20	19.55	67.75	11.50	.....	.....	.....	1.35	22.10	76.55	7.1	" " "	Room 2 off 1 E. level, 1 E. incline.
20	" 5 " "	5 " 6 "	"	1.10	20.50	71.10	7.30	.....	.....	.....	1.20	22.10	76.70	7.2	" " "	" " " 2 W. " 1 W. "
21	" 3 " "	5 " 6 " to 7 ft.	"	1.01	20.95	69.00	9.04	.....	.....	.....	1.12	23.04	75.84	6.9	" " "	Av. 8 samples, Rise workings.
22	" 8 " "	12 "	"	1.85	23.15	69.30	5.70	.....	.....	.....	1.96	24.55	73.49	6.0	" " "	R. 6 E. level, No. 3 incline.
23	" 8 " "	10 "	"	1.85	22.95	70.60	4.60	.....	.....	.....	1.94	24.06	74.00	6.1	" " "	R. 10, " " " " "
24	" 8 " "	10 "	"	1.10	25.70	65.85	7.35	.....	.....	.....	1.19	27.73	71.08	5.6	Bituminous.	R. 34, No. 2 E. level.
25	" 8 " "	20 "	"	0.80	23.50	66.90	8.80	.....	.....	.....	0.87	25.77	73.36	6.2	High-carbon bit...	R. 52, " " "
26	" 8 " "	30 "	"	0.92	23.50	67.46	8.12	.....	.....	.....	1.00	25.57	73.43	6.2	" " "	R. 49, " " "
27	" 8 " "	.....	"	1.62	23.67	67.79	6.92	.....	.....	.....	1.74	25.43	72.83	5.9	Bituminous.	Av. 23 samples, 3 E. and 3 W. main incline.
28	Corbin Coal & Coke Co., Corbin	Special 10 ft. band	D	1.50	13.50	79.00	6.00	.....	.....	.....	1.60	14.36	84.04	10.4	Anthracitic coal..	
29	" " "	Average run of coal	"	2.00	22.00	66.00	10.00	.....	.....	.....	2.22	24.45	73.33	5.9	Bituminous.....	
	Upper Elk River Field.															
30	Aldridge Creek, C.P.R. Synd., Lot No. 6825	No. 1, 14 feet	E	1.10	23.30	69.00	6.60	.....	Good	.....	1.18	24.95	73.87	6.3	High-carbon bit...	Sampled by Prov. Min. 1909.
31	Aldridge Creek, C.P.R. Synd., Lot No. 6825	No. 3, 9 feet	"	0.90	22.40	64.40	12.30	.....	"	.....	1.02	25.55	73.43	6.2	" " "	" " " "
32	Headquarters Camp, Elk river, Lot No. 6047	.....	"	0.90	17.00	73.70	7.50	.....	Fair	.....	0.97	19.35	79.68	8.3	" " "	" " " "
33	Northern Coal Co., Elk river	Outcrop	"	8.60	20.50	54.70	16.20	.....	Poor	.....	10.26	24.46	65.28	3.4	Low-carbon bit...	" " " "
34	Imp. C. & C. Co., Fording river	A	"	1.40	19.10	71.40	8.10	.....	Good	.....	1.52	20.78	77.70	7.4	High- " "	" " " "

TABLE OF ANALYSES OF BRITISH COLUMBIA COAL—*Continued.*

Designation No.	Locality.	Seam.	Authority or Reference.	Prox. Analy. by Fast Coking.				Sulphur.	Coking Quality.	British Thermal Units.	Expanded Analysis Calc. on Clear Coal.			Split. Vol. Ratio.	Classification by Split Vol. Ratio.	Remarks.
				Moist.	V.C.M.	F.C.	Ash.				Moist.	V.C.M.	F.C.			
	Upper Elk River Field—Continued.															
35	Imp. C. & C. Co., Fording river	E	E	4.40	22.20	62.50	10.90	.....	Good	.....	4.94	24.91	70.15	4.7	Bituminous	Sampled by Prov. Min., 1909.
36	Elk river. C.P.R. Syn., Lot 6980	Surface outcrop	F	8.20	30.30	58.50	3.00	.....	Non	.....	8.47	31.23	60.30	3.1	Low-carbon bit	From Prospect workings.
37	" " " " 6047	" "	"	5.40	29.30	62.40	2.90	.....	"	.....	5.56	30.17	64.27	3.8	Bituminous	" " "
38	" " " " "	Deep cut	"	1.00	24.20	67.40	7.40	.....	C'k'ng	.....	1.08	26.13	72.79	6.0	High-carbon bit	
39	" " " " "	" "	"	0.80	19.70	59.20	20.30	.....	"	.....	1.03	24.71	74.26	6.4	" "	
40	" " " " 6822	Shallow cut	"	2.00	18.80	69.60	9.60	.....	Non.	.....	2.21	20.79	77.00	6 9	" "	
41	" " " " 6824	" "	"	0.70	28.30	69.10	1.90	.....	Poor	.....	0.71	28.86	70.43	5.6	Bituminous	
42	" " " " 6823	" "	"	0.80	26.70	63.30	9.20	.....	"	.....	0.88	29.41	69.71	5.4	"	
43	" " " " 6825	" "	"	3.80	15.20	77.90	3.10	.....	Slig'ly	.....	3.92	15.69	80.39	7.4	High-carbon bit	
44	" " " " 6824	" "	"	0.80	26.30	65.10	7.80	.....	C'k'ng	.....	0.86	28.53	70.61	5.6	Bituminous	
45	" " " " 6823	" "	"	1.20	20.00	55.70	23.10	.....	"	.....	1.56	26.00	72.44	5.8	"	
46	" " " " 6646	Surface	"	6.80	23.00	57.10	13.10	.....	Non	.....	7.83	26.46	65.71	3.7	"	
47	" " " " "	"	"	7.30	23.30	64.30	5.10	.....	"	.....	7.69	24.56	67.75	4.0	"	
48	" " " " 6647	"	"	12.8	30.90	36.50	19.80	.....	"	.....	15.96	38.52	45.52	1.8	Lignite	
	Coast District.															
49	Comox Union Colliery	Upper seam	G	1.34	30.01	65.82	2.83	.....	.....	.....	1.39	30.88	67.73	4.9	Bituminous	
50	" " "	Lower seam	"	1.70	32.36	63.08	2.86	.....	.....	.....	1.75	33.31	64.94	4.4	"	
51	" Baynes sd. mine	Richardson seam	"	1.18	34.13	48.51	16.18	.....	.....	.....	1.41	40.72	57.87	3.6	"	
52	Vancouver Id. No. 5 pit, Comox	Upper seam	A	1.08	29.24	57.03	9.60	3.05	.....	.....	1.23	33.48	65.29	4.6	"	
53	" Comox, Hamilton lake		"	1.70	22.82	47.72	27.00	0.76	.....	10,626	2.36	31.58	66.06	4.5	"	
54	No. 4 slope	Comox or low seam	"	0.88	27.34	61.82	8.70	1.26	.....	13,881	0.98	30.36	68.66	5.2	"	
55	" 5 pit	" " "	"	1.32	27.62	63.64	6.70	0.72	.....	14,191	1.42	29.84	68.74	5.1	"	
56	" 6 "	" " "	"	1.26	27.33	63.49	6.80	1.12	.....	14,191	1.36	29.68	68.96	5.1	"	
57	" 1 shaft, Esplan., Nanaimo	Up. se., dip 1 in 10 E.	"	1.88	33.27	54.67	9.40	0.78	.....	12,672	2.10	37.04	60.86	3.8	"	
58	" " " "	Lo. seam, 1 in 10 E.	"	2.86	35.84	54.79	5.50	1.01	.....	12,951	3.06	38.33	58.61	3.5	"	
59	Harewood mine; dip 1 in 10 E		"	1.58	33.84	52.17	11.85	0.56	.....	12,238	1.80	38.64	59.56	3.7	"	
60	No. 5 Southfield mine		"	2.08	35.78	56.26	5.60	0.28	.....	13,261	2.21	38.02	59.77	3.7	"	
61	Bottom vein, 15 to 20° S. 20° W.	Extension seam	"	1.28	35.26	55.83	7.30	0.33	.....	13,199	1.38	38.17	60.45	3.8	"	
62	Top vein " " "	" "	"	1.24	36.49	53.72	8.20	0.35	.....	13,261	1.35	39.90	58.75	3.7	"	
63	Bottom seam, Tunnel vein (Report, 1902)	S. 12° W. dip 10°	"	1.52	35.27	57.04	5.85	0.32	.....	13,416	1.62	37.58	60.80	3.9	"	
64	Top seam, Tunnel vein (Report, 1902)	" "	"	1.44	31.40	46.18	20.65	0.33	.....	11,401	1.82	39.74	58.44	3.6	"	
65	Nanaimo, Wellington mine		G	2.75	38.03	52.64	6.58	.....	.....	12,567	2.95	40.70	56.34	3.3	Low-carbon bit	
66	" New Vanc. C. Co	Commercial coal	"	2.06	34.07	56.94	6.67	0.25	.....	.....	2.21	36.61	61.18	3.8	Bituminous	
67	" No. 5 Southfield		A	2.08	35.78	56.26	5.60	0.28	.....	13,261	2.21	38.02	59.77	3.7	"	
68	" Wellington mine	Commercial samp.	G	8.57	25.30	56.40	9.52	0.21	.....	.....	9.50	28.02	62.48	3.2	Low-carbon bit	
69	Nicola, Middlesboro Colliery	Coal Gully	"	3.04	37.18	52.05	7.73	.....	Good.	.....	3.29	40.30	56.41	3.2	" "	
70	" Lot 1267	Quilchena creek	"	6.95	37.21	47.95	7.89	.....	"	.....	7.54	40.40	52.06	2.6	Lignitic coal	
71	"	Coldwater	"	3.17	35.73	55.25	5.85	.....	"	.....	3.36	37.96	58.68	3.4	Low-carbon bit	
72	" Coldwater	6 ft. seam	"	2.13	27.99	59.66	10.22	.....	"	.....	2.37	31.18	66.45	4.5	Bituminous	
73	"	Coal Gully	"	3.35	26.55	59.30	10.80	.....	"	.....	3.76	29.76	66.48	4.3	"	

TABLE OF ANALYSES OF BRITISH COLUMBIA COAL—*Continued.*

Designation No.	Locality.	Seam.	Authority or Reference.	Prox. Analy. by Fast Coking.				Sulphur.	Coking Quality.	British Thermal Units.	Expanded Analysis Calc. on Clear Coal.			Split Vol. Ratio.	Classification by Split Vol. Ratio.	Remarks.
				Moist.	V.C.M.	F.C.	Ash.				Moist.	V.C.M.	F.C.			
	Coast District—Continued.															
74	Nicola Coal Hill Synd	Av. of 3 seams	H	5.58	37.81	50.77	5.84	.....	.....	.....	5.92	40.16	53.92	2.80	Lignitic coal	Av. of 5 analyses.
75	" Diamond Vale Colliery	Lump	"	2.66	37.84	55.14	4.36	.....	.....	.....	2.78	39.57	57.65	3.40	Low-carbon bit	
76	" Val. C. & C. Co., Nicola	No. 1	"	4.69	36.89	51.06	7.36	....	.....	.....	5.06	39.82	55.12	3.00	"	
77	" " " " "	" 5	"	3.44	38.86	49.24	8.46	....	.....	.....	3.76	42.45	53.79	3.00	"	
78	Princeton Coal and Land Co., Princeton Colliery	By B. of M.	E	16.40	31.70	45.10	6.80	.....	.....	.....	17.60	34.00	48.40	1.89	Lignite	
79	Princeton Coal and Land Co., Princeton Colliery	.....	J	10.45	36 77	45.60	6.42	0.76	.....	.....	11.25	39.62	49.13	2.21	Lignitic coal	
80	Princeton Coal and Land Co., Princeton Colliery	Av. of seam by P.M.	K	11.97	30.49	49.21	8.33	.....	.....	.....	13.06	33.26	53.68	2.40	" "	
81	Coalmont Collieries	Granite creek	Q	2.97	31.28	52.49	13.26	.....	Str'ng	.....	3.42	36.07	60.51	3.60	Bituminous	
82	" "	Collins Gulch	"	4.87	36.86	50.99	7.28	.....	T'nd'r	.....	5.25	39.75	55.00	3.00	Low-carbon bit.	
	Northern Interior.															
83	Telkwa river	5 ft. 6 in	L	1.36	10.87	80.82	6.95	.....	.....	.....	1.46	11.68	86.86	12.70	Anthracitic coal.	
84	" "	7 " 3 "	"	0.80	11.10	78.90	9.20	.....	.....	.....	0.88	12.22	86.90	13.30	Semi-anthracite.	
85	" "	4 " 0 "	"	0.60	10.80	82.70	5.90	.....	.....	.....	0.64	11.48	87.88	14.60	" "	
86	" Goat cr., Cassiar C.C.	14 ft	M	6.60	29.00	56.90	7.50	.....	.....	.....	7.13	31.36	61.51	3.40	Low-carbon bit.	
87	" " Transcontinental Dev. Synd.	28 in	"	0.80	8.20	81.60	9.40	.....	.....	.....	0.88	9.06	90.06	17.50	Anthracite.	
88	Telkwa river	Goat creek, 8 ft. thick.	R	0.60	33.90	56.00	9.50	.....	.....	.....	0.67	37.46	61.87	4.20	Bituminous.	
89	Morice river, Bulkley valley	.....	N	2.70	22.90	68.80	5.60	.....	Non..	.....	2.86	24.26	72.88	5.60	"	
90	Jefferson-Dockrill field	Average	S	2.50	30.50	60.80	6.20	.....	Fair..	.....	2.66	32.52	64.82	4.30	"	
91	Zymoetz River field	9-foot seam	T	3.30	34.50	56.10	6.10	.....	"	.....	3.51	36.74	59.75	3.60	"	
92	" " "	6-foot seam	"	3.10	31.30	55.30	10 30	....	"	.....	3.46	34.89	61.65	3.80	"	
93	Fraser river, near Quesnel	.....	N	14.60	37.30	43.40	4.70	.....	Non..	.....	15.32	39.14	45.54	1.80	Lignite	
94	" " 30 m. below Quesnel	.....	"	27.90	28.60	34.50	9.00	.....	"	.....	30.65	31.43	37.92	1.10	"	
95	Queen Char. Ids., Camp Wilson	No. 1 surface	O	1.33	17.22	61.96	19.49	.....	.....	.....	1.66	21.38	76.96	7.10	High-carbon bit.	
96	" " " " "	" 3 "	"	2.01	9.13	86.06	2.80	.....	.....	.....	2.07	9.39	88.54	13.70	Semi-anthracite.	
97	Tumbo Island	.....	P	1.50	41.00	50.50	6.00	1.00	.....	.....	1.60	44.00	54.30	3.20	Low-carbon bit.	
98	Peace River field	2 ft. 3 in	U	1.80	23.90	67.80	6.50	.....	Fair..	.....	1.92	25.50	72.52	5.80	Bituminous	
99	" " "	2 " 8 "	"	1.60	15.90	77.45	5.10	.....	Non..	.....	1.70	16.80	81.50	8.90	High-carbon bit.	
100	Groundhog field	Godfrey tunnel	V	2.30	5.10	71.10	21.50	.....	.....	.....	2.94	6.50	90.56	15.10	Anthracite	Sampled by Prov. Min.
101	" "	Telfer series	"	2.62	6.96	84.49	5.93	5.75	.....	13,814	2.78	7.42	89.80	14.40	Semi-anthracite.	" " G. W. Evans.
102	" "	....	"	2.97	5.59	65.60	25.84	1.90	.....	11,520	4.00	7.54	88.46	12.00	Anthracitic coal.	" " " "
103	" "	Klappan	.....	4.48	9.98	63.48	22.06	....	.....	.....	5.75	12.81	81.44	7.20	High-carbon bit.	

INSPECTION OF COAL-MINES, 1920.

The coal-producing areas of the Province are divided into the Coast District, which includes the Vancouver Island, the Nicola-Princeton, and the Telkwa 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. In June, 1920, John G. Biggs was appointed to the inspectorate of this district.

NANAIMO INSPECTION DISTRICT.

HENRY DEVLIN, INSPECTOR (OFFICE, NANAIMO).

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.

Granby Colliery No. 1 at Cassidy—3 slopes.

Pacific Coast Coal Mines, Limited—The Morden mine.

Nanoose Collieries, Limited—No. 1 mine.

Canadian Western Fuel Company—Harewood, Reserve, and Wakesiah.

East Wellington Coal Company.

Adit mine, Old Wellington Colliery.

COMOX INSPECTION DISTRICT.

(INCLUDING NO. 1 AND PROTECTION SHAFTS, NANAIMO.)

THOMAS R. JACKSON, INSPECTOR (OFFICE, NANAIMO).

Canadian Western Fuel Company—Protection and No. 1 mines.

The Canadian Collieries (Dunsmuir), Limited—Nos. 4 and 7 slopes and No. 5 shaft.

Pacific Coast Coal Mines, Limited—Suquash Colliery.

NORTHERN INSPECTION DISTRICT.

T. J. SHENTON, INSPECTOR (OFFICE, PRINCE RUPERT).

The Telkwa Collieries—Mine at Telkwa.

NICOLA-PRINCETON INSPECTION DISTRICT.

JOHN G. BIGGS, INSPECTOR (OFFICE, MERRITT).

The collieries operating during the year in this Inspection District, including the new mines that have been started, were:—

The Middlesboro Colliery of the Middlesboro Collieries, Limited, Merritt—Nos. 2, 3, 4, 5, 6, and 7 mines.

Fleming Coal Company.

Princeton Coal and Land Company's Princeton Colliery—No. 1 slope.

Coalmont Collieries.

Chu Chua Colliery.

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 John McDonald, Inspector with headquarters at the Mine-rescue Station at Fernie.

The collieries operating during the year were Coal Creek Collieries, Michel Colliery, and Corbin Colliery.

NANAIMO INSPECTION DISTRICT.

REPORT BY HENRY DEVLIN, INSPECTOR.

I have the honour to submit my annual report for the year ending December 31st, 1920, on the various coal-mines in my inspectorate, consisting of the Reserve, Harewood, and Wakesiah mines of the Canadian Western Fuel Company, Nanaimo; Nos. 1, 2, and 3 mines, Extension, and No. 5 mine, South Wellington, Wellington-Extension Colliery of the Canadian Collieries (Dunsmuir), Limited; Granby No. 1 Colliery of the Granby Consolidated Mining, Smelting, and Power Company, operating at Cassidy; Morden mine of the Pacific Coast Coal Mines, Limited; Lantzville mine of the Nanoose Wellington Collieries, operating at Nanoose; No. 1 slope of the East Wellington Coal Company; and the Adit level at the Old Wellington Colliery, Wellington.

Canadian Western Fuel Company.

Head Office—Nanaimo, B.C.

Capital, $1,500,000.

Officers.	*Address.*
C. P. Heaton, President,	San Francisco, Cal.
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.
Robert Henderson, Mine Manager, Reserve Mine,	Nanaimo, B.C.
Arthur Newbury, Harewood Mine,	Nanaimo, B.C.
William Moore, Wakesiah 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 1920.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	387,136			
" export to United States	136,912			
" " other countries	7,647			
Total sales		531,695		
Used in making coke				
" under colliery boilers, etc	129,433			
Total for colliery use		129,433		
		661,128		
Stocks on hand first of year	45,611			
" last of year	11,116			
Difference taken from stock during year		34,495		
Output of collieries for year		626,633		

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	48		48		96	
Whites—Miners	410				410	
Miners' helpers						
Labourers	276		204		480	
Mechanics and skilled labour	119		140		259	
Boys	52		33		85	
Japanese						
Chinese			107		107	
Indians	3				3	
Totals	908		532		1,440	

RESERVE MINE.

Robert Henderson, Manager, vice David Brown, resigned November 30th, 1920; Frances John, Overman; Albert Manifold, James West, Henry A. Meikle, George Frater, Joseph Thompson, Henry Carroll, James McGrath, Benjamin Cheetham, Henry Allsopp, Ernest Kelly, Frederick Hilley, and James E. Knowles, Firebosses.

This mine is situated in the Cranberry district, about 5 miles south of Nanaimo. The coal is reached by two shafts at a depth of 955 feet. The seam worked in this mine is the Douglas and varies from 1 to 20 feet in thickness. The coal is a very good quality, but friable.

The ventilation of the mine is produced by a pair of 90-inch Sirocco fans, connected to a 20 by 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, are capable of producing 140,000 cubic feet of air a minute, against a 3-inch water-gauge. The fan and engine are erected on a concrete foundation 80 feet from the shaft.

The pillars on the East side of the mine are drawn back as far as No. 30 incline. No. 22 incline on the East side has advanced 600 feet during the year. The inside end of the West level is finished and nearly all the pillars extracted.

No. 1 heading on the West side has advanced about 700 feet during the year and is still being pushed ahead.

No. 1 heading on the West side and No. 22 incline on the East side are parallel to each other and are 2,500 feet apart, but the seam has been so irregular that the levels turned off have not advanced far until they struck faulty ground.

At the present time all coal is hoisted up No. 2 shaft, and it is proposed to drive a haulage-road from No. 1 West heading to connect with No. 22 incline, East side, so that the coal can be hoisted up No. 1 shaft.

Safety-lamps of the Wolf type are used in this mine, also a few Edison storage-battery electric safety-lamps, and all shots fired by electric battery.

On my last inspection of the mine in December I measured 50,000 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 1 East split there was 14,500 cubic feet of air a minute passing for the use of fifty-five men and four horses.

In No. 2 East split there was 3,400 cubic feet of air a minute passing for the use of twelve men and one horse.

In the West side split there was 18,000 cubic feet of air a minute passing for the use of sixty men and four horses.

I found a small quantity of explosive gas in face of two stalls off No. 1 Right dip, No. 1 West heading.

Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: No. 1 East split showing 0.3 per cent. methane in 16,000 cubic feet of air a minute; No. 2 East split showing 0.4 per cent. methane in 5,000 cubic feet of air a minute; West side split showing 0.4 per cent. methane in 20,000 cubic feet of air a minute; main return showing 0.7 per cent. methane in 54,000 cubic feet of air a minute.

The following are the official returns from the Reserve Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	80,483			
" export to United States	28,463			
" " other countries	1,590			
Total sales		110,536		
Used in making coke				
Used under colliery boilers, etc.	25,468			
Total for colliery use		25,468		
		136,004		
Stocks on hand first of year	435			
" last of year				
Difference taken from stock during year		435		
Output of colliery for year		135,569		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	12		10		22	
Whites—Miners	107	5.75-9.01			107	
Miners' helpers						
Labourers	54	5.75-6.29	49	5.82-6.27	103	
Mechanics and skilled labour	14	6.29-6.97	27	6.36-7.62	41	
Boys	18	3.52-5.75	7	2.58-4.83	25	
Japanese						
Chinese			21	3.13-4.33	21	
Indians	3	5.69-5.92			3	
Total	208		114		322	

WAKESIAH MINE.

William H. Moore, Manager; Thomas Jordan, Overman; Charles F. Webber, J. A. Challinor, Alfred Odgers, George W. Nash, George Grey, and Isaac Nash, Firebosses.

This mine is situated on the Canadian Western Fuel Company's farm, about 2 miles from Nanaimo, and is connected by a spur track with the Harewood branch line. Two shafts were sunk to a depth of 320 feet to the Wellington seam and a pair of levels driven about 1,400 feet in a south-westerly direction. Many faults have been encountered which have hindered development to some extent, but work is still being pushed forward. The seam varies from 3 to 14 feet in thickness. The output from this mine at the present time is from 250 to 300 tons daily.

Haulage is carried on by means of five winches driven by compressed air supplemented by horses. Water is taken care of by six pumps, two small and two large Camerons and two duplex pumps, all driven by compressed air, with the exception of the large Cameron at the shaft-bottom, which is steam-driven. The stables underground have been extended during the year.

The methods of working are by pillar and stall and long-wall. Some experiments have been made with the double-stall method of working, having for its object the better control of and the carrying of the frail roof, but this method had to be abandoned. At the present time, where practicable, long-wall seems to be giving the best results. The levels and slopes are driven 10 feet wide, with timbers on 3½-foot centres. Safety-lamps of the Wolf type, with the exception of a few Edison storage-battery lamps, are used underground.

During the year the Main levels were driven to the fault, cutting the coal-measures on the south-west, but slopes are still being driven to the south-east. A pair of headings are also being driven over towards the old Jingle Pot mine and are expected soon to be producing.

The mine is damp and free from coal-dust. Ventilation is produced by means of a single-inlet Murphy fan, which is now being driven direct, but can be changed to belt drive in a few minutes, an auxiliary engine being in readiness for that purpose.

The coal is still being hoisted from No. 2 shaft by a 14- by 16-inch first-motion engine supplied with steam by two 80-horse-power boilers at 120 lb. pressure, a $^{6}/_{10}$ 1⅛-inch hoisting-rope being used.

Another compressor, built on a reinforced concrete foundation, was installed during the year to cope with the increasing demand for power for development-work. Boilers have been suitably housed and steam-pipes covered. Pipe-lines and hydrants for fire-fighting purposes have been installed; also a new lamp-house. A new 23,500-gallon water-tank has been installed; also a feed-water heater.

Strenuous efforts are being made in the interests of safety, and as a consequence no serious accidents have as yet been reported, notwithstanding the poor roof overlying the greater part of the mine.

On my last inspection I measured 22,950 cubic feet of air a minute passing into the mine, divided into two splits.

In the East side split there was 9,000 cubic feet of air a minute passing for the use of twenty-eight men and two horses.

In the West side split there was 12,500 cubic feet of air a minute passing for the use of thirty men and six horses.

I found a small quantity of explosive gas in face of No. 2 stall off No. 1 East level, No. 1 dip. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests with the Burrell gas-detector were as follows: East side split showing 0.2 per cent. methane in 10,000 cubic feet of air a minute; West side split showing 0.2 per cent. methane in 13,000 cubic feet of air a minute; main return showing 0.4 per cent. methane in 24,000 cubic feet of air a minute.

The following are the official returns from the Wakesiah Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	36,368			
" export to United States	12,862			
" " other countries	718			
Total sales		49,948		
Used in making coke				
Used under colliery boilers, etc.	13,395			
Total for colliery use		13,495		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		63,343		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	6		5		11	
Whites—Miners	53	5.75-9.01			53	
Miners' helpers						
Labourers	24	5.75-6.29	28	5.82-6.27	52	
Mechanics and skilled labour	14	6.29-6.97	10	6.36-7.62	24	
Boys	8	3.52-5.75	4	2.58-4.83	12	
Japanese						
Chinese			11	3.13-4.33	11	
Indians						
Totals	105		58		163	

HAREWOOD MINE.

Arthur Newbury, Manager; John White, Overman; John Kirkwood, James Handlen, James Richards, Isaac Hill, George S. Brown, William Bradley, and George Moore, Firebosses.

In this mine the most important development-work during the year was in the main South-east level, which has been driven a distance of 2,000 feet, and a new slope has been driven down a distance of 400 feet from the Main level; also a South-west heading has been driven a distance of 900 feet. This heading is being driven out to the surface for ventilation purposes and has about 200 feet more to go.

This has been the second largest producing mine of the Canadian Western Fuel Company's Nanaimo Colliery during the year, most of the output at present being from pillar-extraction.

(For description of power-house equipment and plant at the Harewood mine, *see* Minister of Mines' Report for 1919.)

Safety-lamps of the Wolf type are used exclusively in this mine and all shots fired by electric battery.

On my last inspection of this mine in December I measured 30,000 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 1 split there was 14,000 cubic feet of air a minute passing for the use of fifty-five men and seven horses.

In No. 2 split there was 10,650 cubic feet of air a minute passing for the use of twenty men and six horses.

In No. 3 split there was 4,000 cubic feet of air a minute passing for the use of nine men and one horse.

No explosive gas found in this mine. Timbering and roadways were in fair condition and the mine free from coal-dust.

The Burrell gas-detector did not show any methane present in the mine-air.

The following are the official returns from the Harewood Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	93,708			
" export to United States	33,140			
" " other countries	1,851			
Total sales		128,699		
Used in making coke				
Used under colliery boilers, etc.	42,492			
Total for colliery use		42,492		
		171,191		
Stocks on hand first of year	21,080			
" last of year	7,170			
Difference taken from stock during year		13,910		
Output of colliery for year		157,281		

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		14		22	
Whites—Miners	91	5.75 - 9.01			91	
Miners' helpers						
Labourers	38	5.75 - 6.29	55	5.82 - 6.27	93	
Mechanics & skilled labour	17	6.29 - 6.97	42	6.36 - 7.62	59	
Boys	6	3.52 - 5.75	11	2.58 - 4.83	17	
Japanese						
Chinese			21	3.13 - 4.33	21	
Indians						
Totals	160		143		303	

Pacific Coast Coal Mines, Limited.

Head Office—Victoria, B.C.

Capital, $3,000,000.

Officers.	*Address.*
James Carruthers, President,	Montreal, Que.
John H. Paine, Vice-President and Managing Director,	Victoria, B.C.
D. D. Muir, Secretary-Treasurer,	Victoria, B.C.
George Wilkinson, General Superintendent,	Victoria, B.C.

The following returns show the combined output of the company's mines for the year 1920:—

AGGREGATE RETURNS FROM MINES OF PACIFIC COAST COAL MINES, LIMITED, FOR 1920.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	61,031			
" export to United States	14,278			
" " other countries				
Total sales		75,309		
Lost in washing	13,479			
Used under colliery boilers, etc	16,145			
Total for colliery use		29,624		
		104,933		
Coal reclaimed 10,908 / Stocks on hand first of year 320	11,228			
" last of year	1,199			
Difference taken from stock during year		10,029		
Output of colliery for year		94,904		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	10		6		16	
Whites—Miners	88				88	
Miners' helpers	19				19	
Labourers	70		10		80	
Mechanics and skilled labour			32		32	
Boys	12		4		16	
Japanese						
Chinese			35		35	
Indians						
Totals	199		87		286	

MORDEN MINE.

William Roper, Manager; Daniel McMillan, Overman; Fred. Bell, John Devlin, Neil McIntyre, Neil McMillan, Richard Rallison, Peter Carr, George Oswald, and Andrew Dean, Firebosses.

This mine is operated on the Douglas seam and is situated in the Cranberry district, and about 2 miles from South Wellington.

(For description of power-house equipment and plant *see* Minister of Mines' Report for 1919.)

The mine is entered by two shafts sunk to a depth of 600 feet. The main shaft is 9 by 16 feet and the air-shaft 9 by 12 feet in the clear. The ventilation is produced by a Sheldon double-entry fan 7 feet in diameter, driven by a 16 by 12 Vulcan Iron Works engine.

During the year fourteen cottages were removed from South Wellington and rebuilt at Morden. These cottages contain four rooms and pantry. Two eight-roomed houses occupied by the manager and overman have also been rebuilt at Morden. One large boarding-house was removed from South Wellington and rebuilt at Morden. This boarding-house in conjunction with three cottages for sleeping-quarters gives accommodation for thirty-two boarders. The overman's office has been temporarily fitted up to accommodate the office and engineering staff until the office is moved from South Wellington. One large water-tank has been removed from South Wellington and rebuilt at Morden to improve the water-supply system to the boilers.

New Equipment installed.—In the machine-shop one oxy-acetylene welding outfit and one punch and shears outfit. At Boat harbour one gasolene pumping-engine has been installed for water-supply; underground, one 9- by 12-inch duplex haulage-engine has been installed.

Improvements on Surface at Mine.—A complete overhaul of boilers, steam-lines, electric units, and screening plant has been made.

Railway.—The tracks in the mine yard have been overhauled and raised to the proper grade and considerable work has been done on the railway. No. 2 locomotive has been completely overhauled and practically rebuilt. Considerable repair-work has also been made on No. 3 locomotive, including new wheels for tender.

Boat Harbour Plant.—The steam plant at Boat harbour has been given a complete overhaul. The Jeffery-Robinson washer has been practically rebuilt and considerable repairs have been made to the loading plant.

Underground Development.—The old slope which was discontinued some four years ago has been reopened and has been cleaned and retimbered and retracked for a distance of approximately 1,300 feet. This slope will now be driven into the south-eastern portion of the field.

A new airway has been made for a distance of some 500 feet, paralleling this slope at points where the old one is caved. Considerable work has been done on permanent stoppings to improve the ventilation.

The development of the mine has been pushed during the year as rapidly as labour conditions would permit, some 15,000 feet of solid work having been driven during the year.

During the coming year it is expected a vigorous policy of development will be continued. Plans have been prepared for the remodelling of the shaft-bottom. Delivery of loaded cars will be arranged from three different sources to one side of the shaft.

Grades will be made whereby the loaded cars will descend gently from a fixed point to the cage. The empty cars will be released from the cage on the opposite side and will fall away on a gentle grade to a fixed point, where they will be picked up and elevated by a car-haul to a height whereby they will run by gravity back to the point where the loads are delivered. This shaft-bottom will be worked automatically as nearly as it is possible to make it.

The main entries of the mine will be pushed ahead vigorously, there being some 1,800 acres of virgin territory yet to be developed in this mine; from the average tons to the acre already produced from the worked portion of the mine, it is estimated this territory will yield 1,000 tons a day for the next fifty years. Various improvements to the preparation and loading plants are contemplated during the coming year.

On my last inspection of this mine I measured 50,000 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 1 split there was 3,800 cubic feet of air a minute passing for the use of fifteen men.

In No. 2 split there was 3,500 cubic feet of air a minute passing for the use of twelve men.

In No. 3 split there was 20,000 cubic feet of air a minute passing for the use of sixty-seven men and three horses.

No explosive gas found. Timbering was in good condition, with the exception of No. 1 North level, where there were some broken stringers which required replacing. This was ordered to be attended to immediately. Roadways were in fairly good order. The mine was fairly free from coal-dust, with the exception of parts of Nos. 1 and 2 North levels, which were somewhat dusty. The attention of the manager was directed to this matter.

Tests made with the Burrell gas-detector were as follows: No. 1 split showing two-tenths of 1 per cent. methane in 4,200 cubic feet of air a minute; No. 2 split showing two-tenths of 1 per cent. methane in 4,000 cubic feet of air a minute; No. 3 split showing three-tenths of 1 per cent. methane in 23,000 cubic feet of air a minute; main return showing four-tenths of 1 per cent. methane in 54,000 cubic feet of air a minute.

The following are the official returns from the Morden Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	61,031			
" export to United States	14,278			
" " other countries				
Total sales		75,309		
Lost in washing	13,479			
Used under colliery boilers, etc.	16,020			
Total for colliery use		29,499		
		104,808		
Coal reclaimed 10,908				
Stocks on hand first of year 320	11,228			
" last of year	1,199			
Difference taken from stock during year		10,029		
Output of colliery for year		94,779		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	10	6.67	5	6.00	15	6.00 - 6.57
Whites—Miners	86	7.02			86	7.02
Miners' helpers	18	5.55			18	5.55
Labourers	70	4.78 - 6.25	9	3.25 - 5.51	79	3.25 - 6.25
Mechanics and skilled labour			31	5.10 - 7.23	31	5.10 - 7.23
Boys	12	4.15 - 4.53	4	3.30	16	3.30 - 4.53
Japanese						
Chinese			35	3.32	35	3.32
Indians						
Totals	196		84		280	

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 by 18 feet in the clear; No. 3 air-shaft, 630 feet in depth, 10 by 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 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 by 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 by 20 by 9 high-speed engines; one Sheldon ventilating mine-fan, direct-connected to a 17 by 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 7½ miles 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.

Officers.	*Address.*
F. H. Lantz, Managing Director,	
John A. Coleman, Secretary-Treasurer,	Vancouver, B.C.
W. W. Norman, Accountant,	
James W. Jemson, Superintendent,	Wellington, B.C.

Value of plant, $200,000.

LANTZVILLE MINE.

This mine is situated at Nanoose Bay, about 9½ miles north of Nanaimo, and is worked in what is known as the Old Wellington seam.

A shaft 8 by 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 thick between the coal. The coal is hoisted from the shaft and the slope is used as a travelling-way for the workmen and for ventilation.

The seam generally is in two parts, with a shale from 2 to 4 feet in thickness. The coal is hard and of good quality and finds a ready market. The seam up to the present time has been subject to considerable disturbance and is very irregular. All the workings so far have been on the pillar-and-stall system.

The plant now consists of three boilers with a total horse-power of 360, two compressors delivering 950 cubic feet of free air a minute, and a first-motion hoisting-engine of 75 horse-power.

Electrical power is generated by a 150-kw. generator, this power being used extensively in the screening and washing plant. The storage-bunkers have a capacity of 1,000 tons, the coal being conveyed from the bunker to the shipping-point by means of cars.

Several important alterations have been made to facilitate the haulage. A new level has been made on the East side, which shortens the haul and makes a satisfactory grade. The Main level is being relaid with 30-lb. steel rails and some sharp curves taken off with a view to installing electric locomotives. Two slopes have been opened which are looking well. No. 2 slope struck a down-throw fault, where the seam dropped about 30 feet; work is being pushed ahead and a good field of coal is anticipated.

So far the ventilating-current has been conducted on one continuous current, but an overcast is being built which will divide the air-current, and allow a larger number of men to be employed on a shift. This will enable the management to increase the output with an eight-hour hoisting-day, which will cheapen the operating expenses considerably.

On the surface extensive improvements are in hand, principally in the preparation and avoiding breakage of lump coal. A new tipple has been installed and a retarding device to prevent coal-breakage in the bunkers.

A conveyor-belt is being installed at the wharf, which will be a great improvement to the loading facilities, both in speed of loading and avoiding serious breakage of coal.

In the spring it is proposed to build a breakwater from the end of the wharf, and thus enable the loading to go on in smooth water, and will also afford safe harbourage for scows in all weather. It will readily be seen that the completion of the above will expedite the rapid loading of scows, estimated to be 600 tons in eight hours. The coal is taken from the bunkers and boom-loaded into 2-ton cars hauled by an endless-rope system to the wharf.

At present the large majority of the workmen are transported by "jitney" from Nanaimo, etc., but twenty-six houses are under course of construction and will be ready for occupation in the near future, whereby about half of the workmen will be living on the spot. The houses are up to date in every respect, each containing a bathroom, and are fully equipped with modern plumbing fixtures, and each house is plastered throughout. The village is situated a short distance from the mine, on the hillside overlooking the bay, and as opportunity offers more houses will be constructed.

A neat and well-equipped first-aid station has been erected, where the mine-rescue apparatus is also stored. First-aid classes are being organized for the workmen, and as the superintendent has always taken a keen interest in first-aid work the Nanoose Wellington Collieries will probably be a close competitor in the first-aid events at the Island competitions.

This company is also equipping the mine with the Edison electric storage-battery safety-lamp, which is a policy to be highly commended. Several new pieces of machinery have been installed in the machine-shop, and the blacksmith-shop is being enlarged to admit two forges. One Radialaxe coal-cutter has been installed, and it is hoped that there will be more required in the near future.

Diamond-drill operations will be commenced on the company's property to prove the coalfield.

On my last inspection of this mine I measured 22,000 cubic feet of air a minute passing into the mine for the use of sixty-five men and eight horses. In all of my inspections of this mine during the year I found the mine free from explosive gas. Timbering and roadways were in good condition and the mine free from coal-dust.

In making tests with the Burrell gas-detector on one occasion I found 0.1 per cent. methane in the mine-air.

The following are the official returns from the Lantzville Colliery for the year ending December 31st, 1920:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	17,923			
" export to United States	9,480			
" " other countries				
Total sales		27,403		
Used in making coke				
Used under colliery boilers, etc.	4,200			
Total for colliery use		4,200		
Stocks on hand first of year	113			
" last of year	1,010			
Difference added to stock during year		897		
Output of colliery for year		32,500		

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	8.00	5	7.50	6	7.60
Whites—Miners	102	7.25	.....	.....	102	7.25
Miners' helpers	40	6.10	.....	.....	40	6.10
Labourers	18	6.00	28	4.75	46	5.25
Mechanics and skilled labour	2	5.73	29	6.10	31	6.05
Boys	.....	.....	.....	.....	.....	.....
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	15	4.50	15	4.50
Indians	.....	.....	.....	.....	.....	.....
Totals	163	.....	77	.....	240	.....

* These figures are from November statistics.

Granby Consolidated Mining, Smelting, and Power Co. Colliery at Cassidy.

Officers.	*Address.*
W. L. Nichols, President,	52 Broadway, New York.
J. T. Crabbs, Vice-President,	52 Broadway, New York.
Edward Everett, Secretary,	52 Wall Street, New York.
G. W. Wooster, Treasurer,	813 Birks Bldg., Vancouver.
H. S. Munroe, General Manager,	
R. R. Wilson, Superintendent,	Cassidy, B.C.

GRANBY No. 1 COLLIERY.

R. R. Wilson, Manager; James Touhey, Overman; Jonathan Henney, Shiftboss; John Bennett, Thomas Bullen, Ernest H. Devlin, John Wright, Joseph Lavin, Henry Mitchell, Alexander McLachlan, Robert Houston, and John Newman, Firebosses.

This mine is situated at Cassidy, and is opened up in the Douglas seam, which averages 10 feet in thickness. It was acquired mainly to secure a supply of coke for the company's smelter at Anyox.

The area set apart at this colliery for a residence district comprises about 80 acres of bench land overlooking the Nanaimo river to the north and Haslam creek to the south, and sheltered by forested ridge to east and west, which is being preserved as a park.

(For description of townsite, rooming-house, mess-house, change-house, mine buildings, tipple and washery, and power-house equipment see Minister of Mines' Report for 1919.)

SURFACE.

The chief improvements in connection with the surface operations are as follows:—

Additional equipment has been installed in the machine-shop, consisting of radial drill, power-shears, power-punch, Universal machine, and Universal tool-grinder. The shop is now one of the best-equipped coal-mine shops in the Province.

The washery has been equipped with seven Deister-Overstrom coal-washing tables for washing the fine slack, and a Dorr thickener 75 feet in diameter is being installed, so that coal can be thoroughly prepared for shipment to market.

Arrangements have been made for the installation of an additional 360-horse-power B. & W. water-tube boiler equipped with Riley mechanical stokers and flume for handling ashes.

A large timber-yard has been installed close beside the railroad-track, so that mine-timber can be dumped from railroad-cars to skids and thence loaded on timber trams or trucks connecting with the mine.

A cooling-pond equipped with thirty-two spray-nozzles has been installed in connection with the power-house condensers.

Granby No. 1 Colliery has now passed from the development to the production stage, and has one of the largest daily productions of any single mine in the Province.

UNDERGROUND.

Development-work has been pushed rapidly ahead during the year. The Main slope and manway are driven approximately 3,600 feet from the surface. Five pairs of levels have been turned to north and south. No. 2 North level was extended to a point about 1,420 feet from the manway. No. 3 North level was not developed during the year. No. 4 North level and counter-level were driven approximately 1,100 feet during the year. No. 5 North level has been turned from the manway and also from a pair of slopes off No. 4 North level. No. 5 South level has been started from the Main slope. No. 4 South level has been driven about 1,300 feet from the Main slope and No. 3 South level extended to a point about 1,500 feet south of the Main slope.

CHARACTER OF SEAM.

The seam continues irregular in thickness, subject to rolls in the roof and floor. A number of silted areas have also been encountered. The coal is a very good quality, but friable.

The colliery produced approximately 200,000 tons during the year, the daily production having been increased to 1,200 tons a day at the close of the year. Preparations are being made to double-track the Main slope in order to get the benefit of balanced hoisting and to speed up the haulage system. This should enable the output to be increased to 1,500 tons when required. The main partings have also been lengthened to efficiently handle the increased production and are being whitewashed and equipped with electric lights.

A thoroughly modern and up-to-date spray or sprinkling system has been installed on the Main slope in order to lay the coal-dust and eliminate as far as possible this danger.

LIGHTING.

Edison storage-battery electric lamps have been used exclusively in the mine during the year. Only firebosses, shotlighters, and bratticemen use the Wolf-type safety-lamp for testing purposes.

VENTILATION.

The new Sirocco fan, capacity 150,000 cubic feet of air a minute, housed in a concrete fire-proof structure, has been in continuous operation and has given satisfactory results. The mine is very well ventilated, and in a short time connections will be made between Nos. 3 and 4 levels on both North and South sides, giving a separate intake and return airway for each side of the mine and separated by large and substantial pillars.

DRAINAGE.

The drainage-level has been completed to the Nanaimo river and now handles all water entering the mine from the quicksand and gravel, relieving two pumps for use in the lower workings. The water from lower levels drains to central sump and is pumped to the drainage-level, along which it flows by gravity.

THE MINE.

The Main slope, which has been driven wide enough for a double track, is exceptionally well timbered with peeled round fir timber from 14 to 16 inches in diameter. The sets are carefully framed on the surface and collar-braced when placed in position.

The mine is being handled with the idea of extracting the largest possible percentage of coal from the area at a minimum cost rather than to produce coal for a few months to the final detriment of the mine. No pillar coal is being extracted.

A complete telephone system has been installed connecting the various offices, shops, and officials' residences with the underground workings.

The landing at the top of the Main slope has been covered in to keep the rope-riders and knucklemen dry and eliminate danger of accident on account of slippery and muddy roadway.

On my last inspection in December I measured 103,500 cubic feet of air a minute passing into the mine, divided into four splits.

In No. 1 South split there was 19,440 cubic feet of air a minute passing for the use of thirty men, or an average of 648 cubic feet of air a minute for each unit employed.

In No. 2 South split there was 24,000 cubic feet of air a minute passing for the use of thirty men, or an average of 800 cubic feet of air a minute for each unit employed.

In No. 1 North split there was 8,000 cubic feet of air a minute passing around the old workings of this section.

In No. 2 North split there was 24,850 cubic feet of air a minute passing for the use of fifty-five men, or an average of 451 cubic feet of air a minute for each unit employed.

I found a small quantity of explosive gas in face of Nos. 5 and 7 stalls off No. 4 North slope. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: No. 1 South split showing 0.2 per cent. methane in 22,400 cubic feet of air a minute; No. 2 South split showing 0.2 per cent. methane in 25,300 cubic feet of air a minute; No. 2 North split showing 0.3 per cent. methane in 26,000 cubic feet of air a minute; main return showing 0.4 per cent. methane in 130,000 cubic feet of air a minute.

The following are the official returns for the Granby Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	144,656			
" export to United States	8,121			
" " other countries				
Total sales		152,777		
Used in making coke				
Lost in washing	44,989			
Used under colliery boilers, etc.	11,511			
Total for colliery use		56,500		
		209,277		
Stocks on hand first of year	12,966			
" last of year	5,278			
Difference taken from stock during year		7,688		
Output of colliery for year		201,589		

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	7.37	10	8.25	14	7.94
Whites—Miners	125	8.61	.....	.....	125	8.61
Miners' helpers	.....	.....	.....	.....	.....	.....
Labourers	68	5.82	51	5.24	119	5.57
Mechanics and skilled labour	7	6.24	25	6.44	32	6.39
Boys	.....	.....	10	3.25	10	3.25
Japanese	.....	.....	.....	.....	.....	.....
Chinese	.....	.....	.....	.....	.....	.....
Indians	.....	.....	.....	.....	.....	.....
Totals	204	7.57	96	5.66	300	6.95

Name of seams or pits—Grauby Colliery No. 1, Douglas seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Douglas seam. Average dip, 20°. Seam irregular in thickness, varying from 0 to 25 feet sometimes in remarkably short distances. Seam subject to rolls, pinched and silted areas. The mine is being operated with the idea of extracting largest possible percentage of coal at minimum cost. Large and substantial pillars have been left along all main haulage-roads and permanent airways. The Main slope has been driven approximately 3,600 feet from the surface, is exceptionally well timbered, and has been driven wide enough for two tracks. Five levels have been turned to north and south off the Main slope. Practically all coal extracted to date has come from development places.

Description and length of tramway, plant, etc.—Plant modern in every way. Sirocco fan capacity 150,000 cubic feet a minute; Vulcan hoist, 18 by 36 inches, double-drum second-motion; tipple equipped with Rotary dump, Marcus screen, loading-booms, railway-cars handled with Fairmont car-retarders; washery equipped with 2-compartment jigs, capacity 80 tons an hour, sludge-recovery, and seven Deister-Overstrom tables. Bone coal burned under the boilers. Edison storage-battery electric lamps used underground. No horses or mules used. Storage-battery locomotives used for underground haulage. Boiler plant equipped with Badenhausen boilers fired by type E mechanical stokers; ashes flumed to dump.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Capital, $15,000,000.

Officers.	*Address.*
F. Perry, President,	Montreal, Que.
H. B. Walker, Vice-President,	Montreal, Que.
H. S. Adlington, Secretary-Treasurer,	Montreal, Que.
J. M. Savage, General Manager,	Victoria, B.C.
Thos. Graham, General Superintendent,	Cumberland, B.C.

The Canadian Collieries (Dunsmuir), Limited, in 1910 acquired all the holdings of the Wellington Colliery Company, Limited, and since then has been operating the following mines:—

The Extension Colliery, in the Cranberry District (Extension); T. A. Spruston, manager.

The Comox Colliery, in the Comox District; Charles Graham, district superintendent; William Walker, John L. Williams, J. G. Quinn, managers at the several mines.

The following table shows the combined output of all this company's collieries during the past year:—

AGGREGATE RETURNS FROM THE CANADIAN COLLIERIES (D.), LTD., MINES FOR YEAR 1920.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	431,588			
" export to United States	139,994			
" " other countries				
Total sales		571,582		
Lost in washing	147,644			
Used in making coke				
Sold to employees	8,738			
" under colliery boilers, etc	22,017			
Total for colliery use		178,399		
		749,981		
Stocks on hand first of year	13,783			
" last of year	6,430			
Difference taken from stock during year		7,353		
Output of collieries for year		742,628		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	89		50		139	
Whites—Miners	572				572	
Miners' helpers	9				9	
Labourers	226		172		398	
Mechanics and skilled labour	63		187		250	
Boys	13		41		54	
Japanese	78		1		79	
Chinese	357		260		617	
Indians						
Totals	1,407		711		2,118	

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 mines, were taken over by the Canadian Collieries (Dunsmuir), Limited, in 1910.

The Wellington-Extension Colliery is composed of Nos. 1, 2, and 3 mines at Extension, and No. 5 mine at South Wellington, all situated in the Cranberry district.

A railway 11 miles in extent connects the Extension mines with Ladysmith, the shipping-point for the output from these mines. The output from No. 5 mine, South Wellington, is taken over the Esquimalt & Nanaimo Railway to Ladysmith and Mainland points.

All these mines have practically worked full time during the year.

Nos. 1, 2, and 3 mines at Extension are connected by a tunnel driven 14 by 7 in the clear, on a 1-per-cent. grade, and a little over a mile in length. Double tracks reach as far as the No. 1 mine junction, with crossover switches at variable distances along the tunnel. Electric lights are strung along the tunnel in close proximity to these switches. Electric-motor haulage is maintained along the tunnel and continued into the Nos. 2 and 3 mines, the underground employees being taken to and from their work in each respective mine along this tunnel by means of a "riding-trip" of cars hauled by a 13-ton Baldwin-Westinghouse electric locomotive.

POWER-HOUSE.

The boiler plant consists of four Goldie & McCulloch return-tubular boilers of 163-horse-power capacity each. The ashes are removed by washing and fluming to a pit and loaded on a rail-dump car by means of a bucket elevator.

Electric power is supplied by three 250-volt D.C. generators. No. 1 is a Cracken-Wheeler generator of 112.5-kw. capacity, direct-coupled to a 15 by 14 Ideal engine; No. 2 is a Westing-house 150-kw. capacity, connected direct to a Fleming-Harrisburg compound engine, size 14 by 14 by 32; and No. 3 is a General Electric 150-kw. capacity, direct-connected to a 16 by 16 Robb-Armstrong engine. A Blake fire and supply pump, 12 by 8 by 10, is maintained in good order in the boiler-house.

TIPPLE.

The mine-cars are handled over a Phillips crossover dump which are cut off the trip and fed to the dump by means of a steam-ram. Perforated shaker screens feed the coal to a 50-foot picking-table. An elevated rock-dump is used in conjunction with the tipple, with a self-dumping skip operated by an electric hoist with a 1-inch wire cable.

The usual repair-shops for underground service are in close proximity to the tipple, consisting of machine, blacksmith, car-repair, and electric shops, with standard mine-gauge track running into each of them, and railway-car repair and carpenter shop. This latter shop is equipped with rip-saw, band-saw, circular saw, boring-machine, and lathes.

THE WASH-HOUSE.

This combined change and wash house for the use of the employees is 120 by 30 feet and consists of four separated changing-compartments capable of providing ninety lockers to each compartment. The bath-room is situated in the centre of the building, giving easy access to the four compartments, and consists of twenty-seven spray-baths and eight hot- and cold-water taps over a 3-foot bench containing wash-basins. The whole installation is good from a sanitary standpoint. A dry-room is provided for extra-wet clothes; here the men may turn their wet garments over to the attendant and have them thoroughly dried for the next day.

A landing-platform, 120 by 40, is laid along the front of the wash-house where the workmen's train arrives, thus giving ample room to the men in getting off the train.

FIRST-AID AND MINE-RESCUE TRAINING-STATION.

A fully equipped building is kept and maintained in good condition at Extension, with work-room, observation-room, smoke-room, and dressing-room fitted with lockers and bath. The equipment consists of four 2-hour sets of the Paul apparatus, one oxygen-pump, four oxygen-tanks, one pulmotor, and electric safety-lamps of the Draeger and Edison type. During the year thirty-seven men have passed an examination in first-aid training and a number of them have taken training in mine-rescue work.

LADYSMITH.

The shipping-point for the output of this colliery is at Ladysmith, where the coal is either shipped by vessel or railway-cars by means of transfer-barge to Mainland points. The coal-washery is also situated at this point, and consists of three "washers" of the following dimensions: Nos. 1 and 2, diameter 8 feet 9 inches, depth 5 feet 6 inches; No. 3, diameter 8 feet 3 inches, depth 5 feet 9 inches; computed capacity of each washer, 300 tons for twelve hours. Six compartment jigs are situated on the lower floor. Two Masco tables, 14 by 7 feet, take care of the fine coal, which produces a high-grade coal for coking purposes and foundry use.

Power for the washery is supplied by a Pelton wheel which is operated from the mountain water source. A 40-k.w. 240-volt Allis-Chalmers-Bullock generator supplies power to operate the Masco tables, which are driven by a 25-horse-power General Electric type H motor, and also supplies light for all purposes on the shipping-wharf, transfer-wharf, and around the plant.

No. 1 or Tunnel Mine, Extension.

James Strang, Manager, Nos. 1, 2, and 3 Mines; William Wilson, Overman; James Glen, John Greenhorn, Walter Joyce, Thos. Wilson, William Clifford, and David, J. Gordon, Firebosses.

This mine is operated on the Wellington seam and has been in continuous operation throughout the year. The method of mining is the long-wall system; owing to the broken and dislocated condition of the field, hand-mining is employed.

The development during the year has been concentrated on the No. 3 slope, which is driven off the Main slope at a point 3,000 feet from the top. This slope is down a distance of 1,600 feet, with counter-slopes paralleling on each side, with 100-foot pillars between them.

Nos. 1, 2, 3, 4, and 5 levels have been turned off on the East side of this slope and are operating at present in coal averaging about 3 feet thick, somewhat troubled with a series of "rolls" and "steps" in the seam, and overlaid with a thick burden of carbonaceous shale. On the West side Nos. 4, 5, and 6 levels are being operated, the seam varying from 2 to 10 feet in thickness.

The haulage equipment consists of a 100-horse-power Ottumwa electric hoist situated at the top of the Main slope. The lower development of the No. 3 slope haulage is maintained by a 50-horse-power Ottumwa hoist driven by a Westinghouse motor.

The Edison storage-battery electric safety-lamps are in use throughout the mine. Only the firebosses use safety-lamps of the Wolf type for testing purposes. All blasting is done with permitted explosives fired by electric battery.

This mine is ventilated by a Murphy-type exhaust-fan with a capacity of 40,000 cubic feet of air a minute, against a 1.9-inch water-gauge, driven by an Allis-Chalmers-Bullock motor.

On my last inspection of this mine I measured 24,600 cubic feet of air a minute passing for the use of forty-five men and five mules.

I found a small quantity of explosive gas in face of No. 6 West level off No. 3 slope. Timbering and roadways were in good condition and the mine free from coal-dust. Test made with the Burrell gas-detector in the return airway showed three-tenths of 1 per cent. methane in 30,000 cubic feet of air a minute.

No. 2 Mine, Extension.

Robert L. Spruston, Overman; Joseph Mason, Joseph Watson, William Cosier, John Davidson, Robert N. Hamilton, Owen Dabb, Edward Heyes, and William Simpson, Firebosses.

This mine has been in continuous operation during the year, and, like No. 1 mine, is operating on the Wellington seam. The method of mining is part long-wall and part pillar and stall, as the conditions and thickness of seam permit.

This mine is divided into two districts—namely, No. 4 East district and the West Incline district. No. 4 East district turns off the Main tunnel at a distance of 1 mile from the entrance to the mine and is in a distance of 1¼ miles.

At present all the operations are being concentrated on the upper or rise side of the level, which is being operated by means of four inclines—namely, East incline, Nos. 1, 2, and 17. The East incline and Nos. 1 and 2 are worked on the pillar-and-stall method, while No. 17 incline is worked on the long-wall system, the seam being very thin and undulating. Nos. 1 and 17 Incline sections are operated by mule and gravity-haulage, while No. 2 Incline section is operated by mules, with an electric hoist conveying the output down the incline. The coal is gathered from all these inclines by a Baldwin-Westinghouse locomotive.

West Incline District.

This incline is up a distance of 1,800 feet and was driven for the purpose of recovering a large number of pillars and a small area of thin coal that had been abandoned previously.

Opening-up work has been continued by means of levels driven from the incline, where some good coal of excellent quality has been recovered. Owing to the heavy cost of maintaining the

timber supporting a very bad roof for a double-track self-acting incline, the section has been idle during the last few weeks, pending the installation of a hoist and alterations to the haulage.

This mine, like No. 1, is equipped with the Edison storage-battery electric safety-lamps, safety-lamps of the Wolf type being used only by the firebosses for testing purposes. All blasting is done with permitted explosives fired by electric battery.

The pumping equipment of this mine consists of a 5-stage Mather & Platt turbine-pump, 375-gallons-a-minute capacity at 250-foot head, running 1,400 r.p.m., driven by a 75-horse-power D.S.C. General Electric motor, and a 3-stage Mather & Platt pump, 275-gallons-a-minute capacity at 225-foot head, running 1,400 r.p.m.

The 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.

On my last inspection I measured 27,850 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 4 East split there was 15,850 cubic feet of air a minute passing for the use of fifty men and nine mules.

In the West Incline split there was 10,000 cubic feet of air a minute passing for the use of twenty men and two mules.

I found no explosive gas in this mine. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: No. 4 East split showing two-tenths of 1 per cent. methane in 17,500 cubic feet of air a minute; West Incline split showing two-tenths of 1 per cent. methane in 11,400 cubic feet of air a minute; Main return showing three-tenths of 1 per cent. methane in 35,000 cubic feet of air a minute.

No. 3 Mine, Extension.

Thomas Strang, Overman; James P. Nimmo, Jr., David Davidson, George Smith, Daniel Campbell, and Patrick Malone, Firebosses.

Operations have been carried out successfully during the year, which consist of pillar-and stall work and pillar-extraction. Development-work has been concentrated principally on the No. 4 West district, which is being driven with the object of recovering an area of solid coal between McCoy's Incline fault-line and the old Vancouver Company's slope; and with a view to recovering a large area of pillars to the rise side of the level.

The Main heading and McCoy's incline are engaged solely on pillar-extraction. The haulage equipment consists of a 50-horse-power Ottumwa electric hoist driven by a 50-horse-power General Electric motor. The Main level haulage is operated by a Baldwin-Westinghouse locomotive. The water in this mine is taken care of by a single-stage Gould centrifugal pump, 100-feet-a-minute capacity, driven by a 25-horse-power Allis-Chalmers-Bullock motor.

This mine is ventilated by a Guibal exhaust-fan with a capacity of 60,000 cubic feet of air a minute, against a 1.7-inch water-gauge.

This mine is also equipped with the Edison storage-battery electric safety-lamp, with Wolf-type safety lamps for the firebosses. All blasting is done with permitted explosives fired by electric battery.

On my last inspection of this mine I measured 22,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 12,000 cubic feet of air a minute passing for the use of thirty men and six mules.

In No. 2 split there was 9,500 cubic feet of air a minute passing for the use of twenty-five men and five mules.

I found a small quantity of explosive gas in face of Souli's pillar, McCoy's incline. Timbering and roadways were in good order and the mine fairly free from coal-dust.

Tests made with the Burrell gas-detector in this mine were as follows: No. 1 split showing three-tenths of 1 per cent. methane in 14,000 cubic feet of air a minute; No. 2 split showing two-tenths of 1 per cent. methane in 11,000 cubic feet of air a minute; main return showing four-tenths of 1 per cent. methane in 32,000 cubic feet of air a minute.

The following are the official returns from the Extension Collieries for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	92,611			
" export to United States	46,717			
Total sales		139,328		
Sales to employees	3,310			
Used under colliery boilers, etc	12,247			
Lost in washing	42,488			
Total for colliery use		58,045		
		197,373		
Stocks on hand first of year	2,426			
" last of year	1,458			
Difference taken from stock during year		968		
Output of collieries for year		196,405		

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	24		14		38	
Whites—Miners	237				237	
Miners' helpers	9				9	
Labourers	90		57		147	
Mechanics and skilled labour	14		32		46	
Boys			19		19	
Japanese						
Chinese	6		49		55	
Indians						
Totals	380		171		551	

Name of seams or pits—Wellington, Extension.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 1, 2, and 3 mines connected by main tunnel.

No. 5 MINE, SOUTH WELLINGTON.

Thomas A. Spruston, Manager; David Martin, Overman; Joseph Lane, James E. Parrott, James McLachlan, Adam Watson, Thomas Robson, Robert Ewing, and William Brown, Firebosses.

This mine is situated at South Wellington, about 5 miles south of Nanaimo, alongside of the Esquimalt & Nanaimo Railway. It is operating in the Douglas seam, adjacent to the Old Alexandria mine.

The slope is down a distance of over 3,000 feet, being driven 14 by 8 in the clear, and well timbered. Operations on the development of this slope have been greatly retarded owing to the broken nature and barren ground in this field. Levels have been turned off to the north and south of the Main slope, where further slopes have been developed, the mine being worked on the pillar-and-stall method.

A diagonal slope was turned away during the year off No. 3 North level at a point 500 feet from the Main slope, and is down a distance of 1,500 feet, and, like the Main slope, has had barren and broken ground to contend with; levels are being driven to the north and south in coal varying from 2 to 10 feet thick.

On the No. 3 South level a diagonal slope has been driven a distance of 1,400 feet, having a showing of 6 feet of good hard coal, which is well adapted for steaming purposes; levels are being extended north and south off this slope.

The haulage equipment consists of a steam-driven hoist, 18 by 36, situated on the surface to operate the Main slope. A 100-horse-power Ottumwa electric hoist is driven by a M.S.D. General Electric motor hauls the output from the North diagonal slope. The South diagonal slope is operated by a 50-horse-power compressed-air-driven hoist.

The ventilation is produced by an 8-foot Stine fan, belt-driven by a 50-horse-power type 3 Westinghouse motor, with a capacity of 80,000 cubic feet of air a minute, against a 1.5-inch water-gauge.

This mine is equipped with the Edison storage-battery electric safety-lamp, the Wolf-type safety-lamp being used only by the firebosses for testing purposes. All blasting is done with permitted explosives fired by electric battery.

Power-house.—Power is supplied by three Goldie & Bullock return-tubular boilers of 163-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. One 250-volt D.C. Cracken-wheel generator of 112-kw. capacity, direct-coupled to a 15 by 14 Ideal engine; one Sullivan air-compressor, W.B. 2 size, 22 by 24 by 14½; one Ottumwa 100-horse-power steam-driven hoist and supply pump.

The tipple consists of a revolving dump, chain car-haul, shaker screens carrying two decks for the separate grades of coal, with suitable arrangements made for taking any boiler fuel automatically when required.

Buildings.—There are the usual mine buildings laid out with a view to facilitating and concentrating the work as near the mine as possible. Lamp-house with a first-aid room adjoining. This mine is equipped with two 2-hour sets of the Paul apparatus for mine-rescue work; the offices, with the mine supply stores attached, blacksmith and machine shops, etc.

On my last inspection of this mine I measured 40,000 cubic feet of air a minute passing into the mine, divided into two splits.

In the North side split there was 18,000 cubic feet of air a minute passing for the use of forty men and five horses.

In the South side split there was 15,000 cubic feet of air a minute passing for the use of thirty-eight men and two mules.

I found a small quantity of explosive gas in a crosscut off No. 8 Right level and in a crosscut off No. 9 Left level, No. 3 North slope. Timbering and roadways were in good condition and the mine free from coal-dust.

Tests made with the Burrell gas-detector were as follows: North side split showing two-tenths of 1 per cent. methane in 20,000 cubic feet of air a minute; South side split showing two-tenths of 1 per cent. methane in 16,500 cubic feet of air a minute; main return showing three-tenths of 1 per cent. methane in 43,000 cubic feet of air a minute.

The following are the official returns from the No. 5 South Wellington Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	60,488			
" export to United States				
" " other countries				
Total sales		60,488		
Lost in washing	25,970			
Used in making coke				
Used under colliery boilers, etc	3,851			
Total for colliery use		29,821		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		90,309		

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		2		10	
Whites—Miners	149				149	
Miners' helpers						
Labourers	38		15		53	
Mechanics and skilled labour	3		10		13	
Boys			8		8	
Japanese						
Chinese	1		21		22	
Indians						
Totals	199		56		255	

East Wellington Coal Company Colliery at Nanaimo.

Officers.	*Address.*
H. W. Maynard, President,	Vancouver, B.C.
R. S. Jones, Treasurer,	Minneapolis, Minn.
J. S. Grant, Superintendent,	Nanaimo, B.C.

EAST WELLLINGTON COLLIERY.

John John, Manager; Samuel K. Mottishaw, Fireboss.

This new slope is situated about 500 yards west of the British Columbia Coal Mining Company's old mine known as the Jingle Pot.

This slope was unwatered in July of the present year and operations started, but were discontinued some time in September. The Main slope is down a distance of 611 feet from the surface, 6 by 12 in the clear, and well timbered. The counter-slope was driven about 86 feet, 6 by 12 in the clear; 155 feet of crosscuts driven, 6 by 10; a sump made on the left side of the Main slope, 6 by 12 by 30; and a pump installed to take care of the surface water.

Surface Work completed.—Ten acres of land cleared and prepared for buildings; two 60 by 16, 200-horse-power boilers installed and equipped; two air-compressors, one 14 by 18 C-2 and one 16 by 16 C-2, installed and equipped; one hoisting-engine at pit-mouth; all air and steam lines completed; one blacksmith-shop and equipment; one machine-shop; three air-receivers; one water-tank, 35,000-gallon capacity; 700 feet railway spur completed from main line to pit-mouth, also 1,200 feet of mine-tracks all completed; engine-house, boiler-house, and compressor-house all completed; mine-fan of 5,000-cubic-feet capacity installed and equipped with pipes, etc., leading to and from same; water and air lines all completed to bottom of shaft.

When I made my last inspection of this mine in August I measured 4,000 cubic feet of air a minute passing into the mine for the use of seven men.

No explosive gas found. Timbering and roadways were in good condition and the mine free from coal-dust.

No production was made by this mine in 1920.

THE ADIT MINE (OLD WELLINGTON COLLIERY).

Thomas Budge, Manager; Henry Shepherd, Fireboss.

The coal rights covering an area of about 600 acres at North Wellington have been leased from the Canadian Collieries (Dunsmuir), Limited, by Alfred G. King, Jr., and Edward Foster, who are operating under the firm-name of "King & Foster." There are under this area the following old mines: No. 1 slope, the Adit mine, and Nos. 2 and 3 shafts. These mines were operated by R. Dunsmuir & Sons and were closed some years ago. The lessees commenced in the middle of November to make an entry into the Adit mine for the purpose of recovering the pillars and the outcrop coal. The Adit mine was one of the first mines opened and operated by the late R. Dunsmuir.

I inspected all accessible parts of the mine in December and found it free from explosive gas and ventilation fair; timbering and roadways were in good order and the mine free from coal-dust.

COMOX INSPECTION DISTRICT.

REPORT BY THOMAS R. JACKSON, INSPECTOR.

I have the honour to submit herewith my annual report of inspection of the various coal-mines in my inspectorate for the year ending December 31st, 1920. They consist of the Canadian Western Fuel Company's No. 1 and Protection shafts, Nanaimo; the Canadian Collieries (Dunsmuir), Limited, Cumberland, Comox mines Nos. 4, 5, 6, and 7; and the Pacific Coast Coal Mines, Limited, Victoria, Suquash Colliery, Suquash, near Alert Bay, Vancouver island. A short description is given of each colliery, with the names of the certificated officials.

FIRST-AID AND MINE-RESCUE WORK.

I have much pleasure in being able to report good progress in both classes of work. The Nanaimo Western Fuel Company's "miners' first-aid team" (Captain Barton) won the Coderre cup, which can only be competed for by miners. In winning this trophy, and because they had obtained the highest number of marks for their work, they also scored a higher achievement in the realm of first aid by winning the Montizambert cup, representing the championship of Canada, which is open for competition to all classes of labour. The competition took place throughout the whole of Canada and was held under the auspices of the St. John Ambulance Association. Dr. Hodgetts, of Ottawa, was the examiner. Such an achievement by the miners should be highly appreciated.

The above company is much interested in assisting and encouraging its employees in this branch of humane labour. A number of men have taken advantage of the opportunity presented to acquire first-aid knowledge. Many of them have obtained their St. John Ambulance certificate. It is to be hoped the interest manifested in the work this year will be continued, if not greatly exceeded, next year, and a better position occupied by the various organizations at work in methods of self-aid.

Working in the mine is a more or less hazardous occupation, and because of that it behoves each worker to recognize the value and necessity of first-aid training, so that, should occasion arise, help to the injured could be rendered immediately, thus minimizing the delay and danger generally associated with accidents.

In mine-rescue training-work fairly good results have been maintained throughout the year. Quite a number of men have taken a training course, and in consequence of their efficiency have obtained the Government's mine-rescue certificate of competency.

The station at Nanaimo is under the supervision of J. D. Stewart, who conducts it in a practical and educational way. Mine-rescue practices are performed with approved Gibbs and Paul breathing apparatus. Volunteers actuated by a desire to become proficient in this class of work deserve to be appreciated. No emergency calls were demanded of the rescue-station, although it is always ready to respond to them.

SAFETY-FIRST WORK.

In the fall of 1917 the company appointed a safety engineer to make visits of inspection to all its collieries, surface and underground, including the wharf and machine-shops, with a view of diminishing the number of accidents which were taking place. This inspection is still being continued. To Arthur R. Wilson is allotted the duty of endeavouring to "prevent" accidents happening by methods of education and suggestion, and encouraging the employees to adopt the "safety-first idea" as the surest and best safeguard to personal security. George Yarrow, the company's mine-rescue instructor, occasionally supplements these visits of inspection.

The Canadian Western Fuel Company.

NANAIMO COLLIERY.

Robert Laird, Manager.

No. 1 SHAFT, ESPLANADE.

Edward A. Courtney, Overman; Robert Adams, William Johnson, Elias Rogers, S. K. Mottishaw, William Halliday, John Hamilton, James McMeakin, James Dudley, Thomas Blenkhorn, George Gardine, Joseph Dykes, James Brown, Joshua Norris, Thomas J. Woods, George Perry, and John Shipley, Firebosses, North Side.

This mine is situated at the south end of the Esplanade and adjacent to the bay shore-line. It is the oldest working-pit in Nanaimo district and has a large submarine area. The mine has three openings. Two of them are in daily operation, No. 1 shaft and Protection shaft. The latter is situated on Protection island. The third opening is Newcastle shaft. A ladder extends from top to bottom of this shaft, by which one can enter or leave the mine. It is used only for inspection or necessity. The shaft also forms the exit for the return air of Newcastle airway.

The men working in Protection mine are conveyed by scow to and from there. No. 1 shaft provides passageway for the men employed in the South side of mine.

Electric lamps of the Edison type are mostly used. The balance of lamps are of Wolf type. Douglas and Newcastle seams are worked. On the South side of mine the Douglas seam is worked exclusively. On the North side of the mine coal is taken from both seams. In blasting nothing but permitted explosives are used and fired by cable and electric battery. Compressed air and electricity are used as motive power for haulage and drainage purposes. The three Prescott pumps are driven by steam; so is the endless haulage-rope and Diagonal slope engines; all of them are situated at the shaft-bottom.

The North side haulage system consists of heavy steel rails and copper trolly-wire on the Main level, approximately 3 miles in length, extending from No. 1 shaft to the foot of Lamb's incline. Five motors are used, four constantly running and one acting as a spare. Four of them are of the Edison type and one Westinghouse 10-ton type; all are spring-trolly connected. Horses and mules with drivers are used to take the cars to the faces and return with loaded cars to the main roads. Small and large winches are employed to attend to these cars and place them on the motor-level. The motors haul them to the shaft-bottom.

The South side haulage system consists of direct, endless, and main and tail. The workmen are supplied with cars in a similar way to North side of mine, with this difference: instead of motors hauling the cars to the shaft-bottom, engines and ropes are used to perform the work.

Development-work done in South Side, No. 1 Mine.

The reopening of the Main slope has been continued to a point 6,400 feet from the shaft, where two rock tunnels were started to the south, known as No. 8 South levels. These levels have been driven a distance of 450 feet, but so far only small pockets of coal have been found. The No. 8 North levels off the Main slope have been driven in a distance of 510 feet, but no coal has been found as yet. Prospect-work has been done in No. 5 North level off the Main slope; it has been driven a distance of 500 feet with results not satisfactory. At No. 4 South level off Diagonal slope two rock tunnels have been driven a distance of 600 feet with good results. The main levels are still being continued. No. 3 level has been reopened and heavy steel laid for a distance of 3,000 feet. Active development-work will be started at the beginning of the year in a large area lying to the east of this point.

North Side, No. 1 Shaft.

In the Douglas seam the work done is chiefly the extraction of pillars; the thickness of the seam varies from 3 to 7 feet. The Newcastle seam averages 3 feet in thickness and is worked by the long-wall system. Most of the output of coal is produced by mining-machines. The machines used are Pick-quick and Siskoll. Where the ground is faulty or the face-line not extensive the mining is done by a Siskoll machine; where there is sufficient length of face to warrant it the Pick-quick machine is used. Both machines are regarded as giving good results. Compressed air is used to drive them. Both machines undercut the coal to a depth of 6 feet, after which it is drilled and shot down. The brushing is taken out the floor to admit the car to the face. Car carries about 16 cwt. of coal. Regulation size of place equals 12 yards, with roadway in centre. Loaders load out the coal into cars. Eight loaders are supervised by one shotlighter, or fireboss. Four loaders are supervised by one faceman, who is a certificated miner. A loader does not need a miner's certificate to load coal. Portions of the long-wall face are worked by diggers.

At present coal from the pillars in the Douglas seam is being taken from the following sections in the North side of the mine: No. 1 wall, Protection slope, and Lamb's incline.

The ventilation of these districts is produced by a Guibal fan, 9 by 18 feet, rope-driven at 70 revolutions a minute by a 100-horse-power engine. This fan is capable of producing 100,000 cubic feet of air a minute at a 2-inch water-gauge.

During my last inspection I measured 47,600 cubic feet of air a minute passing up Protection slope, divided into four splits.

Protection Pillars Section.—There was 7,000 cubic feet of air a minute passing for the use of twenty-four men and four horses. Roadways, timbering, and ventilation good. Found no gas and section fairly free from coal-dust. Burrell gas-detector showed no methane in return air of this section.

No. 3 Longwall Section.—There was 12,360 cubic feet of air a minute passing for the use of fifty men and eight horses. Roadways, timbering, and ventilation good. Found no gas and

section free from coal-dust. Burrell gas-detector showed 0.2 per cent. of methane in return air of this section.

Lamb's Incline Section.—There was 7,200 cubic feet of air a minute passing for the use of thirty-two men and seven horses. Roadways, timbering, and ventilation good. Found a little explosive gas in roof of roadway in first right place of slant, Poverty row. Burrell gas-detector showed 0.4 per cent. of methane in return air of this section.

Upper Seam Section, No. 1 Wall.—There was 4,800 cubic feet of air a minute passing for the use of sixteen men and three horses. Roadways, timbering, and ventilation good. Found no gas and section fairly free from coal-dust. Burrell gas-detector showed 0.1 per cent. of methane in the return air of this section.

In 23,000 cubic feet of air a minute passing in Newcastle airway Burrell gas-detector showed 0.3 per cent. of methane. In 68,000 cubic feet of air a minute passing near to upcast shaft to fan Burrell gas-detector showed 0.2 per cent. of methane.

South Side, No. 1 Mine.

Moses Woodburn, Frank Green, Alex. Coombs, James S. Brown, William Neave, George B. Bradshaw, Thomas Thomson, and Matthew Broderick, Firebosses.

The workings are all in the Douglas seam, and with the exception of No. 4 South level consist of the extraction of pillars. The seam varies much in thickness and inclination. Some parts as low as 2 feet; other parts as high as 24 feet. Inclination running from horizontal to 35° pitch. During the past year a fire arising from spontaneous combustion took place in No. 2 South level workings, causing them to be abandoned and sealed off. An attempt is being made to enter these workings from No. 4 South level. Three sections are being worked which have stoppings so arranged that should a fire take place in any one of them they can almost immediately be sealed off. Practice of this kind, to a great extent, relieves the worry, anxiety, and trouble connected with controlling a fire which suddenly starts up in a section.

The Main slope has been standing idle for a few months while repairs are being made to No. 7 big winch, which does the hoisting in this slope. It is expected to recommence operations prospecting for coal in No. 7 about the beginning of the year.

The ventilation is produced by a 72- by 90-inch double-inlet Sirocco fan, rope-driven, ratio 3½ to 1, capable of producing 195,000 cubic feet of air a minute at a 4-inch water-gauge, and is driven by an engine of 350 horse-power. Another fan capable of producing the ventilation of the mine stands ready to substitute should necessity require.

During my last inspection I found the following conditions to prevail: Measured 36,000 cubic feet of air a minute passing down Diagonal slope at overcast, divided into four splits.

No. 4 South Level Section.—There was 8,400 cubic feet of air a minute passing for the use of forty men and eight horses. Roadways and timbering good. Found no gas and section fairly free from coal-dust. Burrell gas-detector showed 0.1 per cent. methane in 10,000 cubic feet of return air from this section.

Right Incline Section.—There was 3,100 cubic feet of air a minute passing for the use of twelve men and three horses. Roadways and timbering good. Found no gas and section fairly free from coal-dust. Burrell gas-detector showed 0.2 per cent. of methane in return air of this section.

Simms Dip Section.—There was 4,500 cubic feet of air a minute passing for the use of twenty men and three horses. Roadways fair; timbering good. Found no gas and section fairly free from coal-dust. Burrell gas-detector showed 0.2 per cent. of methane in 6,500 cubic feet of return air of this section.

Farmer's Incline Section.—There was 5,760 cubic feet of air a minute passing for the use of eighteen men and four horses. Roadways and timbering good. Found no gas and section fairly free from coal-dust. Burrell gas-detector showed 0.5 per cent. of methane in 7,200 cubic feet of return air in this section.

Burrell gas-detector showed 0.2 per cent. of methane in 25,320 cubic feet of air a minute passing in South side return at No. 3 door. Main return air from South side of mine, measured and tested at entrance to bottom of upcast shaft to fan, showed no methane in 50,000 cubic feet of air a minute passing.

The following are the official returns for the Nanaimo Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
Tons of 2,240 lb.	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	176,577			
" export to United States	62,447			
" " other countries	3,488			
Total sales		242,512		
Used in making coke				
Used under colliery boilers, etc.	48,078			
Total for colliery use		48,078		
		290,590		
Stocks on hand first of year	24,096			
" last of year	3,946			
Difference taken from stock during year		20,150		
Output of colliery for year		270,440		

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		19		41	
Whites—Miners	159	5.75 - 9.01			159	
Miners' helpers						
Labourers	160	5.75 - 6.29	72	5.82 - 6.27	232	
Mechanics and skilled labour	74	6.29 - 6.97	61	6.36 - 7.62	135	
Boys	20	3.52 - 5.75	11	2.58 - 4.83	31	
Japanese						
Chinese			54	3.13 - 4.33	54	
Indians						
Totals	435		217		652	

The Canadian Collieries (Dunsmuir), Ltd.

COMOX COLLIERIES.

Charles Graham, District Superintendent.

These mines are situated in the Comox district, about 17 miles from Union Bay. A railway about 20 miles in length connects the various mines to a shipping-point at Union Bay, over which the whole output of coal is conveyed. The mines in operation are Nos. 4, 5, and 7. Those not operating are Nos. 6 and 8. No. 4 mine is located at the south end of Comox lake and is about 3 miles distant from the city of Cumberland. No. 5 is situated about a mile from the city. No. 7 mine is located at the town of Bevan, nearly 6 miles in a northerly direction from the city of Cumberland. No. 6 mine is close to the city. No. 8 mine is about 2 miles north of Bevan.

In the Tsable River coalfield there are two diamond-drills in operation. A total of 7,450 feet of boreholes has been drilled and 137,000 feet of roadway built. A survey has been completed for a railway between where the mine is located and Union Bay, about 6 miles in length.

The hydro-electric plant has been in constant operation throughout the year. The power-house has been operated satisfactorily and no repairs or improvements were required. Sufficient electricity is generated at this plant to supply motive power to all the collieries; also the wharf at Union Bay, including the lighting of this town and the city of Cumberland.

FIRST-AID AND MINE-RESCUE WORK.

I have much pleasure in being able to report that active interest is displayed in Cumberland district regarding first-aid and mine-rescue work. A number of men have studied first aid and qualified for the St. John Ambulance certificate.

A knowledge of the principles of first-aid treatment to the injured is becoming more and more of a necessity to the mine-worker. The subsequent trouble and danger arising out of delay of self-aid cannot be too prominently brought before their notice, nor can the advantages resulting from a prompt and timely application of first aid be too conspicuously placed before them. In the first-aid competition held under the auspices of the St. John Ambulance Association, and covering the whole of Canada, the Cumberland No. 4 mine surface "first-aid" team (Captain Taylor) won second honours in the Coderre cup.

Quite a few men have qualified for mine-rescue certificates at the mine-rescue station, Cumberland. The supervising officer in charge of this station is John Thomson. The station consists of six Draeger apparatus which are used to train the men. In addition, lectures are given on the subject by the instructor. Ten lessons of two hours' duration each constitute a complete course, performed in a training-gallery filled with irrespirable gaseous fumes and other conditions similar in character to that in which a mine would be after a fire or explosion. The training is difficult to perform; therefore much credit is due the men who willingly and voluntarily carry on this work.

The rescue-station has always been ready to meet emergency calls, but no demands were made during the year.

SAFETY-FIRST WORK.

At the beginning of the year the company appointed George O'Brien as safety engineer. His duty consists of visiting all the collieries, surface and underground, and the wharves connected with these collieries in Comox and Extension districts. His object is to "prevent" accidents from happening by spreading and encouraging safety-first ideas; by persisting in stricter adherence to the rules governing the workmen's own personal safety; to check up carelessness and disregard and to offset the pernicious evil habit of "taking chances" either in or out of the mines. In addition to the coal-mine regulation notices which are in evidence, safety-first notices in large letters are posted up in conspicuous places at the different collieries, printed in four languages, warning the workmen to strictly observe the rules and suggestions laid down for their guidance. Electric safety-bells are in operation at the entrance to Nos. 4 and 7 slope mines. The trip of cars coming out or going in the mine causes the bells to ring, thereby warning the passer-by of approaching danger.

No. 4 MINE, COMOX.

William Walker, Manager; Robert Adamson, Overman, No. 1 Slope; Charles Parnham, Overman, No. 2 Slope; James Quinn and Charles O'Brien, Shiftbosses; Sidney Horwood, Alfred Jones, Hugh M. Davidson, Peter Myers, Richard H. Hodson, Daniel P. Marsh, John Liddle, William Beveridge, Louis Franchesini, Robert Reid, Norman W. Huby, John C. Brown, H. King, D. P. Marsh, Thomas Lewis, A. W. Watson, Fred Hutchison, John Bennie, and John Taylor, Firebosses.

This mine consists of two slopes with one main entrance. No. 1 slope is 7,000 feet in length, running due north. No. 2 slope is 9,000 feet in length, running N. 45° E. These slopes diverge at a point about 75 feet from the main portal. The electric haulage-engine is so connected that trips can be run simultaneously on both slopes to a point where both slopes converge to the main opening.

The men are conveyed from the bottom of these slopes in a man-trip at the end of each working-shift. A safety-car is connected to the rear car of the empty trip, which ensures the workmen's safety while riding up the slopes.

This car was invented and made by Robert Turnbull, blacksmith, Union Bay, one of the company's employees. It is a credit to the ingenuity of the maker for its simplicity of construction, strength, and safety. A demonstration of the action of the car was given to all the miners one afternoon at 3 o'clock. Complete satisfaction was manifested by all officials and employees present at the safety-car's efficiency of action. The test was made with twelve loaded cars. It has been in use for the past eight months and is giving the best of satisfaction.

The ventilation is produced in this mine by a Sullivan reversible fan driven by a 350-horse-power motor, direct-coupled, running at 245 r.p.m., and capable of delivering 196,000 cubic feet of air a minute, against a 7-inch water-gauge.

This mine has been in continuous operation during the year. Safety-lamps of the Wolf type are used by the firebosses; electric lamps of the Edison storage-battery type are used by all the other employees. Where blasting is done only permitted explosives are used and fired by electric battery. During the month of November an average of 11 tons of coal was obtained with 1 lb. of explosive.

No. 1 Slope.

Electricity is used as the motive power to operate all pumps, winches, and coal-cutting machines. A long-wall system of mining coal has been established in part of the West side workings of No. 4 slope. Undercutting is done by a Sullivan type of coal-cutting machine. Miners digging coal by the long-wall system also work in this section. Loaders are employed to load out the machine-mined coal. Certificated miners supervise the timbering and general safety of the loaders. Pillars are also extracted from the upper left of East side section. Formerly this seam was all worked by the pillar-and-stall system.

In the East side of No. 4 slope the pillar-and-stall method is in practice. A Sullivan type of coal-cutter does the undermining. The seam throughout this mine varies from 3 to 7 feet in thickness.

Haulage from the faces is done by drivers with mules to No. 4 slope. A winch situated at the top of this slope, on No. 15 West level, attends to the delivery of cars. A 5½-ton Ironton storage-battery locomotive is used for hauling on above level to the bottom of the Main slope, the source of supply. A recharging apparatus has been installed in above level, so that when necessary the motor can be run into the station and recharged.

During my last inspection in December I measured 27,540 cubic feet of air a minute passing into this part of the mine, divided into two splits.

In No. 1 split there was 11,000 cubic feet of air a minute passing for the use of fifty men and five mules, or an average of 169 cubic feet of air for each unit employed. Ventilation, roadways, and timbering were, in general, good and sections fairly free from coal-dust. I found a little gas in the roof at the face of No. 1 slant and in first left place off same, No. 4 West level, and gas-caps of ¼ inch in three places off No. 1 East level and five places off No. 4 West level. No shooting was being done.

In No. 2 split there was 12,540 cubic feet of air a minute passing for the use of fifty-five men and six mules, or an average of 171 cubic feet of air for each unit employed. The ventilation was fairly good, roadways in fair condition, timbering good, and sections fairly free from

coal-dust. I found a gas-cap varying from ⅛ to ¼ inch in No. 20 West pillars. No blasting is permitted in this section of the mine.

No. 2 Slope.

The long-wall system of mining coal is in practice in New slope off No. 20 East level. Miners dig the coal at present, but mining-machines will follow later. Extraction of pillars is conducted in the remainder of the mine, with the exception of No. 15 East level, where by driving a slope preparations have been made to reach some coal which so far has not been touched. The seam in this mine varies from 3 to 7 feet in thickness.

The haulage system is much similar to that which obtains in No. 1 mine, except the motor. A line of wood stoppings is to be built to shut off all the abandoned workings in the East side of the mine, leaving the pillars to be worked, and new work developed outside of this point.

It is proposed to substitute the present fan with a Sirocco one capable of delivering 300,000 cubic feet of air a minute. There is working at present a new electric-driven machine-gun for forcing cement on the face of the ventilating stoppings in both slopes. This will have the effect of reducing the leakage through these stoppings and considerably augment the quantity of air to be found at the bottom of the slopes.

During my last visit of inspection of this mine I measured 31,000 cubic feet of air a minute passing into this part.

In No. 1 split there was 6,000 cubic feet of air a minute passing for the use of twelve men and a mule, or an average of 400 cubic feet of air for each unit employed.

In No. 2 split there was 20,000 cubic feet of air a minute passing for the use of fifty-five men and eight mules, or an average of 253 cubic feet of air for each unit employed. I found the ventilation and timbering good, roadways in fairly good condition, and sections fairly free from coal-dust.

A ⅜-inch gas-cap was found in No. 16 East pillars, and a small quantity of gas in No. 15 pillars off No. 18 East level; the place was fenced off. Also a little gas in roof-cavity of No. 2 place, New slope, off No 20 East level.

I made Burrell gas-detector tests in the various returns, with the following results: No. 1 split return, No. 1 slope, in 21,600 cubic feet of air a minute passing there was 1.2 per cent. methane; No. 2 split return, No. 1 slope, in 10,000 cubic feet of air a minute passing there was 1.9 per cent. methane; in No. 2 slope return there was 30,000 cubic feet of air a minute passing with 1.7 per cent. methane; in the main return near the fan there was 160,000 cubic feet of air a minute passing with 0.7 per cent. methane.

No. 5 MINE, COMOX.

John L. Williams, Manager; Robert Brown, Overman; Frank Crawford, Shiftboss; Duncan Thomson, Thomas Eccleson, Samuel Jones, William Devoy, Thomas Shields, James Brown, John E. Spicer, William Harmison, James Monks, and William J. Keenan, Firebosses.

The workings of this mine are reached by a shaft 280 feet deep. Electricity is used for hoisting, winch-driving, pumps, coal-cutting machines, and operating Main level 6-ton motor, trolly-connected. A 5½-ton Ironton motor has recently been installed on level 1,000 feet in length at foot of No. 2 dip. A recharging-station has been fitted up on the level. Formerly mules were used to haul the coal.

All the workings at present are in the Upper seam. Long-wall and pillar-and-stall systems are employed. Sullivan type of coal-cutters are principally used in stalls. Depth of undercut, 6 feet; height of seam varies from 2 feet 6 inches to 7 feet. Inclination of seam varies from horizontal to 6°. Coal-loading from the machine-cut face is done by loaders supervised by certificated miners.

In the long-wall the coal getting and loading is done by certificated miners and helpers. Firebosses do the shooting in both cases. No blasting is done without the use of cable and electric battery. Only permitted explosives are allowed. Electric safety-lamps of the Edison type are mostly used. Firebosses use safety-lamps of the Wolf type. Part of the output is produced by extraction of pillars.

During my last inspection of this mine I measured 30,000 cubic feet of air passing into the West side tunnel, divided into two splits.

West Split.—There was 12,000 cubic feet of air a minute passing for the use of twenty-six men and two mules.

East Split.—There was 12,000 cubic feet of air a minute passing for the use of twenty-four men and three mules.

No. 1 Dip Section.—I found 30,240 cubic feet of air passing down this slope. There was 16,000 cubic feet of air a minute passing for the use of twenty-four men and two mules. General conditions of mine good. I found a little explosive gas at face of No. 4 West level crosscut off No. 1 dip. The sections were free from coal-dust.

No. 2 Dip Section.—There was 11,200 cubic feet of air a minute passing for the use of thirty-four men and five mules. General conditions of mine good. I found no gas and sections were free from coal-dust.

The following represents the quantities of air passing in the different return airways of No. 5 mine, also the percentages of methane in air obtained with Burrell gas-detector; East side split, 14,000 cubic feet a minute, methane 0.3 per cent.; West side split, 9,600 cubic feet a minute, methane 0.2 per cent.; West side No. 1 dip, 23,914 cubic feet a minute, methane 0.2 per cent.; No. 2 dip, *nil;* main return at fan, 100,800 cubic feet a minute, methane 0.1 per cent.

No. 6 Mine, Comox.

John L. Williams, Manager; Thomas Mordy, Overman.

There has been no coal hoisted from this mine during the year. Practically all the water made in both Nos. 5 and 6 mines is hoisted from No. 6 shaft by specially constructed tanks capable of delivering 1,200 gallons of water a minute. During my last inspection I measured 24,000 cubic feet of air a minute entering this mine. I found no explosive gas. Timbering and roadways were in fair condition.

No. 7 Mine, Comox.

John G. Quinn, Manager; James L. Brown, Overman; William Herd, Watkin Williams, and Robert Walker, Firebosses.

The workings of this mine are reached by a slope 2,000 feet in length, dipping about 6°. An electric hoist attends to the hauling. The mine has been operating all year. Upper seam is worked. It is confined to solid workings off New slope at end of No. 3 East level, 4,100 feet from Main slope. Longwall and pillar-and-stall systems of working. Seam varies in height from 30 inches to 7 feet. Inclination varies from horizontal to pitch of about 6°.

Electricity is chiefly used for haulage and drainage purposes. Compressed air is slightly used. The output of coal for each day has been doubled within the last month. A Sullivan-Rand mining-machine is being introduced, which is adapted for undercutting coal in stalls or long-wall. Length of cutting-bar, 4½ feet.

The fan producing ventilation for this mine is a double-inlet Sirocco 9 feet in diameter, driven by a 350-horse-power motor, speed 240 r.p.m., direct-connected. Quantity of air produced, 110,000 cubic feet a minute; water-gauge, 6 inches.

Electric safety-lamps of the Edison type are used exclusively. The firebosses use a Wolf safety-lamp. Only permitted explosives are used for blasting rock or coal, and fired by a cable and electric battery.

During my last inspection I found 29,000 cubic feet of air a minute passing near head of New slope off No. 3 East level for the use of forty-five men and four mules. The general conditions of the mine are good. Found no gas and sections free from coal-dust.

I measured the quantity of air entering the fan-drift and obtained 100,800 cubic feet a minute. Test made with Burrell gas-detector registered 0.1 per cent. of methane.

The following are the official returns from the Comox Collieries for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	278,489			
" export to United States	93,277			
" " other countries				
Total sales		371,766		
Sales to employees	5,428			
Used under colliery boilers, etc.	5,919			
Lost in washing	79,186			
Total for colliery use		90,533		
		462,299		
Stocks on hand first of year	11,357			
" last of year	4,972			
Difference taken from stock during year		6,385		
Output of collieries for year		455,914		

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	57		34		91	
Whites—Miners	186				186	
Miners' helpers						
Labourers	98		100		198	
Mechanics and skilled labour	46		145		191	
Boys	13		14		27	
Japanese	78		1		79	
Chinese	350		190		540	
Indians						
Totals	828		484		1,312	

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.

Pacific Coast Coal Mines, Limited.

SUQUASH COLLIERY.

Samuel D. Wark, Manager.

This colliery is situated about 12 miles west of Alert Bay, on Vancouver island. It has been idle since the latter part of the year 1914. At the beginning of June, 1920, operations were started to dewater this mine and get everything in readiness for again operating. This work has been progressing steadily during the year. The roadways are being cleaned and retimbered throughout the mine. No coal has been mined for shipment during the year, but sufficient has been mined to supply the colliery boilers and for household purposes for the employees.

The underground work, cleaning up and timbering, has now almost reached completion. Beginning early in the new year, it is expected that a vigorous policy of development and construction will be inaugurated. A second opening will be driven to tap the seam on a grade of 1 in 6 and wide enough for two tracks to accommodate an endless-rope system of haulage. Simultaneously with the driving of the slope a modern tipple and washery will be erected, also wharves, bunkers, and railway.

The development done at this mine to date is as follows: A shaft 6 by 10 feet in the clear is down 170 feet, with a midwall between. One compartment is used for hoisting and also serves as downcast, and the other compartment is used for an upcast. Parallel levels are driven from the shaft-bottom; one pair N. 45° W. and the other pair S. 45° E. The North-west levels have been driven approximately 500 feet. The South-east levels have been driven a distance of 1,200 feet, and long-wall exclusively has been opened out in this level; there being twenty-six places ready for operating on this face. Two hundred feet from the shaft, on the South-east levels, a pair of slopes are driven N. 45° E. for a distance of 1,700 feet. On the same level, 800 feet from the shaft-bottom, another pair of slopes have been driven N. 45° E. for a distance of 750 feet.

The coal is of excellent quality, is very hard, and practically smokeless. The thickness of seam averages about 6 feet.

Permanent installations at this colliery are as follows: One Goldie-McCulloch high-pressure boiler, 100 horse-power; two Goldie-McCulloch high-pressure boilers, 150 horse-power each, have been installed and foundations are in place for two more; a pair of winding-engines, 24- by 36-inch cylinders and 9-foot drum; permanent buildings, covering all machinery installed, have been erected; and superintendent's residence and a model bunk-house of thirty-six rooms have been erected. There are also ten four-roomed houses, ten two-roomed houses, and a large store building. Telephone communication is established with the wireless station at Alert Bay.

A generator and engine have been installed to furnish light for the buildings of the plant and dwellings. The ventilation of the mine is produced by a steam-driven Sheldon fan, 4 by 2½ feet, making 125 revolutions a minute.

During my last visit of inspection to this colliery I found it being reopened. Part of the mine had been dewatered, roadways cleaned up and timbered. The ventilation was fair and I found no gas.

The following are the official returns from the Suquash Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada				
" export to United States				
" " other countries				
Total sales				
Used in making coke				
Used under colliery boilers, etc.	125			
Total for colliery use		125		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during year				
Output of colliery for year		125		

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	9.00	1	9.00
Whites—Miners	2	6.08			2	6.08
Miners' helpers	1	6.08			1	6.08
Labourers			1	5.55	1	5.55
Mechanics and skilled labour			1	6.44	1	6.44
Boys						
Japanese						
Chinese						
Indians						
Totals	3		3		6	

Name of seams or pits—Suquash No. 1 mine, No. 1 seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—One shaft 6 by 10 feet, with midwall, one side for hoisting and one side for ventilation. From shaft-bottom two levels are driven south-east for a distance of about 1,200 feet; 100 feet from the shaft-bottom two slopes are driven down a distance of about 1,200 feet north-east. About 500 feet from the shaft-bottom another pair of slopes are driven paralleling the above slopes for a distance of 790 feet. The seam is from 6 to 7½ feet in thickness, of good quality, and very hard, being practically smokeless and giving off great heat.

Description and length of tramway, plant, etc.—Two 150-horse-power return-tubular boilers; one 100-horse-power return-tubular boiler; one pair duplex winding-engines, 24- by 36-inch cylinders, with 9-foot conical drums equipped with safety overwinding device, steam-reverse and steam-brake; one electric generator for surface lighting; one donkey-engine with vertical boiler attached; one ventilating-fan producing 14,000 cubic feet of air a minute; two duplex pumps, capacity 50 gallons each. Pit-head and screening arrangement capable of handling 200 tons daily.

NORTHERN INSPECTION DISTRICT.

REPORT BY THOS J. SHENTON, DISTRICT INSPECTOR.

Telkwa Collieries Co., Ltd.

Officers.	*Address.*
W. A. Woodland, President,	Prince Rupert, B.C.
J. K. Ashman, Vice-President,	Smithers, B.C.
T. McClymont, Secretary,	Prince Rupert, B.C.
John Gillespie, Superintendent,	Telkwa, B.C.

TELKWA COLLIERY.

This mine was operated for a period of five months during the year, with an average of three men employed each day, and an output for the same period of 1,400 tons of coal. With respect to conditions of operation, I am pleased to say that the same was in accord with the "Coal-mines Regulation Act." The property has been leased by the company to John Gillespie, former superintendent for the company.

The following are the official returns from the Telkwa Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	1,400			
" export to United States				
" " other countries				
Total sales		1,400		
Used in making coke				
" under colliery boilers, etc.				
Total for colliery use				
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } stock during the year				
Output of colliery for year		1,400		

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						
Whites—Miners	3				3	
Miners' helpers						
Labourers						
Mechanics and skilled labour						
Boys						
Japanese						
Chinese						
Indians						
Totals	3				3	

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my first annual report as Inspector of Coal-mines for the Nicola-Princeton Inspection District during the year 1920.

The companies operating in this district during the year were the Middlesboro Collieries, Limited; Coalmont Collieries, Limited; Princeton Coal and Land Company, Limited; the Fleming Coal Company, Limited; Thompson Valley Coal Company, Limited; and the Harvard Coal Company, Limited.

Mining operations have been suspended by the Harvard Coal Company during the year. A large amount of work has been done by the Coalmont Collieries during the year, chiefly in the construction of surface plant and the installation of machinery and equipment preparatory to commencement of operations of the aerial tramway for conveying the coal from the mine to the tipple to supersede the motor-trucks. A fair amount of development and construction work has been done during the year by the Chu Chua Mine Syndicate.

There have been two accidents reported during the year; one proved fatal and one serious. The fatal accident occurred at the Middlesboro Colliery, No. 7 mine, owing to a cave of roof-rock swinging the timbers. The other happened outside of the mine at Chu Chua, where a workman fell from a scaffold of about 6 feet and sustained serious injuries.

The various mines have not been worked to capacity during the year and there has been a fair amount of idle time. The mining companies evidently depend upon the local trade rather than to compete outside the district. Next year the Coalmont Collieries should become a large producer, which should make a big increase in the output of coal for this district.

During the year inspections on behalf of the workmen, as provided for by section 91 of the Act, have been made at all the larger mines, and the conditions as reported have been found to be very favourable and no reports have been made as to the existence or apprehended existence of any danger.

MINE-FIRES.

Mine fires at some of the older mines have been a serious source of trouble in this district, having been experienced at the Nos. 4 and 7 mines of the Middlesboro Collieries, Limited, Princeton No. 1 mine, and the Fleming Coal Company's No. 3 mine, Coal Hill. During the year 1920 we have been somewhat fortunate in having no new outbursts, with the exception of Coal Hill No. 3 mine, where an old fire that had been sealed off sprang into activity, which necessitated the mine being abandoned and sealed off; however, the life of the mine was very limited and the small amount of coal in the pillars did not warrant any work being done to save it.

The coal-seams in this district are very susceptible to spontaneous combustion, and any slack coal or crushed pillars left in the gobs are subject to heating and may soon spring into activity. These mine fires are extremely hard and costly to deal with owing to the soft nature of the coal. In but few cases is the sealing-off successful to the extent of extinguishing the fires.

It seems unfortunate that there has not been more attention given to this source of trouble, and surely we will receive some knowledge from these costly and dangerous experiences. The chief object in view should be to obtain a system of ventilation and mode of working that will tend to eliminate this destructive and dangerous element.

The Edison electric mine safety-lamp is in general use for the workmen at the Middlesboro, Princeton, and Coal Hill mines, while open lights are being used by the workmen at Coalmont and the Chu Chua mines.

The mines are examined by certified officials with locked safety-lamps. The Coalmont Collieries have Edison safety-lamps on order, which will be installed immediately upon arrival.

MINE-RESCUE WORK.

The standard of the mine-rescue work in this district is not of a high standard, with the exception of the Government station at the Middlesboro Collieries, which is well maintained. The condition of the apparatus and the lack of interest taken does not approach anything that one would desire. The rescue apparatus which has been established by the different mining companies is of the Draeger type, but is not maintained in an efficient and workable condition for immediate use.

The Government station situated at the Middlesboro Colliery is kept in a high state of efficiency, and great credit is due to the caretaker, Mr. Stone, for the care and attention taken in this station.

While there are a number of employees around the various mines that have taken a course of training, there seems to be a lack of supplementary training, so as to be in a condition to make efficient use of apparatus in case of need.

I am pleased to report that first aid was well maintained during the year. Classes were held in Merritt under the tuition of Dr. Gilles, with a good attendance. There is a great deal of credit due to the members for the time and the interest taken in first-aid work.

I wish to take this opportunity of thanking the workmen and officials of the various mines for the manner in which they have received me in this district, and can assure them that it has been a source of pleasure to find that they have been ever ready to co-operate with me in carrying out my duties as Inspector of Mines. We all should have one object in view, and that is to operate the various mines in a safe and efficient manner, as it is only by this means that we can expect to prevent accidents.

Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, $1,107,700.

Officers.	*Address.*
E. W. Hamber, President,	Vancouver, B.C.
G. S. Raphael, Vice-President,	Vancouver, B.C.
Thomas Sanderson, Managing Director and Secretary,	Vancouver, B.C.
C. M. O'Brian, Treasurer,	Vancouver, B.C.
Robert Fairfoull, Mine Manager,	Middlesboro, B.C.

Value of plant, $250,000.

MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This colliery is situated 1 mile west of the Merritt Railroad Station and is served with a branch line from the Kettle Valley Railway. The mines operating during the year were the Nos. 4, 4 East, 4 East prospect, and No. 7 mine.

No. 4 MINE.

James Fairfoull, Overman; George Hudson, William Hallinan, Thomas Archibald, Robert Drybough, and Louis Clark, Firebosses.

This mine is the most extensive of the Middlesboro Collieries and is reached by an horizontal rock tunnel crossing the measures cutting the Nos. 4, 6, 8, and 9 seams. Only the Nos. 6 and 8 seams are at present being operated, which have been connected to the surface at the croppings for ventilation purposes. The method of working is the pillar and stall, pillars being left 50 feet square and the stalls being driven 10 feet wide.

These seams lie at an angle of 25° and are about 6 feet thick. Chutes are used for conveying the coal from the various faces to the levels, where it is loaded into mine-cars, which are collected by horses and taken out to the surface by the means of main and tail haulage.

During the year the mining has been chiefly connected with the extraction of pillars, while the Main level has been driven through the fault at No. 8 and proved the seam. The coal is mined by hand and blasted when required, permitted explosives and electric detonators being used.

Ventilation is produced by a double-inlet Sheldon fan 8½ feet in diameter, driven by an Ideal 14 by 18 steam-engine, and is constructed so that the air-current can be reversed if required. At my last inspection it was producing 42,000 cubic feet of air a minute for the use of seventy-two men and three mules. Speed, 120 revolutions a minute, with a 0.5-inch water-gauge; barometer, 27.95 inches; thermometer, 34° F.

The ventilation of this mine I have always found to be good and have not been able to find a trace of explosive gas during my inspections. The mine is free from dangerous accumulations of coal-dust. The working-places and roadways are kept in good condition, while a good supply of suitable timber is provided convenient for the workmen.

No. 4 EAST MINE.

A. D. Allan, Overman; R. S. Brown, Fireboss.

This mine is situated a short distance to the east of the portal of No. 4 mine and is developed by means of a pair of slopes driven from the outcrop of the No. 4 seam. These slopes have not been driven during the year owing to the faulted nature of the ground. Mining at present is restricted to driving a pair of headings, the work being somewhat of an exploratory nature. The seam in this mine lies at varying angles of inclination and the method of work is pillar and stall. The method of haulage underground is by compressed-air hoist and mules to the Main slope and by steam-hoist to the surface.

The ventilation is produced by a small quick-running fan of the Sirocco type, 4 feet in diameter, driven by a steam-engine. At the time of my last inspection it was producing 14,400 cubic feet of air a minute for the use of eleven men and two mules, running at a speed of 300 revolutions a minute, with a 0.25-inch water-gauge. Barometer, 29 inches; thermometer, 50° F.

The roads and working-places were well timbered and a good supply of suitable timber was provided for the workmen. This mine is free from dangerous coal-dust. Explosives are used when required, which are of the permitted type. Electric detonators are used for firing shots under the supervision of certified shotlighters.

No. 4 EAST PROSPECT.

This mine consists of a small area of the No. 4 seam lying behind a fault, with the croppings between Nos. 4 and 4 East mines. Slopes have been driven from the surface, striking the coal at a distance of 80 feet. The method of work is by pillar and stall, and owing to the limited area of the ground, mining is restricted to the driving of a Main level and counter.

The ventilation I have always found to be very good, the roads and working-places to be well timbered, a good supply of suitable timber provided for the workmen, and free from dangerous coal-dust. Explosives are used in this mine when required and are of the permitted type. Electric detonators are used for firing shots under the supervision of certified shotlighters.

No. 7 MINE.

Andrew McKendrick, Overman; Thomas Rowbottom, David Crawford, and Matthew McKibben, Firebosses.

This mine is situated in Coal gully at an elevation of 400 feet above the entrance to No. 4 mine and tipple. This seam is generally considered to be the No. 4 seam and is about 15 feet in thickness, of which the upper 8 feet is being worked and is overlain by a sandstone roof. The method of work is by pillar and stall.

The mine is developed by a pair of slopes driven directly to the dip, which is about 25° west, and at present reach a distance of 2,000 feet. During the present year mining has been carried on only in connection with the drawing of pillars. The coal that is worked to the raise is generally conveyed from the working-faces by chutes to the mine-cars, and by compressed-air hoists from the dip-workings to landings near the Main slope, and to the surface by means of a compressed-air hoist.

The ventilation is produced by a small fan of the Guibal type, driven by a small compressed-air engine. I have always found the ventilation to be very good and no signs of explosive gas have been found.

At my last inspection I found 18,000 cubic feet of air a minute passing into this mine for the use of twenty-three men. Speed of fan, 150 revolutions a minute; water-gauge, 0.4 inch. Barometer, 27.55 inches; thermometer, 34° F.

The working-places and roadways were well timbered and a plentiful supply of suitable timber was provided for the workmen. The mine is naturally damp and free from dangerous accumulations of coal-dust.

Blasting is carried out at all the mines under the supervision of competent persons as provided for in the "Coal-mines Regulation Act." All lamps in use by the workmen are the Edison electric safety-lamp. The officials are provided with safety-lamps of the Wolf type for inspection purposes.

During the latter part of the year preparation has been made for the development of the No. 5 seam on each side of Coal gully. A hoist has been erected and the track laid from near the entrance of No. 7 mine down the side of the hill, and at present there are two rock tunnels being started from each side of the gully.

The coal from the No. 7 mine is brought down a 3-way incline by 2-car trips to a common tipple in cars having a capacity of 1.5 tons, where it is unloaded into a Phillips crossover dump; a switchback and a creeper take the empty cars back, where they are arranged into trips for distribution to the different mines. The coal passes to a shaking screen which allows the small coal to pass into a hopper; the lump passes over a picking-table, where the rock and waste are picked out before being loaded into railroad-cars. A Christy box-car loader is used for loading box cars.

The main power-plant, which is situated near the tipple, consists of four return-tubular boilers with a capacity of 600 horse-power. Compressed air is supplied by a Canadian Rand cross-compound compresser having a rated capacity of 2,200 cubic feet of free air a minute for driving hoists, fans, and pumps. Well-equipped machine, car-repair, and carpenter shops are maintained, besides offices and dwellings for the employees.

Copies of the "Coal-mines Regulation Act," special rules, systematic timbering rules, and plans of the mines are posted near the entrance to the various mines.

A well-equipped mine-rescue station is maintained at the Middlesboro Colliery, where, in addition to their own rescue apparatus, that of the Department of Mines is kept in a high state of efficiency.

The following are the official returns from the Middlesboro Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR THE YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	83,059			
" export to United States				
" " other countries				
Total sales		83,059		
Used in making coke				
Used under colliery boilers, etc.	4,445			
Total for colliery use		4,445		
		87,504		
Stocks on hand first of year	36			
" last of year	134			
Difference added to stock during year		98		
Output of colliery for year		87,602		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		
Supervision and clerical assistance	12		5		17	
Whites—Miners	48	7.00-12.00			48	
Miners' helpers	20	5.00			20	
Labourers	42	5.00-6.00	22	4.80-5.25	64	
Mechanics and skilled labour			16	5.50-6.40	16	
Boys			8	2.50	8	
Japanese						
Chinese						
Indians						
Totals	122		51		173	

Name of seams or pits—As no new mines were opened in 1920, operations are still confined to No. 4 mine, No. 4 East mine, and No. 7 mine.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 4 mine: Access to the various sections of this mine is gained by an horizontal level first driven in a portion of the No. 5 seam, then by crosscut tunnels to the Nos. 4, 8, and 6 seams. These seams are about 6 feet thick, pitching south at an angle of about 25°. The method of working is pillar and stall. The coal is usually conveyed from the working-faces by chutes to the mine-cars, then by mules and compressed-air hoists to the tipple. Ventilation is provided by a double-inlet Sheldon fan 8½ feet in diameter, driven by an Ideal 14 by 18 steam-engine. The fan is built so that the air-current can be reversed and is capable of producing an air-current of 90,000 cubic feet of air a minute, against a 4-inch water-gauge. No. 4 East: This slope is situated about 1,200 feet to the east of the tipple. Mining in this mine is restricted to the driving of a main heading and counter in the No. 4 seam. Haulage underground is by compressed-air hoists and mules, then by steam-hoist to the surface. No. 4 East prospect: A small area of coal near the outcrop of No. 4 East being inaccessible from the No. 4 East workings, an entrance was made on the surface connecting with the coal at 80 feet distance. The method of working is pillar and room, the seam being No. 4. No. 7 mine: No changes have been made in or around this mine during the past twelve months, mining being carried on only in connection with the withdrawal of the pillars.

Description and length of tramway, plant, etc.—No additions or changes have been made to the surface plant during the past year; the coal, as in former years, being brought to the surface to a common tipple in cars having a capacity of 1.5 tons, then dumped by a Phillips crossover dump, a switchback and car-haul bringing back the cars for distribution to the different mines. A Christy box-car loader is used for loading the box cars. The main power plant is situated near the tipple and consists of four return-tubular boilers, each 150 horse-power. Compressed air is supplied by a Canadian Rand cross-compound compressor with a rated capacity of 2,200 cubic feet a minute. Electricity for charging Edison lamp-batteries and for lighting purposes is generated by a 27½-k.w. generator. There is also a well-equipped machine-shop, car-repair and carpenter shops, and training-station for mine-rescue work. Water for household and power purposes is supplied from wells sunk near the Coldwater river, these wells ensuring a supply of good water for both purposes.

The Fleming Coal Company, Ltd.

(FORMERLY THE INLAND COAL AND COKE COMPANY, LTD.)

Head Office—Vancouver, B.C.

Officers.	*Address.*
Joseph Martin, President,	315 Credit Foncier, Bldg., Vancouver, B.C.
Joseph Graham, Managing Director,	Merritt, B.C.
A. L. Welch, Secretary-Treasurer,	404 Drake Street, Vancouver, B.C.
A. E. Smith, Manager,	Merritt, B.C.

COAL HILL COLLIERY.

No. 3 MINE.

A. E. Smith, Manager; John T. Brown, Overman; John Smith, Geo. Maxwell, and George Walker, Firebosses.

This colliery is situated south-west of the Middlesboro Colliery, at an elevation of 500 feet above it, and is served by a branch of the Kettle Valley Railway. The mine is sunk on the No. 3 seam at a point about 500 feet higher up the hill than the Middlesboro Colliery, which is the same as that worked at the No. 7 mine, Middlesboro.

A crosscut tunnel extends from the No. 3 seam to the No. 5 seam and both have been worked during the year. The No. 3 seam is about 12 feet thick, while the No. 5 seam is about 5.5 feet; both are worked by the pillar-and-stall method. The pitch varies from 20 to 30°, which allows the coal to be brought from the faces to the levels by means of chutes. During the year all the work has consisted in the extraction of pillars.

Unfortunately, at the latter part of the year a fire which had been sealed off for a number of years revived, when it was found necessary to abandon this mine and seal up the slopes.

Conditions with respect to ventilation and gas I have generally found to be very good. All working-places were well timbered and a sufficient supply of suitable timber was always provided for the workmen.

No. 2 MINE.

A. E. Smith, Manager; John T. Brown, Overman; Geo. Maxwell, John Smith, and Jim Simm, Firebosses.

This mine was opened up the latter part of the year, and is situated about 400 feet west of the entrance of the No. 3 mine; it is being developed by slopes which have been driven a distance of 500 feet, showing a good seam of coal about 6 feet in thickness, intersected with 1 foot of rock and bone, dipping from 20° to 30° S.W.

This seam is being developed by the pillar-and-stall method, the pitch of the seam allowing the coal to be brought from the faces to the levels by means of chutes.

This mine is at present being ventilated by a small direct-coupled Sheldon fan producing about 7,000 cubic feet of air a minute, and preparation is being made to install an Aloes fan, 50,000-cubic-feet capacity, driven by a 60-horse-power steam-engine, which will be operating early in January.

Conditions with regard to ventilation at this mine have been fairly good and no explosive gas has been reported. All the working-places are well timbered and plenty of timber was provided convenient for the use of the workmen. The mine is fairly free from coal-dust.

The coal is all mined by hand. The explosives used are of the permitted class and all shots are fired with electric detonators under the supervision of certified officials. The haulage is at present by hand from the foot of the chutes to the Main slope, where the coal is hoisted to the surface by a steam-hoist. From the top of the slope the cars are lowered in trips to the top of a gravity-plane, which lowers them to the tipple. This gravity-plane consists of a 3-rail track with a passing at the centre, 1,800 feet long, handling 6-car trips, each car having a capacity of 1 ton, using a 1-inch rope on a Stine wheel.

The lamps used in this mine are either Edison electric safety-lamp or the Wolf safety-lamp.

The power plant consists of two Leonard-type boilers with a joint capacity of 80 horse-power, furnishing steam for the hoists, fan-engine, and lighting plant. An auxiliary plant at the tipple consists of one small 25-horse-power boiler which furnishes steam for a small hoist at the tipple and a pump for delivering water at the mine. Another small boiler is situated near the river which furnishes steam for the pump, which delivers the water to a tank at the tipple. The other surface equipment consists of machine, carpenter, car-repairing shop, and office buildings.

The following are the official returns from the Fleming Coal Company for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	30,487			
" export to United States				
" " other countries				
Total sales		30,487		
Used in making coke				
" under colliery boilers, etc	1,635			
Total for colliery use		1,635		
Stocks on hand first of year	100			
" last of year	100			
Difference { added to / taken from } stock during year				
Output of colliery for year		32,122		

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	6.50	2	5 50	6	
Whites—Miners	24				24	
Miners' helpers						
Labourers	6		20	4.50	26	
Mechanics and skilled labour	4		5	5.50	9	
Boys						
Japanese						
Chinese						
Indians						
Totals	38		27		65	

Name of seams or pits—Nos. 2, 3, and 5 seams.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 2 seam was discovered several years ago and a certain amount of development-work done, but was suspended when No. 3 seam was opened up. A new slope has been sunk now almost 600 feet deep on the pitch, levels are broken away every 200 feet, and the usual room-and-pillar system developed from the levels. The entire output is now being won from the seam, which is 6½ feet thick, with a very good roof and floor. No. 3 seam was only worked for the extraction of

pillars, but in October, on it showing signs of an underground fire, it was completely shut down, and also No. 5 seam, which is connected with No. 3 seam.

Description and length of tramway, plant, etc.—The plant consists of two 40-horse-power Leonard boilers; two Beatty boilers, 12 horse-power. Hoisting-engine is an Ottumwa 60 horse-power, with other auxiliary hoists. The fan has a capacity of 30,000 cubic feet and is run by a 60-horse-power Ideal engine, providing excellent ventilation. The gravity-tramway is 1,800 feet long to the bunkers, which hold 400 tons. The coal is carefully picked and cleaned and then loaded by hand. Ninety per cent. of the output goes to the Canadian Pacific Railway and Kettle Valley Railway.

Coalmont Collieries, Ltd.

Head Office—Coalmont, B.C.

Capital, $3,000,000.

Officers.	*Address.*
W. J. Blake-Wilson, President,	Vancouver, B.C.
W. L. Parrish, Vice-President,	Winnipeg, Man.
A. H. Douglas, Secretary-Treasurer,	Vancouver, B.C.
Donald McLean, Manager,	Coalmont, B.C.

COALMONT COLLIERY.

Donald McLean, Manager; Alex. Bryden, Overman; John McMurtrie and Thomas Bysouth, Firebosses.

Coalmont is situated on the Kettle Valley Railway, 170 miles east of Vancouver and 12 miles west of Princeton, at an elevation of 2,400 feet above sea-level. Mining operations are being conducted on the south-western slope of the mountain about 5 miles from the town of Coalmont, on the north bank of Granite creek, at an elevation of about 3,600 feet and 1,600 feet above the valley of the Tulameen river at Coalmont.

This mine has been operated during the whole of the year. As the coal has been brought from the mine by auto-trucks to the railway siding at Coalmont, a distance of about 5 miles, the output of the mine has been limited to the capacity of the trucks. During the year there has been a large staff of workmen employed, chiefly in the construction of surface plant, aerial tramway, and installation of machinery and equipment for the production of coal on a large scale.

DEVELOPMENT.

The principal work done during the year has been the extending of No. 2 level on the No. 2 seam, which is about 10 feet thick, and may be classed as bituminous coal of good steaming and coking qualities. This level is at an elevation of 3,764 feet and has been driven a distance of 3,250 feet from the portal. A large amount of work has been done to this level during the year by way of straightening, renewing timber, ditching, grading, and relaying track at a 3-foot gauge with 30-lb. steel. All work has been opened to the rise of this level and the method of work is by pillar and stall. The mine is divided into panels, so that in case of fire it will be more easily controlled. The counter-level is driven about 100 feet above the level and raises 12 feet wide are driven to the full inclination of the seam, which is about 20° W. The main raise strikes the croppings at a distance of 660 feet, from which the No. 1 level has been started. The coal is conveyed from the faces by means of chutes to the mine-cars on the level, where it is taken by horse-haulage to the surface.

The mine-workings are ventilated by a fan manufactured by the American Blower Company and is capable of producing 38,000 cubic feet of air, with a 1-inch water-gauge, which is greatly assisted by the natural ventilation produced by the mine. Upon my last inspection I found 11,970 cubic feet of air a minute passing through this mine for the use of ten men and two horses. Barometer, 26 inches; thermometer, 32°; water-gauge, 0.2 inch.

During my inspections I have not been able to find any trace of explosive gas and the mine is well timbered throughout. A good supply of timber is provided for the use of the workmen,

and due to the nature of the coal the mine is very free from coal-dust. All explosives used are of the permitted class, shots being fired by electrical detonators by certified officials.

To the east of the No. 2 tunnel, a distance of 330 feet, a pair of large tunnels, 8 by 12 feet, known as the Wilson tunnels, are being developed, and at present are driven a distance of 825 feet. They are strongly timbered by sets up to 20 inches diameter. In driving these a large amount of wet ground was encountered and bridging and spilling had to be adopted; at present they are fairly dry. This tunnel is ventilated by means of 12-inch pipes connected to a force-fan driven by a small steam-engine and provides ample ventilation. Eighty feet below the No. 2 tunnel an airway has been prepared where the fan is situated and is connected with the workings of No. 2 level. Development-work is being directed, following the strike of the measures to the centre of the basin towards the Coalmont side of the mountain, to enable the mine to be opened from that side, and when that is done the transportation problem will be solved.

PLANT AND EQUIPMENT.

The only power used at this mine is a 20-horse-power vertical boiler generating power for driving the fan. The coal is lowered by means of a gravity-plane from the portal of No. 2 tunnel to the terminal of the aerial tramway, where the body of the car, which has a capacity of 1 ton, is lifted from the frame and automatically attached to a rail directly connected to the tramway. This tramway is about 3 miles in length and is provided with towers supporting a 1½-inch locked coil steel rope over which the buckets run, attached by means of grips to a ½-inch endless rope running at a speed of about 4 miles an hour. This tramway is provided with an auxiliary hoist which may be used in case of need, but very little power is required, seeing that the difference in the elevation of the terminals is about 1,600 feet.

At Coalmont, where the main power plant is situated, a power-house is under construction and is equipped with two water-tube boilers, fitted with induced draught, duplicate pumps, and feed-water-heating attachments; these boilers have cross-drum and horizontally inclined tubes and may be considered to be very economical for a modern steam plant. At the power-house a 600-kw. electric generator has been installed with transformers; the current is taken over high-tension wires to the mine at a voltage of 10,000 volts, where it is reduced to 550 volts for use at the mine.

The tipple, which is situated at the lower terminal of the tramway, is provided with automatic detacher and attacher, the buckets running by gravity to the dump and emptying into a chute connected to a Marcus screen which is at present provided for making three sizes of coal.

ACCOMMODATION FOR EMPLOYEES.

At the town of Coalmont there are about twenty cottages for the accommodation of the employees and their families, also an excellent hotel; the business office is also situated here. At the mine a new mess-house 32 by 36 feet has been constructed and includes store, kitchen, and dining-room; it is comfortably furnished, well equipped, and steam-heated.

A large and commodious rooming-house to accommodate seventy-two men is under construction and will be furnished to accommodate two men in each room, single beds being provided. The rooms will be steam-heated and electric-lighted. The company will supply the furniture and bedding as a precaution to ensure cleanliness and comfort of employees. Near the entrance to the rooming-house and connected by a passage a large and commodious wash-house is being erected, electric-lighted and steam-heated, and provided with shower-baths, wash-basins, with hot and cold water; also lockers which are steam-heated and a large lavatory which includes every convenience.

CARPENTER, MACHINE, AND BLACKSMITH SHOPS.

These shops, which are situated near the mine-tracks, are being well equipped and provided with modern machinery; at present they are being used for car building and repairing. The machine and blacksmith shop is being provided with two forges, steam-hammer, large lathe, planer, pipe-threading machine, etc.

At present open lights are being used at this mine, generally carbide-lamps. The inspection of the mine is made by certified officials with locked safety-lamps of the Wolf type, and, as already stated, no trace of methane has been found in this mine. Edison electric safety-lamps are on order and will be installed as soon as received.

MINE-RESCUE APPARATUS.

The mine-rescue apparatus maintained at this mine is of the old negative type and is not in a satisfactory condition, and in case of need would be useless and not in a fit condition to be used. There is a good supply of first-aid equipment provided for immediate use.

Copies of the "Coal-mines Regulation Act," special rules, and plans are kept posted near the entrance to the mine.

The following are the official returns from the Coalmont Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	5,801			
" export to United States	2,702			
" " other countries				
Total sales		8,503		
Used in making coke,				
Used under colliery boilers, etc.	480			
Total for colliery use		480		
Stocks on hand first of year	1,000			
" last of year	1,000			
Difference {added to / taken from} stock during year				
Output of colliery for year		8,983		

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	6.50	4	6.50	8	
Whites—Miners	22	7.50			22	
Miners' helpers	2	5.75			2	
Labourers	6	5.50	14	5.50	20	
Mechanics and skilled labour			6	6.75	6	
Boys	2				2	
Japanese						
Chinese						
Indians						
Totals	36		24		60	

Name of seams or pits—Wilson tunnel No. 3 and No. 2 tunnel.

Description of seams, tunnels, levels, shafts, etc., and number of same—Seam now being mined, average thickness 10 feet; No. 1 level driven 300 feet; No. 2 level driven 3,200 feet; No. 3 level driven 800 feet; all in same seam. Seam being mined, fourth seam under 12 feet of sandstone. Aggregation of seams immediately under seam mined averages 80 feet in thick-

ness. Total aggregation, 160 feet thick. Seam 300 feet below above aggregation 12 feet in thickness. All seams conformable.

Description and length of tramway, plant, etc. Tram in No. 1 level, 300 feet; tram in No. 2 level, 3,400 feet; tram in No. 3 level, with yard, 1,900 feet; aerial tram, 2¼ miles. Plant at mine: One upright tubular boiler, 22 horse-power; one Jenck's tubular boiler, 42 horse-power; one 200-horse-power, 550-volt, 3-phase, 60-cycle G.E. induction-motor; one 50-horse-power, 550-volt, 3-phase, 60-cycle Canadian Westinghouse induction-motor; one 30-horse-power, 550-volt, 3-phase, 60-cycle Westinghouse motor; one compressor, 1,055 cubic feet a minute. At Coalmont: Two water-tube boilers, 250 horse-power each; one Corliss cross-compound condensing-engine, 600 horse-power; one generator, C.G.E., 3-phase, 60-cycle, 550 volts, 480 amperes, 150 r.p.m.

Princeton Coal and Land Company, Ltd.

Head Office—15 Great St. Helens, London, E.C.

Capital, $1,000,000.

Officers.	*Address.*
A. St. George Hamersley, Chairman,	London, Eng.
E. S. Neave, Secretary,	London, Eng.
Ernest Waterman, General Manager,	Princeton, B.C.
Francis Glover, Manager,	Princeton, B.C.

Value of plant, $77,000.

PRINCETON COLLIERY.

Francis Glover, Manager; William James, Overman; Robert Gourley, Ben. J. Barlow, and Thomas Leeman, Firebosses.

This colliery is situated near the right side of the Similkameen river, about half a mile from the town of Princeton, and is developed by a pair of slopes driven in a south-western direction, dipping at an angle of 14° and reaching the coal about 200 feet from the portal.

The coal-seam averages about 20 feet in thickness, dipping to the south at an angle of 12° to 14°. The work until the present year was chiefly confined to the upper 10 feet of the seam, while during the present year a large portion of the output has been extracted from the lower part of the seam.

Mining of the coal during the development stage is done by machines of the post-puncher type, driven by compressed air, but when retreating the coal is easily extracted without the machine, the method of work being the pillar-and-stall system; during the year the work has chiefly consisted in the extraction of pillars. The only development-work done during the present year may be said to consist of a pair of diagonal slopes which are being driven to the west of the Main slopes at a distance of 750 feet from the portal of the Main slope. It is the intention to drive these below the present workings and open the mine up by the pillar-and-stall method, leaving a panel of coal between each section so that in case of fire it will easily be dealt with.

Ventilation is produced by a small fan of the Guibal type, driven by a small steam-engine, and at my last inspection was producing 21,000 cubic feet of air a minute for the use of ten men, running at a speed of 200 revolutions a minute, with a 0.5-inch water-gauge. Barometer, 27.75 inches; thermometer, 32° F.

The method of haulage in the mine is by means of small compressed-air hoists, while the cars are hoisted to the surface by means of a steam-hoist situated near the tipple.

Fortunately, during the present year there have been no new outbursts of fire in this mine and a considerable amount of fluming has been done with sand and water near the entrance to the fire areas, and permanent stoppings have been built which seem to be very effective in sealing off these sections of the mine.

During my inspections I have always found this mine to be very free from explosive gas. On several occasions I have found a little black-damp at the foot of stoppings near the fire areas, which generally indicates a leakage in the wall, and is remedied as soon as the defect is repaired.

The roads I have generally found to be in a fairly good condition and free from coal-dust. The working-places are well timbered, as required by the special rules, and a sufficient supply of suitable timber is provided for the workmen. Blasting is carried out at this mine under the supervision of competent persons, as provided for by the "Coal-mines Regulation Act." All lamps in use are the Edison electric mine safety-lamp for the workmen, while safety-lamps of the Wolf type are used by the officials for inspection purposes.

The surface equipment consists of a modern screening plant capable of handling about 600 tons of coal in eight hours. The mine-cars, which have a capacity of about 1.5 tons, are hauled up the Main slope in 5-car trips by a steam-hoist situated near the tipple. The cars are dumped by a rotary tipple-dump upon a reciprocating feeder which regulates the coal, which then goes to a jigging-screen, where the coal is cleaned and made into different sizes or grades, the various grades being taken to different bunkers by belt-conveyors having a joint capacity of about 400 tons. The tipple machinery is driven by a 50-horse-power steam-engine, while the loader and conveyor are driven by a separate engine.

The power plant consists of three return-tubular boilers with a combined capacity of 200 horse-power; a Canadian Rand compressor with a capacity of 750 cubic feet of free air a minute providing air for the mining-machines, hoists, and pumps; a 60-kw. 3-phase alternator, driven by a Goldie-McCulloch steam-engine, supplying light for the mine and the town of Princeton. During the latter part of the year this electric-light plant has not been in operation, as this company is at present taking power from the Kootenay Power and Light Company, having connected its lines with the power-lines of the above company at Allenby.

Well-equipped machine-shop, car-repairing and carpenter shop, wash-house, and lamp-room are maintained, and a 30,000-gallon water-tank is provided for fire-protection and other purposes.

Unfortunately, on December 23rd a destructive fire broke out and destroyed the tipple, link-belt screens, bunkers, and rotary dump; this is at present being replaced by a temporary tipple, bar screens, and rotary dump which are expected to be in operation about the middle of January.

Copies of the "'Coal-mines Regulation Act," special rules, "systematic timbering" orders, and plan of the mine are kept posted near the entrance to the mine.

The following are the official returns from the Princeton Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	15,616			
" export to United States	1,464			
" " other countries				
Total sales		17,080		
Used in making coke				
" under colliery boilers, etc	3,836			
Total for colliery use		3,836		
		20,196		
Stocks on hand first of year	232			
" last of year	33			
Difference taken from stock during year		199		
Output of colliery for year		20,717		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
				$		
Supervision and clerical assistance	4		5	5.50	9	
Whites—Miners	14	$6-$10			14	
Miners' helpers	5	5.25			5	$5.25
General underground men	15	$5-$5.25	7	4.85	22	$4.85-5.25
Mechanics and skilled labour			7	5.80	7	5.80
Boys			2	$2-$3	2	
Japanese						
Chinese						
Indians						
Totals	38		21		59	

Name of seams or pits—Same as last year.

Description of seams, tunnels, levels, shafts, etc., and number of same—Same as last year, with the exception that new slopes have been started off in a westerly direction from a point approximately 750 feet down the present Main slope.

Description and length of tramway, plant, etc.—Approximately same as last year. On December 23rd a disastrous fire destroyed the tipple, link-belt screens, bunkers, and rotary dump. This has been replaced with a temporary tipple, bar screens, and Robinson rotary dump, and picking-tables will be installed as soon as possible. The electric-light plant is not now operating, as the company is taking power from the West Kootenay Power Company, having linked up with their line at Allenby. The origin of the surface fire was reported by the Chief Government Fire Inspector to be spontaneous combustion.

Chu Chua Mine Syndicate.

Officers.	*Address.*
W. H. Glass, Trustee,	Seattle, Wash.
H. W. Schuett, Trustee,	Seattle, Wash.
David Brown, Superintendent,	Chu Chua, B.C.

CHU CHUA COLLIERY.

David Brown, Manager; John Sullivan, Fireboss.

This mine is situated east of the North Thompson river, 55 miles north of Kamloops and about 1 mile from the Canadian National Railway. It may be described as comprising the whole of the foot-hills and flats from the Newhykulston creek to the Chu Chua depot, a distance of nearly 3 miles.

There are three small seams outcropping on the side of the hill, the upper one of which is at present being developed. The workings consist of a level and counter driven on the strike of the seam a distance of about 200 feet and connected by crosscuts. The measures are dipping north-east at an angle of about 20°, and upon my last inspection slopes were being started off the Main level to prove the measures to the dip.

All the coal is mined by compressed-air machines of the post-puncher type. This seam being overlain by sandstone, it is the intention to develop this mine by the long-wall system. The coal is brought out of the level by hand and dumped into a 2-chamber bunker provided with screening-bars having a capacity of about 100 tons; from the bunker the coal is transported by teams to a railroad spur a distance of 1 mile.

The mine is at present being ventilated by a small Sirocco fan, driven by a small compressed air-engine, which produces ample ventilation.

SURFACE PLANT.

The surface plant consists of one locomotive-type steam-boiler of 44 horse-power, which is used for driving a 10 by 10 single-stage compressor for running the fan and mining-machines. A cook-house and several small one-room cottages are provided for the employees; also office, blacksmith-shop, and stables.

During my inspections I have found no trace of explosive gas and the mine is very well timbered. Plenty of timber is provided for use by the workmen.

This mine is at present using open lights, generally carbide-lamps, Wolf lamps being used for testing.

The coal is of a firm nature and is blasted with a permitted explosive, all shots being fired with electric detonators under the supervision of a certified shotlighter. The mine is very free from coal-dust.

This mine is well provided with first-aid appliances and copies of the "Coal-mines Regulation Act" are posted near the entrance of the mine.

The following are the official returns from the Chu Chua Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	232			
" export to United States				
" " other countries				
Total sales		232		
Used in making coke				
Used under colliery boilers, etc.	75			
Total for colliery use		75		
Stocks on hand first of year				
" last of year				
Difference { added to / taken from } Stock during the year				
Output of colliery for year		307		

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	9.00			2	
Whites—Miners	7	7.00			7	
Miners' helpers	2	5.50			2	
Labourers			2	4.50	2	
Mechanics and skilled labour			2	6.00	2	
Boys						
Japanese			1	4.00	1	
Chinese						
Indians						
Totals	11		5		16	

Name of seams or pits—No. 1 seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—An adit level which starts from outcrop on Newhykulston creek is in a distance of 225 feet on the strike of the seam, running N. 5° E., and a counter-level in a distance of 200 feet crosscuts on 60-foot centres; seam pitching 25°. Coal-seam, 3 feet thick, with 3 inches of rock in the centre and a sandstone roof. Good domestic and steam coal.

Description and length of tramway, plant, etc.—Coal is dumped into bunkers of 80-tons capacity at the opening of adit level, and then hauled by teams a distance of half a mile to siding on Canadian National Railway for shipment to Kamloops. A tramway will be built during 1921. Plant consists of one 44-horse-power boiler, locomotive type; one compressor, capacity 270 cubic feet of free air a minute; one steam-electric plant for lighting and power to drive fan, with a total capacity of 75 kw.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT OF ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report covering the operation of all coal and metalliferous mines in the Kootenay-Boundary District during the year ending 1920.

This district is subdivided into two portions for the purpose of inspection—namely, the East Kootenay and the West Kootenay and Boundary Inspection Districts.

The East Kootenay District was in the early part of the year under charge of William Lancaster, who was unfortunately killed in an auto accident while proceeding from his office in Fernie to Coal Creek mines about the end of May. In August John McDonald, of Middlesboro, was appointed to succeed Mr. Lancaster. The West Kootenay and Boundary District has been under the charge of H. H. Johnstone, with office in Nelson, during the entire year.

Through the unfortunate accident to Wm. Lancaster the Department of Mines lost a very valuable servant, while I personally lost a colleague who through his general knowledge of mining and his very intimate knowledge of the many intricate problems relating to this district was of invaluable assistance in carrying out the many duties which devolve on the Inspectors.

EAST KOOTENAY DISTRICT COAL-MINES.

No new collieries were opened during the year, nor was any attempt made to reopen either the Carbonado Colliery at Morrissey, owned by the Crow's Nest Pass Coal Company, Limited, or the Hosmer mines at Hosmer, belonging to the Canadian Pacific Railway, Natural Resources Department, which mines have been idle for some years. The collieries operated were Coal Creek and Michel, owned by the Crow's Nest Pass Coal Company, Limited, of Toronto, and Corbin, owned by the Corbin Coal and Coke Company, Limited, Spokane, Washington, U.S.A.

The colliery at Coal Creek consists of seven mines, all of which were in operation during the year; that at Michel consists of three mines, all of which worked during the year; while at Corbin the No. 4 mine worked during the whole year, but the No. 3 mine (open-cut) was stopped, both in the beginning and at the end of the year, owing to trouble with the heavy snowfall, which made it difficult to operate the steam-shovel by which the coal is extracted and loaded. The Nos. 5 and 6 mines at Corbin, which are in the prospecting stage, were worked in a small way during the entire year with very promising results.

In the early part of the year there was a slight shortage of labour, while at the latter end the supply was greater than the demand; the closing of sawmills and logging camps and the end of the harvest season probably accounting for the influx.

With the exception of a few days' stoppage in March and two weeks' stoppage in October, the mines worked fairly steadily throughout the year. The first stoppage was incidental to the conclusion of an agreement between the employees, as represented by the United Mine Workers of America, and the employers, represented by the Western Coal Operators' Association, and the stoppage in October was over some further adjustment of the wages paid to day-men in and around the mines.

The agreement entered into between the United Mine Workers of America and the Western Coal Operators' Association covers the period of two years from April 1st, 1920, to March 31st, 1922, and covers all the mines in Alberta and Eastern British Columbia.

Attached to this report is a short list of the wages paid to the workmen in and around the mines, taken from the agreement on the basis of an eight-hour day.

The amount of time lost during the year amounted to about fifty-six days; this represents quite a large sum when we take into account the number of workmen employed. If we take the average wage at $5 a day, which is pretty low, the amount of money lost through this stoppage of work will amount to $442,960.

Consideration should be given to the fact that no proper provision is made for granting annual vacations in mining to the workmen, and I think that if some study was given to this subject it would tend to stabilize the trade and create a better feeling between the employees and employer.

The following table shows the output of coal in long tons as reported to this office, the amount of increase over the previous year, and the number of days worked:—

Colliery.	Output of Coal.	Increase over 1919.	Days Worked.
	Tons.	Per Cent.	
Coal Creek	431,783	41	279
Michel	264,592	53	281
Corbin	151,014	89	291
Totals	847,389	55	...

The amount of coke produced during the year was 67,792 tons, showing an increase of almost 18 per cent. All the coke was produced from the ovens at Michel, of which only about 50 per cent. are in operation, while those at Fernie have not been in use since April, 1919.

The following table shows the output of coal for each underground employee and each miner for the year and daily during the past three years:—

Colliery.	1918. Underground Employees.		1919. Underground Employees.		1920. Underground Employees.	
	Per Year.	Per Day.	Per Year.	Per Day.	Per Year.	Per Day.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Coal Creek	816	3.3	497	2.48	408	2.4
Michel	791	3.0	542	2.64	782	2.7
Corbin	2,066	7.3	1,225	6.90	1,987	6.8

Colliery.	1918. Miners only.		1919. Miners only.		1920. Miners only.	
	Per Year.	Per Day.	Per Year.	Per Day.	Per Year.	Per Day.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Coal Creek	1,742	7.0	972	4.86	1,277	4.6
Michel	1,638	6.0	993	4.80	1,310	4.6
Corbin	3,647	12.8	2,658	15.10	2,157	7.4

The figures of output per man per day in Corbin are high and reflects the system of mining, which is by steam-shovel at the open-cut and in the mine by allowing the pillars to cave.

ACCIDENTS.

Thirteen accidents were reported during the year, involving death or serious disability to fourteen workmen. There were three fatalities among the accidents reported and eleven persons seriously injured.

Two of the accidents with fatal results occurred in Coal Creek Colliery—one in No. 1 East mine and the other in No. 1 North mine. One accident with fatal results occurred at Michel in the No. 3 East mine.

Causes of the accidents were as follows:—

Colliery.	Falls of Coal at Face.	Falls of Rock at Face.	Haulage.	Timbering.
Coal Creek	1*	1*	3	..
Michel	2	1*	4	..
Corbin	..	..	..	2

*Fatal.

Of the above, six occurred at the working-face and include the three which ended fatally, six on the roadways, and two outside the mine.

The accidents according to occupation are as follows: Fireboss, 1; miners, 4; miner's helper, 1; trackman, 1; drivers, 3; motorman, 1; trapper, 1; tipple-boy, 1; carpenter, 1; total, 14.

The rate per thousand of fatal accidents is 1.89, and as compared with the previous year reflects a considerable increase.

In the fatal class there was an increase from one to three and in the serious class an increase from six to eleven; and while we have to admit that the mines during 1920 were in operation about two months more than in 1919 the figures would almost seem to indicate a relaxing of the discipline around the mines, and especially at the working-faces.

Coroners' inquests were held in the case of all fatal accidents. At these the Department was represented by the Inspector of Mines, and through the courtesy of the Coroner he was allowed to examine any witnesses whom they thought could throw any light on the cause of the accident; reports on these accidents were made immediately following the inquest.

The first fatal accident, which occurred to Frank Disgusto in the No. 1 East mine at Coal Creek Colliery on February 26th, occurred through the lack of a proper sprag at the working-face. The deceased, who was working as a helper to two certificated miners, was allowed to go in and shovel some loose rock under an overhanging piece of top coal to which a post had been put, but which required a sprag or stay; the result was that the coal fell outwards, fatally injuring the deceased.

The second occurred to Matthew Turnbull, fireboss in No. 1 North mine, Coal Creek Colliery, on March 15th, and in this case the deceased, who was on duty, recklessly and despite the protests of the miners in the place, who had been instructed by the overman how to proceed with the work, commenced to withdraw timbers without using a timber-drawing machine, as required by Special Rule 115 (*f*), with the result that the place caved, burying him.

The third fatal accident occurred to Louis Nagy in No. 3 East mine, Michel Colliery, on April 17th. The deceased was engaged taking a slice off a pillar; some coal had been extracted from the loose end without any timber being placed, and, according to the evidence of his working partner, the deceased was barring down a piece of loose roof rock; when this piece of rock was about to fall he ran under it notwithstanding that it was impossible to get out that way, instead of retreating to the safety of the working-place, where the roof was secured by timber.

The other two serious accidents at the working-face were likewise due to lack of sufficient spragging.

Two of the haulage accidents were due to trips of cars smashing through doors set up to control the ventilation, and would suggest that some means of opening doors should be provided that would not require the person in charge to have to go out on the haulage-road for this purpose, more especially where boys have more than one door to attend.

The other accidents inside the mine consist of a motor attendant falling off the motor, drivers thereby getting their legs injured between the car and a door or the car and the shafts of the horse.

The two accidents outside the mine consisted of one at Coal Creek, on the tipple, where a boy engaged in carrying checks to the weighman was run down by a trip of loaded cars pushed

ahead of the compressed-air locomotive, and would seem to indicate the necessity for a more frequent use of some method of warning, more especially when the trips are being pushed ahead of the locomotive. The other accident outside the mine occurred to a carpenter who fell off a scaffold while repairing a snow-shed.

When we consider the large percentage of accidents from falls of coal and roof at the working-face, some method of impressing on the workmen the necessity of setting sufficient supports to the roof and sides becomes apparent.

VENTILATION.

The general condition of the mines with respect to ventilation is fairly well treated in the detailed report made by Inspector McDonald and attached, although in some cases I think greater advantage of splitting the air-current, and more care could be taken in regard to conducting the air-current into rise places and holes in the roof, in order to prevent the accumulating of bodies of inflammable gas in such places.

For the purpose of determining the conditions of the air-currents with respect to methane and other gases, advantage was taken of the opportunities offered by the Dominion Department of Mines for analysing air samples, for which we are very much indebted. Three hundred and seventy-nine samples, of which thirty-two were lost either in transit or otherwise, were secured and sent for analysis. Of these, 206 were taken in Coal Creek, 169 in Michel, and four in Corbin. In addition, the Burrell gas detector was used to great advantage in determining the percentage of methane in the various splits and main return airways.

I am attaching tables showing the average percentage of methane, as well as the average percentage of mine-air measured in cubic feet a minute; also a comparison with the two preceding years and the amount in cubic feet of methane given off to the ton of coal mined.

An increase will be noted in some cases, and in others a decrease; the increase is not surprising when we consider that the mines are penetrating farther into the mountains, leaving greater areas of exposed surface.

In the case of the West split in No. 1 East mine, Coal Creek, this increase amounts to almost double what it formerly showed, but it must be taken into account that this district is only being reopened after the serious disturbance in 1916, when the "bump" created havoc.

In the No. 3 East mine, Michel Colliery, a very decided increase is noted in the West split, where the average percentage has risen from 1.61 to 1.74. In this case the increase seems to be due more to the area of ground exposed and roof conditions than to the actual mining of coal.

A rather interesting feature in this mine was noted during the time the mine was idle in October. A sample of the air in this (West) split was taken eight days after work was discontinued and showed 1.99 per cent. of methane. Another sample taken at the same place and under similar conditions, except that the mine had been working for twelve days, showed 1.39 per cent. of methane, which would seem to indicate that the methane is given off more from the areas exposed and roof conditions than due to actual mining of coal. In this particular district I might say that the work consists mostly of the extraction of pillars.

Similar samples were taken in No. 1 East mine, Coal Creek, but, owing to the speed of the fan having been reduced to about half the normal, could not be used for comparison.

Another interesting feature, which I think could be investigated to advantage, is the report of the analyst made in in regard to the samples from No. 3 East mine, Michel Colliery, which states: "In every sample of mine-air from this mine traces of free hydrogen are found, which, although negligible unless in the case of high percentage of methane, might increase the danger by rendering the gas more easy to explode."

No new ventilating apparatus has been installed during the year at any of the mines, although at least two fans have been on the ground at Coal Creek since 1917.

COAL-DUST.

During our inspections we have had occasion, all too frequently, to impress on the management the necessity of dealing effectively with this danger.

Methods of sprinkling the roadways and the working-faces are installed in nearly all the mines which are not naturally damp or free from dust, but too often these are given a secondary consideration. Flue-dust barriers are erected and then forgotten, and unfortunately in most cases these are built in such a manner as really to be of very little service should the occasion arise for arresting or stopping the flame of an explosion.

I feel that no effort should be spared to maintain these mines free from dust, and in cases where water is not available non-combustible dust should be used liberally, not simply thrown on the roads and sides, but distributed all over by machines as are now available for this purpose.

One feature which is very hard to overcome is that, while officials are willing to admit the dangers from coal-dust, they never seem willing to admit danger from the dust in their particular mine. The only means that can be taken to overcome this would be to have some method of sampling the dust at regular intervals, and the resultant analysis to be posted at the mine entrance.

BUMPS AND BLOW-OUTS.

No fatal or serious accidents have been reported from this source during the year, although in the latter part minor bumps have been reported rather frequently in the No. 1 East mine, Coal Creek. These have mostly occurred in the West district or tunnel, where the bumps were experienced in 1916, and so far the disturbances have been limited to destroying about 100 feet of roadways in each case.

In several cases bumps have been felt outside the mine, alarming the residents of the village at Coal Creek, but inspection of the mine has failed to reveal any serious damage. The bumps which have occurred fortunately took place when the workmen were absent, or we might have to record a longer accident list.

The nature of the disturbance seemed to follow the regular course, the floor being thrown upwards and the sides of the pillars being squeezed out into the open space, in some cases completely blocking the roadways. Timbers are thrown out with considerable violence and in some cases cogs built to secure the roof have followed a like course.

I should like to see some investigation to clear up the matter of these "bumps," and I feel that the sooner we dismiss all obscure or illusive theories as to their cause, and recognize the fact that the weight of the overhead strata is the determining factor, we will be on the road to find the remedy. This may be aggravated by weaknesses in the strata, but we must remember that the present workings are under 2,435 feet of strata representing a weight of 187 tons per square foot under normal conditions; and the conditions at this mine are far from normal, the mountains being open on the north, while deep gashes cut up each side, leaving them, as has been described by the Provincial Mineralogist, "almost like a lever supported at one end."

A few bumps were reported in the No. 3 mine, Coal Creek, in the early part of the year; these were in the proximity of a fault which may have contributed to the result, but as this seam is directly under the No. 1 East mine and separated only by about 150 feet of strata, no doubt exists but that the same conditions apply as in the No. 1 East mine, and whenever the seam is weakened by the extraction of a certain percentage of coal we have a bump. Considerable gas was given off, especially in the No. 3 mine, and can be accounted for by the pillars being thrust into the floor, which is composed of rock and coal.

In one case a miner was imprisoned for a short time, but I am glad to record that he used very good judgment and remained in the safety of his working-place, and when the disturbance subsided he managed to get out. In this case I think the use of the Edison electric lamp was a very important factor; if he had carried a safety-lamp, in all probability it would have been extinguished, or if damaged would have been a danger in the gas, whereas with the electric lamp he still had a light and was able to extract himself later.

Outbursts of gas, generally termed "blow-outs," have occurred quite a number of times in the No. 1 East mine, Coal Creek, the largest of which took place in the month of May, dislodging between 200 to 800 tons of coal and rock. These come generally from the overhead strata, which consists of about 3 feet of rash (shale) and 3 feet of roof coal which is timbered up, and lies between the main rock roof of the seam and the coal extracted. This rash is very soft and friable and when allowed to come down is almost impossible to separate from the coal, which is the reason for leaving these strata.

In determining the amount of coal and other material dislodged by the blow-outs, all this top rash and coal comes down owing to the timbers being blown out, making it very hard to estimate what is thrown out by the outburst and what is brought down by the disturbance of the timbers. The amount of gas (methane) given off is also very hard to estimate, but the amount of coal, etc., dislodged, and the fact that the blower continues to blow for hours, can give some idea that the quantity is enormous.

The method of drilling to prevent these outbursts has been fairly successful in the places to which it was applied, but these were only the development places, and the majority of outbursts which occurred during the year were in crosscuts or places which do not ordinarily come in this category. Under such conditions it is needless to point out the necessity for well-kept airways of large areas and powerful fans with ample margins of capacity to cope with these abnormal conditions.

INSPECTION ON BEHALF OF THE WORKMEN.

The inspection as provided for by section 91, Rule 37, has been carried out regularly at all the mines, and no occasion has arisen when a report was required to be sent to this office. This inspection is a great help to us in maintaining safer conditions, and we are very much indebted to the workmen for doing so.

PROSECUTIONS.

Fifteen prosecutions have been made during the year, eight of which were due to workmen having matches in their possession contrary to section 91, Rule 9; four for failing to sprag the undermined coal, Special Rule 115; one owing to the workman having exposed himself to unnecessary danger, Special Rule 112; and two for fighting in the mine contrary to Special Rule 110. Of these prosecutions, eight were for offences in Coal Creek, one in Michel, and two at Corbin.

The punishments inflicted were: Five were fined $10 and six were fined $5, two were allowed to go on suspended sentence, one fled the country, and one case was dismissed.

The sentences in none of the cases erred on the side of severity, and especially in the case of persons having matches in their possession, when we consider the danger to which the workmen are exposed in mines with such great percentages of explosive gas, a penalty of $5, and in one case that of being dismissed on suspended sentence, are altogether too lenient.

A list showing the names, mines, and offences committed, with the sentence imposed, is attached to this report.

HAULAGE.

The haulage in the large majority of the mines is either by ropes or compressed air, and the only place where electricity is used underground is at Corbin, where a drill is run in a rock tunnel by this power.

The cars are brought to the partings from the working-faces by horses, and the following table shows the number of the latter employed:—

Colliery.	Inside Mine.	Outside Mine.	Total.	Died from Injuries.	Died.
Coal Creek	109	10	119	5	8
Michel	32	8	40	4	1
Corbin	9	6	15	2	..
Total	150	24	174	11	9

All the horses are brought out to the stables, which are situated convenient to the mines, and are very well cared for.

LIGHTING.

All the miners at Coal Creek and Michel and about 50 per cent. of those working underground at Corbin use the electric head-lamp of the Edison mine safety type, and the only other light permitted underground is the Wolf safety-lamp. The latter is used by the bratticeman and officials for inspection purposes, while the Burrell gas-detector is used for determining lower percentages of gas than can ordinarily be detected in the mine-air with the Wolf safety-lamp, as required by section 91, Rule 4, of the "Coal-mines Regulation Act."

The returns show 1,096 electric lamps in use and 120 Wolf safety mine-lamps, all of which are cleaned, repaired, and inspected before being issued to the workmen, in substantial lamp-rooms convenient to the mines.

EXPLOSIVES.

The total explosives used in the coal-mines of the Crowsnest pass was 22,729 lb., or 11,364 tons (2,000 lb.). The following table shows how they were used:—

Colliery.	Explosive.	Quantity.	Shots fired.	Amount per Shot.	Work used for
		lb.		lb.	
Coal Creek	Permetite	1,130	1,548	0.73	Rock-work.
Michel	"	646	687	0.94	"
"	Monobel	12,578	18,023	0.70	Coal.
Corbin	Permetite	2,762	2,620	1.00	Rock-work.
"	Monobel	2,513	2,472	1.00	Coal.
"	Stumping powder	3,100	126	24.60	"

NOTE.—The stumping-powder used at Corbin was in the open-cut, frequently to shoot off the cover and sometimes to loosen up the coal for the steam-shovel.

No explosives were used in breaking down coal at Coal Creek mines; in Michel the amount of coal produced per pound of explosive was about 20 tons and at Corbin 28.7 tons.

COAL-CUTTING MACHINES.

Owing to the friable nature of the coal very few machines are used and the amount of coal produced by these amounts to 11,819 long tons. One machine of the post type produced 245 tons at Coal Creek and four at Michel produced 11,574 tons.

At Corbin the steam-shovel is used at the No. 3 mine or open-cut for both digging and loading the coal, but it is not generally termed a coal-cutting machine.

MINE-RESCUE AND FIRST AID TO THE INJURED.

The work of mine-rescue training has made very little progress at Coal Creek mines, as only five workmen took some training; all of these previously held certificates. At Michel, thanks to the grant given by the Hon. the Minister of Mines, which allowed us to appoint a temporary instructor there, nine workmen took a course in this work.

The following shows the proportion of men trained in mine-rescue work compared with the number employed underground:—

Colliery.	No. employed Underground.	No. holding Mine-rescue Certificates.	Ratio.
Coal Creek	648	35	1 : 18
Michel	338	18	1 : 18
Corbin	76	6	1 : 12.6

The amount of mine-rescue apparatus maintained at the collieries is similar to that reported for the past few years, all consisting of the Draeger type. The following is a list of types, with amount of oxygen on hand:—

Colliery.	Draeger Positive, 2-hour.	Draeger Negative, 2-hour.	Draeger, ½-hour.	Oxygen.
				Cu. Ft.
Coal Creek	5	..	5	700
Michel	5	..	5	100
Corbin	..	2	1	300

In addition to the above, there are at the Government station at Fernie six Gibbs and four 2-hour positive-type Draegers. In addition, there is one Paul which has been loaned from the Nanaimo station for testing purposes. There is also maintained on hand here 1,800 cubic feet of oxygen and 690 regenerators for the Draegers and ninety-eight regenerators for the Gibbs. The Gibbs apparatus is not fitted with a by-pass, and in the present condition of affairs it

would be a great advantage to all concerned if we could arrive at some standard for mine-rescue apparatus.

I think it is due to the coal companies, which have to purchase apparatus, that we could assure them a fair life for apparatus, and I should like to suggest that before coming to a conclusion on this point the new Briggs apparatus, the results of the investigation of the Research Committee of the British Coal Commission, should be inquired into.

When we consider the amount of time spent on investigation, the facilities for the same, and the eminence in mining affairs of the committee, I feel that we cannot dismiss this apparatus, practically the result of all their work, without due consideration.

The work of first aid to the injured has been carried out very well during the year; a class of twenty-two was in training in this work at Michel at the end of the year, while classes are being started at Corbin and Coal Creek, and in Fernie a class of forty-two started the other day. The following table shows the number trained, the number of employees, and the ratio of first-aid men to total employees.

Colliery.	No. holding First-aid Certificates.	No. of Employees.	Ratio.
Coal Creek	65	847	1 : 13
Michel	30	581	1 : 19
Corbin	17	152	1 : 9

Of the above, ten in Corbin and nineteen in Michel took certificates in mine-rescue work during the year.

Thanks to the financial assistance granted by the Vancouver Island Mine Safety Association and W. R. Wilson, president and general manager of the Crow's Nest Pass Coal Company, two teams, one from Michel and the other from Fernie, were able to attend the mine-rescue and first-aid meet at Ladysmith on Labour Day, which materially assists in maintaining the interest in this work.

Thirteen examinations held for the purpose of granting coal-miner's certificates of competency were attended, in addition to the examinations for coal-mine officials. One hundred and thirty-five applications were considered for provisional certificates of competency as coal-miners, of which eighty-four were granted, as provided for in section 9 of the "Coal-mines Regulation Act Amending Act, 1919."

In conclusion, we wish to thank the workmen and the officials of the various mines for their hearty assistance in carrying out our duties during the year, and trust for a continuation of the same in 1921, realizing that it is only through an earnest endeavour to co-operate that we can make any attempt to make conditions safer and pleasanter in what is admittedly a dangerous occupation.

Attached is a list of the accidents reported during the year, prosecutions, tables showing the percentages of methane, etc., also a brief description of the various coal-mines by John McDonald, Inspector of Mines for the East Kootenay District, accompanied by the returns from the various collieries.

LIST OF WAGES PAID AS PER THE AGREEMENT BETWEEN THE WESTERN COAL OPERATORS' ASSOCIATION AND DISTRICT 18, UNITED MINE WORKERS OF AMERICA, INCLUDING THE INCREASE EFFECTIVE OCTOBER 25TH, 1920.

(Agreement from April 1st, 1920, to March 31st, 1922.)

Inside Wages.	Per Day of Eight Hours.
Shotlighter	$7 50
Bratticeman	7 50
Bratticeman's helper	6 89
Timberman	7 50
Timberman's helper	6 89
Tracklayer	7 50
Tracklayer's helper	6 89
Motorman	7 21
Motorman's helper	6 89

Inside Wages—Continued.	Per Day of Eight Hours.
Locomotive engineer	7 21
Locomotive switchman	6 89
Driver	7 21
Driver (spike team)	7 73
Coupler (man)	6 89
Coupler (boy)	4 40
Switch-boy	$4 03 to 4 40
Main- and tail-rope riders	7 50
Pusher	6 89
Loader	6 89
Miner	7 50
Rock-miner	8 02
Pumpman	6 89
Outside Wages.	
Teamster	$7 08
Blacksmith	8 14
Blacksmith's helper	7 09
Carpenter	8 14
Carpenter's helper	7 09
Fanman	6 58
Tipple engineer	7 61
Fireman (boiler)	7 08
Car-repairer	7 61
Car-repairer's helper	7 09
Lampman	$6 58 to 7 08
Machinist	$7 61 to 8 14
Machinist's helper	7 09
Stableman	6 58
All other labour not classified	6 58

AVERAGE PERCENTAGE OF METHANE IN THE AIR-CURRENTS OF THE COAL-MINES IN THE CROWSNEST PASS DISTRICT FOR 1918, 1919, AND 1920.

Colliery.	Mine.	District.	1918.	1919.	1920.
Coal Creek	No. 1 East	Main return	1.30	1.07	1.50
"	"	First East split	2.00	1.63	1.66
"	"	Second East split	....	....	1.37
"	"	North split	1.38	1.08	0.66
"	"	West split	....	0.43	0.96
"	No. 1 South	Main return	1.71	1.34	1.14
"	No. 3	"	0.90	1.23	1.17
"	"	South level	....	1.31	1.12
"	"	Incline split	....	1.42	1.38
"	No. 2	Main return	0.70	0.70	0.73
"	"	Rock Tunnel split	....	0.72	0.81
"	"	High Line split	....	0.48	0.63
"	No. B North	Main return	1.20	0.90	1.06
"	"	Slope split	....	1.06	1.08
"	"	Incline split	....	1.14	1.40
"	No. 1 North	Main return	0.50	0.44	0.37
"	No. 9	"	....	....	0.59
Michel	No. 3 East	"	1.10	1.20	1.44
"	"	No. 6 East split	0.70	1.04	0.95
"	"	West split	1.66	1.61	1.74
"	No. 3	Main return	0.69	0.71	0.78
"	"	East split	....	0.60	0.83
"	"	West split	....	0.44	0.76
"	No. 8	Main return	0.10	0.11	0.19
Corbin	No. 4	"	0.33	0.28	0.09

AVERAGE PERCENTAGE OF METHANE IN THE AIR-CURRENTS, ALSO THE AVERAGE AMOUNT OF VENTILATION IN CUBIC FEET A MINUTE IN THE MAIN RETURNS AND SPLITS OF THE MINES IN THE CROWSNEST PASS DISTRICT DURING 1920.

Colliery.	Mine.	District.	Ventilation in Cu. Ft. a Minute.	Percentage of Methane.
Coal Creek	No. 1 East	Main return	114,725	1.50
"	"	First South split	34,200	1.66
"	"	Second South split	18,127	1.37
"	"	North split	22,170	0.66
"	"	West split	17,122	0.96
"	No. 3	Main return	51,520	1.17
"	"	Incline split	23,075	1.12
"	"	South level split	18,623	1.38
"	No. B. North	Main return	40,000	1.06
"	"	Slope split	11,740	1.08
"	"	Incline split	13,510	1.40
"	No. 1 South	Main return	41,000	1.14
"	No. 1 North	"	19,060	0.37
"	No. 2	"	32,875	0.73
"	"	Rock Tunnel split	14,475	0.81
"	"	High Line split	8,220	0.63
"	No. 9	Main return	9,570	0.59
Michel	No. 3 East	"	88,230	1.44
"	"	No. 6 East split	27,270	0.95
"	"	West split	39,920	1.74
"	No. 3	Main return	54,000	0.78
"	"	East split	27,000	0.83
"	"	West split	32,000	0.76
"	No. 8	Main return	34,730	0.19
Corbin	No. 4	"	28,500	0.09

AMOUNT IN CUBIC FEET OF METHANE GIVEN OFF PER TON OF COAL MINED IN THE CROWSNEST PASS DISTRICT DURING 1918, 1919, AND 1920.

Colliery.	Mine.	1918.	1919.	1920.
Coal Creek	No. 1 East	5.389	4.925	6.192
"	No. 3	3.010	2.544	2.697
"	No. 1 South	1.917	1.796	1.867
"	No. 1. North	0.585	0.550	0.384
"	No. 2	1.716	1.491	1.360
"	No. B North	2.326	2.720	3.082
Michel	No. 8	0.145	0.130	0.211
"	No. 3 East	3.142	4.800	6.096
"	No. 3	5.186	2.253	1.732
Corbin	No. 4	0.360	0.245	0.136

AMOUNT OF METHANE GIVEN OFF IN THE TWENTY-FOUR HOURS IN THE MINES OF THE CROWSNEST PASS DISTRICT.

Colliery.	Mine.	Methane in Cu. Ft.
Coal Creek	No. 1 East	2,476,800
"	No. 3	868,320
"	No. 1 South	672,480
"	No. 1 North	102,240
"	No. 2	345,600
"	No. B North	610,560
"	No. 9	82,080
Michel	No. 8	95,040
"	No. 3 East	1,828,800
"	No. 3.	606,240
Corbin	No. 4.	37,440
Total		7,725,600

Crow's Nest Pass Coal Company, Ltd.

Capital, $3,500,000.

Officers.	*Address.*
W. R. Wilson, President,	Fernie, B.C.
E. C. Whitney, Vice-President,	Ottawa, Ont.
R. M. Young, Secretary,	Fernie, B.C.
A. Klaner, Treasurer,	Fernie, B.C.
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 5 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 14 miles from Fernie by rail in a south-westerly 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 23 miles in a north-easterly direction from Fernie.

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 1920.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	132,900		35,805	
" export to United States	408,596		31,718	
" " other countries				
Total sales		541,496		67,523
Used in making coke	101,649			
" under colliery boilers, etc.	53,208			
Total for colliery use		154,857		
Stocks on hand first of year	98		312	
" last of year	120		581	
Difference added to stock during year		22		269
Output of collieries for year		696,375		67,792

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	48		21		69	
Whites—Miners	540				540	
Miners' helpers						
Labourers	116		218		334	
Mechanics and skilled labour	271		185		456	
Boys	11		20		31	
Japanese						
Chinese						
Indians						
Totals	986		444		1,430	

COAL CREEK COLLIERY.

Bernard Caufield, Manager; Jas. Taylor, Assistant Manager.

At this colliery seven mines are being operated, three on the north and four on the south side of the Coal creek. Connection is made with the town of Fernie, Canadian Pacific and Great Northern Railways by a short branch road which is part of the Morrissey, Fernie & Michel Railway. In addition to the coal-train, a passenger service is maintained with the town of Fernie, where the majority of the workmen reside, while about 400 dwellings are provided at Coal Creek for the workmen desirous of living convenient to the works.

The No. 1 East, No. 1 South, and No. 1 North mines are all operating in the No. 1 seam at different points; this seam averages about 25 feet in thickness, the present operations being in the upper 10 feet.

Nos. 2, 3, and 9 mines are in the No. 2 seam, which averages 6 feet in thickness. No. B North is in the B seam, which in about 5 feet thick, with about 4 feet of inferior coal for a floor, part of which is taken up to allow of height for haulage.

The inclination of the above seams averages about 12°, pitching to the east. The method of haulage is by horse from the working-faces to the partings, and then by mechanical haulage, either main or endless-rope or compressed-air locomotives to the tipple. Nos. 1 North, B North, and No. 1 South are situated at an elevation of 200 feet above the tipple; the loaded cars from these mines are lowered by means of gravity-planes, and then conveyed by steam and compressed-air locomotives to the tipple.

The tipple, which is of steel construction throughout, is 840 feet long, extending from one side of the valley to the other and receives coal on both sides. It is equipped with two electrically driven circular dumps, each acting independently, which deliver the coal to feed-conveyors that supply the shaking screens; these separate the slack from the commercial screened coal. The screened coal is then delivered to picking-tables, where all foreign material is picked out before the coal is finally loaded into the railway-cars, these being loaded by means of two Smith hydraulic box-car loaders. The main power plant is situated on the north side of the valley and consists of fourteen boilers, with an auxiliary plant of three boilers on the south side; the total capacity of the whole boiler plant is 3,000 horse-power approximately. Two extra boilers are being installed on the south side to cope with the increasing needs of the mines there and provide the additional power required for the new fans which are expected to be installed at No. 1 East and No. 3 mines in the early part of 1921.

The power to drive the compressed-air hoists and pumps underground is supplied by three compressors having a total capacity of 6,000 cubic feet of free air a minute, compressing it to 100 lb. to the square inch. There is also a Canadian Rand (high-pressure) compressor having a capacity of 1,346 cubic feet of free air a minute, compressing it to 1,100 lb. to the square inch; this provides the power to drive the air-locomotives.

The electric plant consists of two 400-ampere, 250-volt generators and one 280-ampere, 250-volt Crocker-Wheeler generator; all are driven by two Robb-Armstrong engines. This electrical installation provides the power to drive the fans at No. 1 South, No. 1 North, and B North mines, the motors on the tipple, and provides the electric light for all the buildings, yards, and workmen's houses at Coal Creek.

A large and up-to-date lamp-room is situated in a central position at the mines, where the electric lamps used by the workmen, as well as the Wolf safety-lamps used by the officials for testing purposes, are cleaned and repaired. The lamp-room is well equipped with all modern appliances for keeping the lamps in a good state of repair, and has been kept in good condition at all times and the requirements of the "Coal-mines Regulation Act" and special rules well complied with. There are in use at the present time 700 electric head-lamps of the Edison type and fifty Wolf safety-lamps.

A large wash and change room is located convenient to the mines; here each employee has his own locker (of steel construction). The wash-room is directly under the charge of an employee of the coal company, whose duty it is to keep it in a clean and sanitary condition, the workmen providing their own soap and towel.

Adequate stable accommodation is provided for the horses employed in and around the mines, those engaged underground being brought outside at the end of each shift, and machine, car, blacksmith, and repair shops are situated at the mines in addition to those at Fernie.

The following is a brief description of the mines and the conditions prevailing therein throughout the year:—

No. 1. EAST MINE.

John Caufield, Overman; H. Dunlap, Jas. Duncan, Jas. Maltman, and Thos. Reid, Firebosses.

This mine is situated on the south side of the valley and to the east of the tipple, the seam being reached by a crosscut tunnel at a distance of 215 feet from the entrance. Following the disturbance in November, 1916, the principal operations in this mine have been to the dip; now the Tunnel district is being actively developed and should provide a greater output from this mine.

The method of work is along the lines suggested, following the reports on the bumps in this mine, and includes an extensive system of levels separated by 60-foot pillars and duplicate rooms, each pair separated by 200-foot pillars, only about 15 per cent. of the coal being extracted in the first operation.

At present a pair of parallel entries are being driven to the dip or east of the Main tunnel, the purpose being to connect with another pair of entries that are being driven up from the South split, while another pair of entries are being driven to the west of the tunnel. A number of rooms are ready to start off these west entries, but active development of this district will require the exercise of great care, as this is a portion of the mine that is likely to have trouble from bumps, and much thought and study will be required to ascertain which method of work will be most suitable and afford the greatest maximum of safety to the workmen.

This mine is ventilated by a fan of the Guibal type, which, running at a speed of 148 revolutions a minute, produces an average quantity of 120,000 cubic feet of air a minute, under a 3.5-inch water-gauge; a self-recording water-gauge has lately been installed at this fan.

This mine is divided into four splits; the quantity of air passing in each at the last inspection measured as follows:—Tunnel split, 300 by 72: 21,600 cubic feet of air a minute for the use of twenty-one men and four horses. South split, 430 by 75: 32,250 cubic feet of air a minute for the use of twenty-five men and three horses. Second South split, 300 by 75: 22,500 cubic feet of air a minute for the use of twenty men and three horses. North split, 230 by 88: 20,240 cubic feet of air a minute for the use of twenty-one men and one horse. Main return, 1,280 by 90: 115,200 cubic feet of air a minute for the use of eighty-seven men and eleven horses.

Throughout the year explosive gas has been found twelve times, mostly in cavities in the roof above the timbers, the soft nature of this coal contributing largely to the formation of these cavities. On two occasions the workmen have had to be withdrawn from the South split owing to blow-outs or outbursts of gas taking place; these fouled the air of the district to such an extent that the methane content was higher than the standard of safety as determined by the "Coal-mines Regulation Act." Sufficient warning was given the workmen in each case to enable them to reach a place of safety.

The percentage of methane present in the return air from each district as determined by the Burrell gas-detector varied from 1 per cent. in the North split to 1.9 per cent. in the South split.

General conditions have been good in this mine throughout the year, roadways kept in good shape, and the "systematic timbering" order fairly well attended to at the working-faces. Spraying systems to alleviate the dust are in general use all over the mine, and at all inspections it has been found free from dangerous accumulations of dust, all main roadways being treated with second-burnt ashes. Flue-dust barriers have been erected at the junction of No. 10 East and the main haulage-road with a view to establishing safety-zones at this place.

No. 1 South Mine.

F. Landers, Overman; W. Hynds, W. Stockwell, W. Morgan, and M. Hilton, Firebosses.

This mine is situated half a mile to the west of the tipple and operates the upper and western portions of the No. 1 seam, the workings all being to the rise of the main haulage-road and driving towards the outcrop. It is ventilated by an electrically driven 8- by 4-foot Keith fan, which, running at a speed of 260 revolutions a minute, produces an average quantity of 39,000 cubic feet of air a minute, under a 2.5-inch water-gauge. At the last inspection the ventilation was good and measured as follows:—Main return, 840 by 54: 45,360 cubic feet of air a minute for the use of sixty men and thirteen horses.

At the present time this mine is all on one split, but two levels are now being driven; these, when finished, will allow the above current to be split and divide the mine into two separate splits.

Explosive gas has been found five times during the year, in every case in cavities in the roof above the timbers, the soft nature of the roof making it almost impossible to prevent the formation of these cavities. The percentage of methane in the return air was determined by the Burrell gas-detector varied from 1 to 1.5 per cent., which is well below the standard for ventilation as provided for by section 11, "Coal-mines Regulation Act Amendment Act, 1919."

Roadways have been kept in fairly good condition, although during the latter part of the year serious trouble was encountered from caves, resulting in one case in the closing-off of a portion of No. 4 incline; the coal from this place will eventually be taken out through No. 8 incline. As the roof of this mine consists of from 30 to 40 feet of soft inferior coal and shales, the breaking of one or two timbers means a bad cave and the performing of some very dangerous work before the roadway can be made safe. Under conditions such as these, officials and workmen must see that the regulations enacted for the safety of the mine are strictly attended to, as only by doing so can we hope to reduce our accident list to the lowest possible minimum.

The main return airway is caved in several places and is under repair at the present time. General conditions have been fairly good during the year and the "systematic timbering" order well attended to at the working-faces. Spraying systems are in use all over the mine; these are attended to by persons specially detailed off for that purpose, while all main roads are treated with second-burnt ashes.

No. 1 North Mine.

J. Worthington, Overman; Ed. Rutledge, J. Charnock, and H. Parsons, Firebosses.

This mine is situated on the north side of the valley and also operates in the western portion of No. 1 seam, but as the workings are close to the outcrop there is no trouble from bumps or outbursts of gas and working conditions are fairly good. It is all on one split and is ventilated by an electrically driven 7- by 4-foot Keith fan, which, running at a speed of 214 revolutions a minute, produces an average quantity of 21,000 cubic feet of air a minute, under a 1.8-inch water-gauge. The ventilation was good at the last inspection and measured as follows:—Main intake, 270 by 80: 21,600 cubic feet of air a minute for the use of sixty-one men and ten horses.

During the year explosive gas has been found three times in small quantities in cavities above the timbers. Roadways and working-faces have been kept in good condition and the "systematic timbering" order well attended to at the working-faces. The percentage of methane in the return air has never risen above 0.5 per cent., and as this mine is naturally damp it is free from dust and general conditions have been very good throughout the year.

No. 9 MINE.

Robert Fowler, Fireboss.

This mine is also on the north side of the valley, but operates in the No. 2 seam; the principal work consisted of driving the main and counter levels through the faulted ground on this side with a view to proving this part of the field, also repairing the main return airway, good progress being made with the seam.

Ventilation is produced by a 16- by 4-foot fan of the Guibal type, which, running at an average speed of 54 revolutions a minute, produces 10,000 cubic feet of air a minute, under a 1.3-inch water-gauge. At the last inspection there was a quantity of 11,340 cubic feet of air passing a minute for the use of ten men and two horses.

Explosive gas has never been found during the year in the course of inspection and general conditions have been good. The "systematic timbering" order has been well attended to and the mine kept fairly free from dust.

No. B NORTH MINE.

W. Commons, Overman; Jas. Whyte and Evan Jones, Firebosses.

This mine operates in the B seam and is situated east of the tipple at an elevation of 200 feet above No. 1 seam. It is ventilated by an electrically driven 10-. by 3-foot Brazil fan, which, running at a speed of 150 revolutions a minute, produces an average quantity of 40,000 cubic feet of air a minute, under a 1.4-inch water-gauge.

This mine was formerly divided into two splits, called the Slope and Incline splits respectively, but with a view to reducing the methane content in the return air from the Slope district the ventilation was rearranged, and the intake air taken direct to the bottom of the slope, splitting there and returning back up each side of the slope-workings, the return air from the left side ventilating the abandoned workings of the old Incline split. The result so far has been encouraging, a slight reduction being noticed in the methane percentage in the Slope district, but room exists for further improvement, as the following figures show that of the total quantity of air passing in this mine only 53 per cent. is doing duty at the working-faces. The quantity of air passing in each split at the last inspection measured as follows:—Right side of slope, 180 by 60: 10,800 cubic feet of air a minute for the use of twenty-five men and two horses. Left side of slope, 220 by 70: 15,400 cubic feet of air a minute for the use of thirty-five men and five horses. Main return, 750 by 65: 48,750 cubic feet of air a minute for the use of sixty men and seven horses.

During the year explosive gas has been found five times, mostly in cavities in the roof; the men were withdrawn on one of these occasions to allow the counter-slope making connection with the crosscut off the Main slope. General conditions have been fairly good during the year, roads well timbered, and the "systematic timbering" order fairly well attended to at the working-faces. The percentage of methane present in the return air varied from 1.3 to 1.7 per cent.; the Burrell gas-detector indicated 1.4 per cent. in the main return airway at the last inspection.

A spraying system has lately been installed and is attended to by a man detailed off specially for that purpose; this has been the means of keeping down the dust at the faces, while all main roads are treated with second-burnt ashes.

No. 2 MINE.

C. McNay, Overman; J. Bushell, W. Clarkstone, and E. Ward, Firebosses.

This mine is situated on the south side of the valley and operates the south and west portions of No. 2 seam. It is ventilated by a 16- by 8-foot Wilson fan, which, running at a speed of 132 revolutions a minute, produces an average quantity of 32,000 cubic feet of air a minute, under a 3-inch water-gauge.

During the year explosive gas has been found eleven times, always in cavities in the roof above the timbers, while the percentage of methane present in the return air has been kept under 1 per cent., with one exception; the Burrell gas-detector on this occasion indicated 1.2 per cent.

General conditions have been good, roads well timbered, while the "systematic timbering" order has been fairly well attended to at the working-faces. The main return airway is still being enlarged and repaired, good progress being made with the same; this, when completed, should greatly improve ventilating conditions in this mine. All main roads are treated with second-burnt ashes, and pipe-lines are now being installed for the purpose of spraying all working-faces and roadways.

At the last inspection the quantity of air passing in the different splits measured as follows:—High-line split, 100 by 70: 7,000 cubic feet of air a minute for the use of four men and one horse. Rock Tunnel split, 180 by 90: 16,200 cubic feet of air a minute for the use of sixty-one men and six horses. Main return (junction of splits), 460 by 70: 32,000 cubic feet of air a minute for the use of sixty-five men and seven horses. The above figures show a considerable leakage of air and every effort should be made to reduce the same to the lowest possible minimum.

No. 3 Mine.

J. Biggs, Overman; W. Brown, R. Phillips, and E. Caufield, Firebosses.

The operations of this mine are all to the dip of No. 2 mine and in the same seam. It is ventilated by a 16- by 8-foot Wilson fan, which, running at a speed of 142 revolutions a minute, produces an average quantity of 54,000 cubic feet of air a minute, under a 3.5-inch water-gauge.

This mine is divided into two different splits and the quantity of air passing in each at the last inspection measured as follows:—Incline split, 290 by 70: 17,400 cubic feet of air a minute for the use of twenty-seven men and four horses. Slope split, 390 by 50: 19,500 cubic feet of air a minute for the use of thirty-five men and four horses. Main return, 890 by 60: 53,400 cubic feet of air a minute for the use of sixty-two men and eight horses.

During the year explosive gas has been found three times, generally in cavities in the roof, while the percentage of methane present in the return air as determined by the Burrell gas-detector has varied from 1.3 to 1.8 per cent. in the Incline split and from 1.2 to 1.6 per cent. in the Slope split.

General conditions have been found very good in this mine throughout the year, roadways and working-faces well timbered, and the "systematic timbering" order very well attended to. Spraying systems are in use at the working-faces and on all main roads, the latter being also treated with flue-dust and second-burnt ashes.

The following are the official returns from the Coal Creek Colliery for the year ending December 31st, 1920:—

Sales and Output for Year.	Coal.		Coke.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	58,546			
" export to United States	338,466			
" " other countries				
Total sales		397,012		
Used in making coke				
Used under colliery boilers, etc.	34,749			
Total for colliery use		34,749		
Stocks on hand first of year	98			
" last of year	120			
Difference added to stock during year		22		
Output of colliery for year		431,783		

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	32		10		42	
Whites—Miners	338				338	
Miners' helpers						
Labourers	90		79		169	
Mechanics and skilled labour	180		101		281	
Boys	8		11		19	
Japanese						
Chinese						
Indians						
Totals	648		201		849	

* Does not include Fernie coke-ovens; not operated since April 4th, 1919.

The following shows the number of days Coal Creek Colliery worked each month during 1920:—

January	24	August	25
February	22	September	25
March	17	October (on strike 10 days)	15
April	25	November	26
May	24	December	25
June	26		
July	25	Total	279

Name of seams or pits—No. 1 North, No. 1 South, and No. 1 East, same seam; No. B, Nos. 2, 3, and 9, same seam.

MICHEL COLLIERY.

T. H. Williams, Manager.

This colliery, also operated by the Crow's Nest Pass Coal Company, is situated on both sides of Michel creek, 24 miles east of Fernie, on the Crowsnest Pass branch of the Canadian Pacific Railway, and also has rail connection with the Great Northern Railway.

The mines operated during the year were No. 3 and No. 3 East on the south side of Michel creek and New No. 8 on the north side; the first-mentioned mines are working the upper No. 3 seam, while No. 8 is working the upper portion of the No. 8 seam, the lower part of which has been sealed off for fire for some years.

The general method of work is pillar and stall in all the mines, pillars being extracted in certain portions of No. 3 East and No. 8 mines. Haulage is by horse from the working-faces to the partings, from which the loaded cars are taken to the tipple by means of gravity-inclines, main and endless-rope haulage, and compressed-air locomotives.

As the No. 8 mine is situated at an elevation of 500 feet above the tipple, the loaded cars from this mine are weighed at the top of the incline, where the coal is dumped into bunkers, then loaded into skips and lowered by gravity, and again dumped into other bunkers situated at the bottom of the incline, where it is loaded into mine-cars, these being conveyed to the tipple by endless-rope haulage.

A steel tipple, 664 feet in length and 14 feet in width, extends right across the valley and receives coal on both sides; the loaded cars from the South side are weighed at the foot of the tipple incline, up which they are taken by a Green car-haul consisting of an endless chain which travels on car-wheels, the latter acting as pushers or retarders of the mine-cars on the incline. The track for the mine-cars is laid inside that on which the pusher-wheels run, and when a car is delivered at the bottom of the incline the pusher-wheels move in behind, gripping the rear wheels of the car, thereby conveying the loaded cars up to the dump on the tipple.

This dump is a continuation of the track, with a pitch increasing from 20° to 60°, and when the car reaches this pitch the door opens, discharging the coal into the dump, the chain-haul continuing to travel around a large sprocket-wheel conveying the car to the overhead track and then back down the incline. On the No. 8 side of the tipple the cars are dumped by an automatic dump and returned by a transfer underneath the track to the endless-rope haulage, which conveys them back to the bunkers at the bottom of No. 8 incline. The tipple is equipped with shaking screens and picking-tables, the slack being conveyed by a travelling belt to the slack-bins, from which it is drawn into cars and conveyed by steam-locomotive to the coke-ovens. The tipple machinery is driven by electric power, provision being made for loading open and box cars, the latter being handled by two Smith gravity box-car loaders.

The boiler-plant consists of eleven boilers having a total capacity of 1,650 horse-power, and along with the power plant are housed in a fire-proof brick building. Power to drive the underground hoists and pumps is provided by two compressors—one of the Walker, the other of the Rand type—having a total capacity of 8,000 cubic feet of free air a minute, compressing it to 100 lb. to the square inch. Power to drive the air-locomotives is provided by a high-pressure Rand compressor having a capacity of 1,450 cubic feet of free air a minute, compressing it to 1,200 lb. to the square inch.

The electric plant consists of two 250-kw. generators, which provide the power for the tipple machinery and lighting purposes around the colliery and the town of Michel.

A well-equipped lamp-room is situated in a central position at the mines, where the electric head-lamps used by the workmen and the Wolf safety-lamps used by the officials for testing purposes are cleaned and repaired. There are in use at the present time 345 electric head-lamps of the Edison type and twenty Wolf safety-lamps, while Burrell gas-detectors are provided to enable the detection of lower percentages than could be detected by the ordinary safety-lamp.

Large stables are provided for the forty horses employed in and around the mines; those employed underground are brought out at the end of the shift. A large wash and change room is located convenient to the mines, where each employee has his own locker (of steel construction) and provides his own soap and towel. Well-equipped machine, blacksmith, car, and repair shops are located in a central position at the colliery.

Following is a brief description of the mines and the conditions prevailing therein:—

No. 3 MINE.

M. Littler, Overman; A. Frew, A. Davies, T. Owens, and T. James, Firebosses.

This mine is operating the upper No. 3 seam and is reached by means of a level tunnel from the surface which crosscuts Nos. 3, 4, and 5 seams; the two latter seams have been abandoned for some time. It is ventilated by a 12- by 6-foot Murphy fan, which, running at a speed of 124 revolutions a minute produces on an average 54,000 cubic feet of air a minute, under a water-gauge of 1.7 inches.

This mine is divided into two separate splits; the quantity passing in each split at the last inspection measured as follows:—West split, 400 by 80: 32,000 cubic feet of air a minute for the use of twenty-nine men and four horses. East split, 900 by 30: 27,000 cubic feet of air a minute for the use of twenty-four men and three horses. Main return, 540 by 100: 54,000 cubic feet of air a minute for the use of fifty-three men and seven horses.

At no time during the year has explosive gas been found in the course of inspection and the percentage of methane present in the return air has always been kept around 1 per cent. General conditions have been very good, roadways and working-faces well timbered, and the "systematic timbering" order fairly well attended to. Spraying systems are in general use all over the mine, while all main roads are treated with second-burnt ashes. A good supply of timber is provided for the use of the workmen and kept in a convenient place close to the working-faces.

No. 3 EAST MINE.

M. McLean, Overman; B. Ball, Alf. Ball, and W. Picton, Firebosses.

This mine is also operating the upper No. 3 seam and is ventilated by a 16- by 8-foot Wilson fan, which, running at a speed of 126 revolutions a minute, produces an average quantity of 90,000 cubic feet of air a minute, under a 2.5-inch water-gauge. It is ventilated by two separate splits; the quantity passing in each at the last inspection measured as follows:—West side, 350 by 120: 42,000 cubic feet of air a minute for the use of forty-four men and four horses. No. 6 East split, 350 by 60: 21,000 cubic feet of air a minute for the use of forty men and five horses. Main return, 1,400 by 63: 88,200 cubic feet of air a minute for the use of eighty-four men and nine horses.

In the course of inspection during the year explosive gas has been found three times in cavities in the roof. The "systematic timbering" order has been fairly well attended to at the working-faces and the roadways are in fairly good condition, but there is room for further improvement in the East and West side return airways.

The percentage of methane in the return air has been kept below the standard for ventilation as provided for by section 11, "Coal-mines Regulation Act Amendment Act, 1919." Repairing and enlarging the airways on the West split has improved ventilating conditions in this district, with a consequent reduction in the methane percentage as determined by the Burrell gas-detector.

Spraying systems are in general use throughout the mine, with the exception of a part of the West side workings, where, owing to a rearranging of the pipe-lines, watering of faces and roadways has been discontinued for some time. As this is one of the most practical methods adopted to alleviate the dust, it should not on any account be neglected by mining men, as only by paying the closest attention to the removal of the dust and the thorough watering of all dusty places can we hope to eliminate or reduce the danger arising from this condition. A good supply of timber is provided at all times for the use of the workmen and placed convenient to the working-faces.

No. 8 MINE.

T. Baybutt, Overman; A. Almond, E. Ainsworth, J. Marsh, and R. Taylor, Firebosses.

This mine is situated on the north side of the valley at an elevation of 500 feet above the tipple and operates the upper and northern portion of No. 8 seam. It is ventilated by a compressed-air-driven 8- by 4-foot Murphy fan, which, running at a speed of 145 revolutions a minute, produces an average quantity of 35,000 cubic feet of air a minute, under a water-gauge of 0.5 inch. At the last inspection the ventilation was good and measured as follows:—West side, 180 by 70: 12,600 cubic feet of air a minute for the use of thirty-two men and five horses. No. 6 incline, 200 by 90: 18,000 cubic feet of air a minute for the use of forty-three men and four horses. Main return, 490 by 70: 34,300 cubic feet of air a minute for the use of seventy-five men and nine horses.

Explosive gas has been found four times during the year in the course of inspection. Roadways are in good condition and well timbered and the "systematic timbering" order well attended to at the working-faces, while a good supply of timber is provided for the use of the workmen. As this mine is naturally damp, it has been fairly free from dust at all times, and the percentage of methane present in the return air has always been under 1 per cent. and conditions generally have been good.

The following are the official returns of the Michel Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	74,354		35,805	
" export to United States	70,130		31,718	
" " other countries				
Total sales		144,484		67,523
Used in making coke	101,649			
Used under colliery boilers, etc	18,459			
Total for colliery use		120,108		
Stocks on hand first of year			312	
" last of year			581	
Difference added to stock during year				269
Output of colliery for year		264,592		67,792

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	16		11		27	
Whites—Miners	202				202	
Miners' helpers						
Labourers	26		139		165	
Mechanics and skilled labour	91		84		175	
Boys	3		9		12	
Japanese						
Chinese						
Indians						
Totals	338		243		581	

The following shows the number of days Michel Colliery worked each month during 1920:—

January	26	August	26
February	22	September	24
March	20	October (on strike 11 days)	14
April	24	November	26
May	24	December	25
June	26		
July	24	Total	281

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, $7,000,000.

Officers.	*Address.*
Rush Taggert, President,	New York, N.Y.
J. K. O. Sherwood, Vice-President,	New York, N.Y.
Wm. Weaver Heaton, Secretary-Treasurer,	New York, N.Y.
A. M. Allen, Assistant Treasurer,	Spokane, Wash.
R. S. Ord, General Manager,	Spokane, Wash.
E. L. Warburton, Mine Manager,	Corbin, B.C.

Value of plant, $400,000.

CORBIN COLLIERY.

E. L. Warburton, Manager.

This colliery is situated on the right bank of Michel creek and has railway connection with the Crowsnest Pass branch of the Canadian Pacific Railway at McGillivray Junction by a branch line 14 miles in length called the British Columbia Eastern Railway.

The boiler plant at this colliery consists of two Jencks return-tubular boilers and one locomotive-type boiler, the total capacity of the plant being approximately 275 horse-power.

The electric plant, consisting of one 70-horse-power generator, alternating type, 2,300 volts, driven by one 100-horse-power steam-engine, provides the power to drive the motors at the machine-shops and the electric air-drill at No. 6 mine, and for lighting purposes around the plant and the town of Corbin; it will also provide the power for several 3-horse-power motors that are being installed to drive a Sirocco fan and two small disk fans which will be required in the early part of 1921.

The tipple, which is constructed of wood, has a bunker capacity of 1,200 tons and is equipped with a Marcus screen and conveyor-belt, driven by a 60-horse-power steam-engine. There is a wash and change room located in a convenient position at the colliery, also a well-equipped lamp-room, where the electric head-lamps used by the workmen and the Wolf safety-lamps used by the officials for testing purposes are cleaned and repaired. There are in use at this colliery electric head-lamps of the Edison type and Wolf safety-lamps, while a Burrell gas-detector is provided to enable the detection of lower percentages of methane than could be determined by the ordinary safety-lamp.

In addition to the offices and warehouse, blacksmith, car, and repair shops are situated at the mines, while at the wye well-equipped machine-shops are maintained where the locomotives are overhauled and repaired.

Following is a brief description of the mines operated during the year and the conditions prevailing therein:—

No. 3 MINE, OR "BIG SHOWING."

John Virgo, Fireboss.

This mine is situated at an elevation of 800 feet above and at a distance of 2 miles from the town of Corbin, and is generally termed an open-cut or stripping mine. The seam at this point being very close to the surface, the overburden is stripped off by steam-shovels, loaded into dump-cars, and hauled to the dump, which is situated in such a position as not to interfere with future operations. When the surface material and coal-blossom is all cleaned off the

section in operation, work proceeds in the coal-seam by a series of benches or steps. Blasting is done where the coal is hard, stumping-powder being used for this purpose; all shots are fired under the direct supervision of a competent official.

The coal is loaded by steam-shovel directly into the railway-cars; these are hauled by Shay locomotives specially built for the purpose of hauling on heavy grades. A switchback railway 6 miles in length connects the mine with the tipple. The above railway is owned by the coal company and is equipped with turntables at convenient points for the purpose of turning the snow-plough and allowing of greater efficiency when it is required, as compared with the old system of running the full seven miles back to the wye for the above purpose.

General supervision with respect to the safety of the workmen has been well maintained during the year.

No. 4 MINE.

J. Blair, Overman; H. Osborne, W. Almond, G. Luck, and G. Elmes, Firebosses.

This mine is situated to the west of No. 1 mine and operates the No. 4 seam, which is vertical and varies in thickness from 50 to 200 feet. The general system of work is by driving pairs of levels, with a vertical distance of 100 feet between each pair and connected by raises 5 by 8 feet, angle chutes being driven off these raises to the level above to facilitate pillar-drawing.

Pillars are extracted on the retreating caving system, the chutes being arranged so that the coal falls towards them with very little loss. The upper workings of this mine are reached by an incline direct from the tipple. The method of haulage inside the mine is by horse and main and tail rope to the incline, down which the cars are lowered by steam-hoist. Frequent and careful examination of the fire area has failed to reveal any fresh outbreaks during the year; the extensive concrete stoppings erected last year at the No. 4 level have apparently checked the fire at this point.

Ventilation is produced by a 12- by 4-foot fan of the Guibal type, which, running at a speed of 90 revolutions a minute, produces an average quantity of 30,000 cubic feet of air a minute, under a water-gauge of 0.5 inch. The quantity passing at the last inspection measured as follows:—Main intake, 1,130 by 30: 33,900 cubic feet of air a minute for the use of thirty-four men and two horses.

Very little trouble is encountered from gas and no explosive gas has been found in the course of inspection during the year. Roadways are kept in good condition, the "systematic timbering" order well attended to at the working-faces, and a good supply of timber is provided at all times for the use of the workmen. As it is naturally damp, this mine has always been found free from dust and the percentage of methane in the return air has been kept below 0.5 per cent.

NOS 5 AND 6 MINES.

J. Blair, Overman; H. Ferryman, Fireboss.

No. 5 mine is still in the prospect stage, the principal work consisting of driving the main and counter levels through a piece of faulted ground with a view to proving this part of the field. Gas has not yet been found in this mine; ventilation is natural and has been good at all times. A small disk fan will be installed in the near future.

Up to the present time the principal work at No. 6 mine has been prospecting and proving the extent of the coal-seam by driving level drifts at different points with a view to ascertaining the actual thickness of the seam. At a lower elevation than the above drifts a level rock tunnel is being driven to tap the seam, and if this reaches the seam at a reasonable distance from the surface it is the intention of the management to drive another tunnel at a still lower elevation and on the same level as the tipple. During the late summer the railroad-track was extended to this mine and a new tipple built; a temporary chute has also been erected to allow of the upper levels being developed while the lower tunnels are driving in towards the seam. This mine gives every promise of being an important and valuable addition to the mines of this colliery.

The following are the official returns from the Corbin Colliery for the year ending December 31st, 1920:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	72,176			
" export to United States	70,746			
" " other countries				
Total sales		142,922		
Used in making coke				
" under colliery boilers, etc.	5,589			
Total for colliery use		5,589		
Stocks on hand first of year	4,019			
" last of year	6,522			
Difference added to stock during year		2,503		
Output of colliery for year		151,014		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		$		$		$
Supervision and clerical assistance	6	8.27	5	8.18	11	8.22
Whites—Miners	*56*	9.87			*56*	9.87
Miners' helpers	14	6.89			14	6.89
Labourers			41	6.83	41	6.83
Mechanics and skilled labour			29	8.06	29	8.06
Boys			1	4.40	1	4.40
Japanese						
Chinese						
Indians						
Totals	76		76		152	

Name of seam or pit—No. 3 mine, open-work; Nos. 4, 5, and 6 mines, underground.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 3 and 4 mines as per previous reports, with following adjustments: About 90 per cent. of output from No. 4 mine from pillar or caving system; 300 level and "A" tunnel, whole work. During 1920 70,000 cubic yards of stripping was removed at No. 3 or open-work operations. Rock tunnel 1,000 feet to the north and 75 feet below present No. 3 open-work has been advanced about 70 feet. All work at No. 3 was abandoned for season early in December. At No. 4 mine a rock-drift was driven through the right wall of left basin into a right-hand basin of coal. This is now opened out with levels and crosscuts, pillars being formed 75 by 140 feet. At "A" tunnel, No. 4 mine, considerable work has also been put in to get to right-hand basin of coal and to ultimately work as parallel operation to 300 level. No. 5 mine during year has been in prospect stage, but is now into vertical basin of coal 70 feet in width, and at an early date this mine should be on a shipping basis. At No. 6 mine considerable work has been done

erecting tipples and chutes to upper levels of this basin of coal. From prospect-work at this point the basin of coal would indicate running almost parallel with Corbin creek for a considerable distance, probably 1½ miles and about 300 feet wide, with depth unknown. A rock tunnel is now being driven at this point by rock-drilling machine and has advanced 125 feet. It is expected to strike coal at about 200 feet. Tipples, chutes, spur railway, etc., are now advanced to a point whereby coal can be shipped from upper levels until other work at this unit is complete.

Description and length of tramway, plant, etc.—As per previous report, with following additions: New incline hoist and housing installed and working at No. 4 Mine; horse-haulage, 300 level and "A" tunnel, No. 4 mine; electric line installed to No. 6 mine to drive No. 5 Temple-Ingersoll-Rand drilling-machine; spur railway from high line built to No. 6 mine, 3,000 feet in length; tipple at No. 6 mine; trestle-work and chutes from tipple to upper levels at No. 6 mine; new boarding-house to accommodate fifty workmen; G.W.V.A. Hall erected; ten steel main-line hopper-bottom cars.

PER CAPITA PRODUCTION OF COLLIERIES, 1920.

District.	Gross Tons of Coal mined in 1920.	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	847,389	1,582	535	1,062	797
Coast	1,849,385	4,767	385	3,129	591
Total for Province	2,696,774	6,349	425	4,191	643

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

As is incumbent upon the Inspector, he has laid information before the local Magistrates in the following cases of infractions by the workmen in the mines of the General and Special Rules and Regulations which are provided for the safety of all underground employees. The carelessness of one man endangers the lives of his fellow-workmen, and is treated as a criminal offence.

The following prosecutions have been brought during the year for the offences noted; the judgments given by the Magistrate being shown:—

Date.	Name.	Mine.	Occupation.	Offence charged.	Judgement.
Jan. 28	Isaac Hill.....	Wakesiah.....	Fireboss ...	For allowing two shot-holes to be tamped at one time	Fined $10 and costs.
Feb. 6	Tom Radish...	Morden.....	Labourer....	For fraudulently making use of another man's certificate	Fined $10 and costs.
April 11	Robert Walker	No. 7, Cumberland	Fireboss	Breach of Rule 12, sec. 91; tamping two shot-holes at the same time	Fined $10 and costs.
April 14	Dom Langi....	No. 1, Coal Creek	Miner	For having matches in his possession	Fined $10 and costs.
April 14	L. Domovitch..	No. 2, Coal Creek	Miner	Matches in his posession, contrary to Special Rule 9, sec. 91	Fined $10 and costs.
April 30	Thomas Bullen	Granby	Fireboss	For firing shot, contrary to Special Rule 66, sec. 92	Fined $10 and certificate suspended for two months.
May 12	T. Richards...	Wellington Extension Col'ry	Miner	For violating Rule 11	Fined $5 and costs.
May 12	Harry Borak .	No. 4, Corbin	Miner	Fighting in mine, contrary to Rule 110	Fined $10 and costs.
May 12	M. Wasylymink	No. 4, Corbin..	Miner	Fighting in mine, contrary to Rule 110	Fined $10 and costs.
May 22	Joe Januk ...	No. 3, Coal Creek	Miner	For having matches in possession, contrary to Special Rule 9, sec. 91	Fined $10 and costs.
Aug. 17	F. Mattinderfer	B North, Coal Creek	Miner	Failing to sprag coal, contrary to Special Rule 115	Fined. Dismissed.
Aug. 28	R. Derbyshire.	No. 1 East, Coal Creek	Miner	Failing to sprag coal, contrary to Special Rule 115	Fined $5 and costs.
Aug. 28	F. Sorrinto....	Coal Creek....	Miner	Failing to sprag coal, contrary to Special Rule 115	Fined $5 and costs.
Oct. 26	J. Magu	Coal Creek....	Miner's helper	Matches in his possession, contrary to Rule 9, sec. 91	Allowed on suspended sentence.
Nov. 10	Joseph Lane...	Wellington Extension Col'ry	Fireboss	For violating Rule 11, by unramming a shot-hole	Fined $10 and costs.
Nov. 16	Jas. Davidson.	No. 2, Coal Creek	Miner	Failing to sprag coal, contrary to Special Rule 115	Fined $5 and costs.
Nov. 16	Ben Drew.....	No. 2, Coal Creek	Miner	Exposing himself to unnecessary danger, contrary to Special Rule 112	Dismissed with caution.
Nov. 16	Wm. Holmes..	No. 1 South, Coal Creek	Driver.....	For having matches in possession, contrary to Rule 9, sec. 91	Fined $5 and costs.
Nov. 16	Leroy Taylor..	No. 3, Coal Creek	Miner	For having matches in his possession	Fined $5 and costs.
Nov. 16	James Parsons.	No. 1 South, Coal Creek	Miner	For having matches in his possession, contrary to Rule 9, sec. 91	Fined $5.
Dec. 9	A. Burbee.....	No. 8, Michel..	Miner	For having matches in his possession, contrary to Rule 9, sec. 91	Fined $10 and costs.

METALLIFEROUS MINES SHIPPING IN 1920.

SKEENA.

SKEENA MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Belmont–Surf Inlet..	Surf inlet	Belmont–Surf Inlet Mines, Ltd...	Surf Inlet	Gold, silver, copper.
Drum Lummon	Douglas channel	Drum Lummon Mines, Ltd.	Vancouver	Gold, silver, copper.
Patterson group	Porcher island	F. T. Patterson	Refuge Bay	Gold, silver.

NASS RIVER MINING DIVISION.

Dolly Varden	Alice arm	Taylor Engineering Co., Ltd.	Vancouver	Silver.
Esperanza	Alice arm	Pedro Salinas	Alice Arm	Gold, silver.
Golskeish	Anyox	H. W. Heidman	Anyox	Gold, silver.
Hidden Creek	Anyox	Granby Cons. M. S. & P. Co.	Anyox	Gold, silver, copper.

PORTLAND CANAL MINING DIVISION.

Premier	Salmon river	Premier Gold Mining Co.	Stewart	Gold, silver.
Silver Tip	Salmon river	Silver Tip Mining Syndicate	Vancouver	Gold, silver, lead, zinc.

QUEEN CHARLOTTE MINING DIVISION.

Ikeda	Ikeda bay	Ikeda Mines, Ltd.	Vancouver	Gold, silver, copper.

OMINECA MINING DIVISION.

Silver Standard	Hazelton	W. G. Norrie-Lowenthal	New Hazelton	Gold, silver, lead, zinc.

EAST KOOTENAY.

FORT STEELE MINING DIVISION.

North Star	Kimberley	Thompson & McKinney	Kimberley	Silver, lead.
St. Eugene	Moyie	Consolidated M. & S. Co.	Kimberley	Silver, lead, zinc.
Sullivan	Kimberley	Consolidated M. & S. Co.	Kimberley	Silver, lead, zinc, iron pyrites.

WINDERMERE MINING DIVISION.

Bunyan	Windermere	E. J. Fader	Wilmer	Gold, silver, lead.
Helldriver	Windermere	J. L. McKay	Athalmer	Silver, lead.
Isaac	Frances creek.	Paul Denhart.	Brisco	Silver, lead.
Monarch	Golden	Wm. Adkins	Vancouver	Silver, lead.
Paradise	Toby creek	R. R. Bruce	Invermere	Silver, lead.
Ptarmigan	Toby Creek	E. W. Watson	Wilmer	Silver, copper.

WEST KOOTENAY.

AINSWORTH MINING DIVISION.

Bluebell	Riondel	S. S. Fowler	Riondel	Silver, lead.
Caledonia	Blaylock	G. E. McCready	Zincton	Silver, lead.
Florence	Ainsworth.	F. R. Wolfle.	Spokane	Silver, lead.
Highland	Ainsworth	Consolidated M. & S. Co.	Trail	Silver, lead.
Index	Ainsworth	E. J. Edwards	Kaslo	Silver, lead.
Kirby	Riondel	A. J. Curle	Kaslo	Silver, lead.
Krao	Ainsworth	W. E. Zwicky	Kaslo	Silver, lead.
Little Phil	Ainsworth	J. W. Smith	Ainsworth	Silver, lead.
Maestro	Ainsworth	H. Giegerich	Kaslo	Silver, lead.
No. One	Ainsworth	Consolidated M. & S. Co.	Trail	Silver, lead.
Ruth	Ainsworth	W. D. Smith	Ainsworth	Silver.
Silver Bell	South fork, Kaslo creek.	W. E. Newton	Kaslo	Silver, lead.
Silver Bear	South fork, Kaslo creek.	M. S. Davys.	Kaslo	Silver, lead.
Spokane-Trinket	Ainsworth	Jas. McDougall	Ainsworth	Silver, lead.
Skyline	Ainsworth	H. Giegerich	Kaslo	Silver, lead.
Tam O'Shanter	Riondel	C. F. Sherwin	Riondel	Silver.
Tariff	Ainsworth	J. W. Smith	Ainsworth	Silver, lead.
United	Ainsworth	J. W. Smith	Ainsworth	Silver, lead.
Utica	Paddy peak.	C. F. Caldwell	Kaslo	Silver, lead.
Whitewater	Retallack	W. H. Burgess	Kaslo	Gold, silver, lead, zinc.

SLOCAN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Alamo	Alamo	C. Cunningham	Sandon	Silver, lead.
Antoine	McGuigan basin	James Anderson	Kaslo	Silver, lead.
Bosun	New Denver	Rosebery-Surprise Mining Co.	New Denver	Silver, lead, zinc.
Canadian and Adams	Sandon			Silver, lead.
Comstock	Slocan	Rosebery-Surprise Mining Co.	New Denver	Silver, lead.
Hewitt	Silverton	J. F. Duthie	Seattle	Silver, lead.
Idaho	Sandon	C. Cunningham	Sandon	Silver, lead.
Ivanhoe	Sandon	Rosebery-Surprise Mining Co.	Sandon	Silver, lead.
Last Chance	Sandon	Robt. Cunning	Sandon	Silver, lead.
McAllister	Three Forks	R. A. Grimes	Three Forks	Silver, lead.
Mollie Hughes	New Denver	H. Clever	New Denver	Gold, silver, lead.
Mowitch	New Denver	J. Beber	New Denver	Gold, silver.
Noble Five	Sandon	Paul Lincoln	Sandon	Silver, lead.
Payne	Sandon	Oscar V. White	Sandon	Silver, lead.
Queen Bess	Sandon	C. Cunningham	Sandon	Silver, lead.
Rambler	Three Forks	W. A. Cameron	Three Forks	Silver, lead, zinc.
Redress	Sandon			Silver, lead.
Richmond	Sandon	C. Cunningham	Sandon	Silver, lead.
Ruth	Sandon	James Anderson	Kaslo	Silver, lead.
Silver Glance	Zincton	J. W. Power	Kaslo	Silver.
Silversmith	Sandon	John B. White	Sandon	Silver, lead, zinc.
Sovereign	Sandon	C. Cunningham	Sandon	Silver, lead.
Standard	Silverton	A. N. North	Silverton	Lead, zinc.
Surprise	Sandon	J. P. McFadden	Sandon	Gold, silver, lead, zinc.
Van-Roi	Silverton	C. Cunningham	Sandon	Silver, lead.
Washington	Rambler	W. H. Burgess	Kaslo	Silver, lead.
Wonderful	Sandon	C. Cunningham	Sandon	Silver, lead.

SLOCAN CITY MINING DIVISION.

Anna	Springer creek	K. E. Zimmerman	Slocan	Silver.
L. T.	Springer creek	D. B. O'Neail	Slocan	Silver, lead.
Ottawa	Slocan	A. L. McPhee	Slocan	Silver.
Republic	12-Mile creek	A. H. Bonner	Calgary	Gold, silver.

NELSON MINING DIVISION.

Aspen	Deer creek	P. F. Horton	Nelson	Silver.
Emerald	Salmo	R. W. Mifflin	Salmo	Silver, lead.
Molly Gibson	Kokanee creek	Consolidated M. & S. Co.	Trail	Silver, lead.
Nugget	Sheep creek	Harold Lakes	Salmo	Gold.
Second Relief	Erie	A. D. Westby	Erie	Gold, silver, copper.
Yankee Girl	Ymir	Mining Corporation of Canada	Ymir	Gold, silver, lead.

TRAIL CREEK MINING DIVISION.

Centre Star	Rossland	F. S. Peters	Rossland	Gold, silver, copper.
Le Roi No. 2	Rossland	P. S. Couldrey	Rossland	Gold, silver, copper.
Mountain Chief	Renata	J. W. Evans	Nelson	Gold, silver, copper.
Velvet	Rossland	C. E. Nordman	Rossland	Gold, silver, copper.
White Bear	Rossland	Consolidated M. & S. Co.	Rossland	Gold, silver, copper.

REVELSTOKE, TROUT LAKE, AND LARDEAU MINING DIVISIONS.

Lanark	Illecillewaet (Revelstoke)	W. B. Dornberg	Illecillewaet	Silver, lead.
Ferguson	Trout lake	James Anderson	Kaslo	Gold, silver, lead.

BOUNDARY.

GREENWOOD MINING DIVISION.

Bell	Beaverdell	D. McIntosh	Beaverdell	Gold, silver, lead.
Can. Copper Corpn.	Greenwood	Canada Copper Corporation	Greenwood	Gold, silver, copper.
Castor Frac.	Beaverdell	R. D. McKenzie	Greenwood	Silver.
Crescent	Greenwood	Geo. Thompson	Greenwood	Gold, silver, lead.
Kokomo	Beaverdell	J. M. Barrett	Beaverdell	Gold.
Last Chance	Greenwood	James Poggi	Greenwood	Gold, silver.
Napanee	Beaverdell	E. G. Cummings	Beaverdell	Gold, silver, lead.
Providence	Greenwood	A. J. Morrison	Greenwood	Gold, silver, lead.
Rambler	Beaverdell	W. H. Rambo	Beaverdell	Silver, lead.
Sally	Beaverdell	E. A. Morley	Penticton	Silver, lead.
Skylark	Greenwood	C. D. Hunter	Vancouver	Gold, silver.
Sunnyside	Greenwood	E. Williamson	Rock Creek	Gold, silver, lead.
Wellington	Wallace mountain	J. Sutherland	Beaverdell	Silver, lead.

GRAND FORKS MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Emma	Eholt	Consolidated M. & S. Co.	Trail	Gold, silver, copper.
Lightning peak	Lightning peak	W. A. Calder	Edgewood	Silver, lead.
Molly Gibson	Paulsen	I. J. Trembath	Rossland	Gold, silver.
Rock Candy	Grand Forks	Consolidated M. & S. Co.	Trail	Fluorspar.
Union	Grand Forks	Lewis Johnson	Grand Forks	Gold, silver.
Waterloo No. 2	Lightning peak	G. A. Rendell	Greenwood	Silver, lead.
Yankee Boy	Hardy mountain	J. Bailey	Eholt	Gold, silver, lead.
Granby smelter	Grand Forks	Granby Cons. M. S. & P. Co.	Vancouver	Gold, silver, copper.

OSOYOOS MINING DIVISION.

Nickel Plate	Hedley	S. L. Smith	Hedley	Gold, arsenic.
Horn Silver	Similkameen	E. W. Condit	Similkameen	Gold, silver.
Stemwinder	Fairview	Henry Lee	Vancouver	Gold, silver.

SIMILKAMEEN MINING DIVISION.

Copper mountain	Allenby	Canada Copper Corporation	Allenby	Gold, silver, copper.
Joshua	Nicola	F. M. Hawkes	Seattle	Gold, silver, lead.
Voight	Copper mountain	Emil Voight	Princeton	Silver, copper.

LILLOOET AND CLINTON MINING DIVISIONS.

Lorne	Cadwallader creek	A. F. Noel	Lorne Mine	Gold.

YALE, ASHCROFT, AND KAMLOOPS MINING DIVISIONS.

Iron Mask	Kamloops	A. Wallinder	Kamloops	Gold, silver, copper.
Emancipation	Yale	B. H. Heyer	Vancouver	Gold, silver.

SOUTH COAST.

VANCOUVER MINING DIVISION.

Britannia	Howe sound	E. J. Donohue	Britannia Beach	Gold, silver, copper.
Iron King	Alta lake	J. H. Thompson	Vancouver	Iron.

NANAIMO MINING DIVISION.

Venus	Lasqueti island	Henry Lee	Lasqueti island	Gold, silver, copper.

CLAYOQUOT MINING DIVISION.

Indian Chief	Sidney inlet	S. P. Silverman	Sidney Inlet	Gold, silver, copper.

VICTORIA MINING DIVISION.

Hill 60	Cowichan lake	E. F. Miller	Duncan	Manganese.

LIST OF CROWN-GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1920.

CASSIAR.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Chakawana	Atlin	James A. Fraser, Official Administrator of the estate of Frederick William Markus, deceased, intestate	3289	45.42	Jan. 27
Nest Egg	"	Alexander Barrington Taylor and Robert Webster	3292	50.24	Jan. 27
Alice Fraction	Nass River	John Edmund Stark and Herbert Francis Kergin	3515	32.30	Nov. 18
Beaver	"	Granby Consolidated M. S. & P. Co., Ltd.	3895	50.35	Mar. 9
Blue Jay	"	" "	3874	41.63	Mar. 19
Clark	"	" "	3869	47.64	Mar. 18
Dandy No. 2 Fraction	"	Frank Stringham	3617	50.60	Dec. 28
David Copperfield	"	William McLean, Alfred Wright, Alfred E. Wright, and Robert F. McGinnis	3520	19.06	Nov. 12
Drum Lummon Fraction	"	Granby Consolidated M. S. & P. Co., Ltd.	3879	50.05	Mar. 19
Iron Bug	"	" "	3875	45.43	Mar. 19
Jimm Fraction	"	" "	3870	26.89	Mar. 18
John Bull	"	" "	3876	51.65	Mar. 19
John Bull No. 1	"	" "	3877	51.15	Mar. 19
John Bull No. 3	"	" "	3878	45.52	Mar. 19
Kitzol No. 1	"	William Martin	3815	39.61	Sept. 28
Kitzol No. 2	"	"	3814	35 38	Sept. 28
Maud McPhee	"	"	3817	47.16	Sept. 28
Mohawk	"	George R. Naden	3512	51.41	May 13
Mohawk No. 1	"	"	3514	43.52	May 13
Mohawk No. 2	"	"	3513	45.19	May 13
Molybdenum	"	Brian H. Tyrwhitt Drake, Registrar of Supreme Court, Victoria Registry	3648	17.90	May 27
Nephin Fraction	"	Granby Consolidated M. S. & P. Co., Ltd.	3872	38.83	Mar. 18
Rob Roy	"	" "	3871	31.18	Mar. 18
Sportsman	"	William Martin	3816	48.13	Sept. 28
Sunset No. 1	"	"	3818	11.46	Sept. 28
Sunset No. 2	"	"	3819	45.48	Sept. 28
Sundog Fraction	"	Granby Consolidated M. S. & P. Co., Ltd.	3873	43.84	Mar. 19
Success	"	Brian Tyrwhitt Drake, Registrar of Supreme Court, Victoria Registry	3652	29.39	May 27
Silver Tip No. 1	"	Franz August Swanson	3823	39.61	Nov. 18
Silver Tip No. 2	"	John H. McMullen, Official Administrator of the estate of Charles Swanson, deceased, intestate	3824	17.60	Nov. 18
Wolf	"	John Edmond Stark	3821	39.34	Oct. 8
Albana	Omineca	John B. Paine	6328 R. 5	47.67	Aug. 23
Balmoral Fraction	"	Delta Copper Co	620	2.41	April 29
Balmoral	"	"	1002	45.11	April 29
Caribou	"	Cassiar Crown Copper Co.	6476 R. 5	26.86	May 27
Chalco	"	Delta Copper Co.	514	49.34	April 29
Chicago	"	"	513	51.65	April 29
Copper Crown	"	Cassiar Crown Copper Co.	6472 R. 5	50.47	May 27
Crooked Fraction	"	Delta Copper Co.	602	46.52	Oct. 9
Delta	"	"	600	51.65	April 29
Delta Fraction	"	"	604	48.18	April 29
Drumbo Fraction	"	John B. Paine	6322 R. 5	27.38	Aug. 9
Emma	"	Lewis W. Patmore	71 R. 5	50.37	May 22
Eureka	"	Cassiar Crown Copper Co.	6473 R. 5	51.64	May 27
Fiddler	"	John B. Paine	6323 R. 5	42.85	Aug. 19
Grand View	"	Cassiar Crown Copper Co.	6475 R. 5	37.72	May 27
Happy Jack	"	Delta Copper Co.	1003	48.03	April 29
Hedley	"	John B. Paine	6324 R. 5	45.42	Aug. 19
Highland Boy	"	Delta Copper Co.	1000	49.84	April 29
Hope	"	John B. Paine	6325 R. 5	44.37	Aug. 27
Islander	"	Delta Copper Co.	710	51.65	April 29
I.X.L.	"	Lewis W. Patmore	72 R. 5	51.62	May 22
Josie	"	John B. Paine	6321 R. 5	51.44	Aug. 9
Lake View	"	Delta Copper Co.	515	20.76	April 29
Lucky Jack	"	"	603	21.09	Oct. 9
Mayflower	"	Cassiar Crown Copper Co.	6471 R. 5	39.08	May 27
Nelson	"	John B. Paine	6326 R. 5	51.65	Aug. 19
Royal Sovereign	"	"	6327 R. 5	39.48	Aug. 23
Ruby	"	Cassiar Crown Copper Co.	6474 R. 5	47.92	May 27
Silver Tip	"	Delta Copper Co.	1004	34.90	April 29
Skeena	"	"	606	50.88	April 29
Summit	"	"	601	49.84	April 29
Summit	"	"	605	47.05	April 29
Zig Zag Fraction	"	"	1005	21.24	April 29
Boston	Portland Canal	Forty-nine Mining Co.	4026	51.40	Dec. 28
Chicago	"	"	4027	40.77	Dec. 28
Columbia	"	Arthur Bagg	411	50.82	June 8
Darwin	"	Forty-nine Mining Co.	4028	41.39	Dec. 28
Dickens	"	"	4030	51.65	Dec. 28
Dumas	"	"	4029	51.00	Dec. 28
Evening Sun	"	Arthur Bagg	1517	32.50	June 10

CASSIAR—*Continued.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
The "49"	Portland Canal	Forty-nine Mining Co	4024	50.51	Dec. 28
Little Joker	"	Louis Watkins, Charles Douglas Carter, and Patrick Welch	3904	50.17	Feb. 7
Lookout	"	Martin Welch, Harvey James Fetter, and Harry E. Carlton	3905	38.15	Feb. 7
Midas Lake Fraction	"	" " "	3900	35.83	Feb. 7
Midas	"	Charles Douglas Carter and Patrick Welch	3901	25.09	Feb. 7
Mystery	"	Martin Welch, Harvey James Fetter, and Harry E. Carlton	3903	4.22	Feb. 7
Mineral Hill	"	Charles Douglas Carter and Patrick Welch	3902	13.44	Feb. 7
Oxedental	"	Forty-nine Mining Co	4023	51.65	Dec. 28
Pass Fraction	"	Martin Welch, Harvey James Fetter, and Harry E. Carlton	3906	40.55	Feb. 7
Yellowstone Fraction	"	Forty-nine Mining Co	4025	9.39	Dec. 28
King Solomon	Bella Coola	Smelters Steel Co	1087 R. 3	36.15	May 19
Iron King	"	"	1257 R. 3	40 71	Oct. 22
Washburn Lateral	Cariboo	Henry E. C. Carry	9545	49.55	Jan. 27

EAST KOOTENAY.

Bryan	Golden	Alexander David James Mathieson	3951	41.87	May 3
Lincoln	"	Elizabeth Mathieson	3952	44.81	May 3
Lucky Jack	"	Alexander David James Mathieson	3953	37.80	May 3
Dragon	"	William John McRae	3949	37.80	April 8
Copper Belt Fraction	Fort Steele	John H. Hayes	12249	51.31	Nov. 12
Roby Roy	"	"	12250	37.90	Nov. 12
Tillaeum	"	"	12251	49.07	Nov. 12
Black Bird	Windermere	John Hopkins Taynton	9178	29.57	May 3
Delight	"	William Walter Taynton	9181	51.65	May 3
Great Northern	"	Dorothy Hanman	5358	43.03	Feb. 10
Grey Eagle	"	John Hopkins Taynton	9179	30.19	May 3
Lucky Boy	"	William Walter Taynton	9180	51.14	May 3
Phoenix	"	Ritchie Spurgeon Gallop	5359	50.23	Feb. 10
World's Fair	"	"	5356	50.29	Feb. 20
Wilderness	"	Dorothy Hanman	5357	30.79	Feb. 20

WEST KOOTENAY.

Dellie Fraction	Ainsworth	William Sheldon Hawley	10711	51.63	Dec. 28
Nellie Fraction	"	"	10713	46.14	Dec. 28
Silver Hoard Fraction	"	"	10712	47.88	Dec. 28
Arnold Fraction	Nelson	William Connolly	12183	4.41	Dec. 28
Big Chief	"	Western Belle Mining Co	12666	35.65	May 19
Gracie R	"	William Connolly	12174	48.43	Dec. 28
Rosebud Fraction	"	"	12185	17.74	Dec. 28
Black Bird	Slocan	Clarence Marsh (the elder)	4180	31.18	May 3
Donnelly	"	John Robert Hunter	5195	35.26	July 23
Elvira	"	George Thomas Gormley	3155	51.65	July 3
Ironside	"	Robert Aylmer Chester	4182	30.25	May 4
Lone Star No. 3	"	Nathan Sawyer Tucker and Thomas Avison	1891	47.65	April 14
Monument No. 2	"	Joseph Miller	5013	51.65	Dec. 28
Monument No. 2 Fraction	"	John T. Miller	5014	12.91	Dec. 28
Monument No. 3	"	Joseph Miller	5011	51.65	Dec. 28
Nonpareil	"	Clarence Marsh (the elder)	4179	47.87	May 3
Nonpareil Fraction	"	Alfred McQueen	4554	14.14	May 4
Seattle	"	Thomas Trenery	4178	38.92	May 17
Seattle Fraction	"	Alfred McQueen	4555	18.58	May 4
Vernon	"	Robert Aylmer Chester	4181	29.65	May 3
Albion Fraction	Trail Creek	Joe Kloman and John Vanebo	12491	3.18	Dec. 28
Albion No. 2	"	" "	12489	28.45	Dec. 28
Duluth	"	Joe Kloman	12490	10.18	Nov. 12

BOUNDARY.

Big Raymond	Grand Forks	Vincenzo Bruno	2596 S.	47.30	July 28
Black Bear	"	"	2597 S.	46.72	July 28
Arcadia	Greenwood	William Clough Wilson	3135	21.70	May 17
Bay Fraction	"	Donald Hugh McGillis	3285	46.00	Dec. 28
Dictator	"	John Glover	4636	51.65	Oct. 9
Hope No. 2	"	William Clough Wilson	1849	41.20	May 17
Helen	"	Ola Lofstad	691	29.94	May 31
Last Chance	"	James Poggi	753	46.83	Oct. 8
Mountain Belle	"	Ellen Hallett	2272	49.76	July 16
Nelson	"	George Arthur Rendell	2293	50.27	June 21
Phoebe	"	Paul Dumont	2790	49.58	Dec. 28
Riverside	"	Paul Nelson	1031	50.13	July 3
Tip Top	"	James Napier Paton	1229	38.43	July 28
Blue Bird	Similkameen	Canada Copper Corporation, Ltd	2574 S.	24.72	Oct. 9
Edna	"	" "	2309 S.	48.60	Oct. 9
H. P. Fraction	"	" "	2575 S.	18.54	Oct. 9
J. W. Hill	"	Emil F. Voight	2149 S.	50.50	Sept. 11
Lemon No. 15	"	Canada Copper Corporation, Ltd	2004 S.	50.00	Oct. 9
Lemon No. 16	"	" "	2005 S.	51.30	Oct. 9

BOUNDARY—*Continued.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
New No. 61	Similkameen	Emil F. Voight	2254 S.	27.20	Oct. 16
No. 18 Fraction	"	"	2256 S.	13.10	Sept. 17
No. 40 Fraction B	"	"	2255 S.	33.10	Sept. 17
No. 60 B	"	"	2164 S.	48.90	Oct. 16
Riverside	"	Canada Copper Corporation, Ltd	2571 S.	25.76	Oct. 9
Rough Neck	"	Emil F. Voight	1802 S.	51.65	Sept. 17
Senora Fraction	"	Canada Copper Corporation, Ltd	2014 S.	1.70	Oct. 9
Senorita	"	" "	2001 S.	47.00	Oct. 9
Eagle Fraction	Osoyoos	Robert C. Johnston	2395 S.	40.82	April 22
Silver Bell	"	Bertram Wood Powell, Leonard Hugh Patten, and James Dallas Brass	2393 S.	36.84	Jan. 7
Silver Horde	Vernon	Gunner Severide	4328	51.65	Dec. 28

VANCOUVER ISLAND AND COAST.

Albright	Nanaimo	William Stramberg	999	37.82	Sept. 24
Black Warrior	"	Redonda Iron Copper Co., Ltd	2446 G. 1	51.65	Jan. 28
Blizzard	"	Edward E. Rorem	465	40.53	Aug. 13
Bonanza	"	Redonda Iron Copper Co., Ltd	2476	51.65	July 12
Copper Cave	"	Edward E. Rorem	151	50.07	Aug. 9
Copperite	"	"	153	51.65	Aug. 9
Dolphin	"	Colin F. Jackson	1039 R. 2	14.98	Jan. 20
Eagle	"	Redonda Iron Copper Co., Ltd	2426 G. 1	38.22	Jan. 28
Gillis Fraction	"	Colin F. Jackson	918A R. 2	4.73	Jan. 20
Hill 60	"	Alexander Kurtzhals	79	41.97	Oct. 16
Homestake	"	Redonda Iron Copper Co., Ltd	2475 G. 1	51.65	Mar. 22
Joan of Arc	"	Rudolf Kurtzhals	80	51.52	Nov. 3
Josephine	"	Harry J. Thomas	378	51.65	April 8
Mars	"	Alexander Kurtzhals	78	42.23	Oct. 19
Sunrise	"	Harry J. Thomas	377	51.05	April 8
Venus	"	Joseph Van-hone Purviance	81	49.08	Nov. 9
Joseph Hunter Fraction	Quatsino	Joseph Hunter	530	19.40	June 24
Young Sports No. 4	"	William James Warren	1556	41.35	Nov. 26
Alberta	Vancouver	Angus Alexander Crowston and Annie Lee Crowston	3844 G. 1	24.44	Sept. 23
Amazon	"	Britannia Mining & Smelting Co.	5004 G. 1	51.38	July 8
Annie	"	" "	4868 G. 1	50.79	Feb. 4
Arrow Fraction	"	" "	2781 G. 1	47.17	Dec. 28
Ash	"	George William Campbell and John Wilson Thornton, Executors and Administrators of the estate of Henry Cornwall Stewart, deceased, and William Barker, Robert Bruce Kirk, and Joel Chase Calhoun	5010 G. 1	42.05	Jan. 26
Atkins	"	Britannia Mining & Smelting Co.	4875 G. 1	47.59	Feb. 4
Atlin Fraction	"	" "	5039 G. 1	11.81	Dec. 28
August Fraction	"	William Arthur Goddard	4028 G. 1	3.77	Feb. 14
Avon Fraction	"	Britannia Mining & Smelting Co.	2780 G. 1	44.45	July 12
Bay No. 1	"	Angus Alexander Crowston	5201 G. 1	39.63	Sept. 24
Bay No. 2	"	" "	5202 G. 1	43.00	Sept. 24
Bay Fraction	"	" "	5203 G. 1	48.34	Sept. 24
Bee	"	Britannia Mining & Smelting Co.	4237 G. 1	40.60	Dec. 29
Bella Fraction	"	" "	2901 G. 1	40.25	Jan. 19
Belmont	"	" "	4998 G. 1	51.56	July 6
Bewick	"	" "	2783 G. 1	21.76	July 12
Bingham	"	" "	4874 G. 1	51.65	Feb. 4
Bow Fraction	"	" "	2774 G. 1	46.23	Dec. 28
British Columbia	"	Angus Alexander Crowston and Annie Lee Crowston	3773 G. 1	49.38	Sept. 17
Burke Fraction	"	Britannia Mining & Smelting Co.	4787 G. 1	50.52	Jan. 30
Caledonia No. 1	"	" "	2784 G. 1	51.65	July 8
Caledonia No. 2	"	" "	2787 G. 1	51.65	July 8
Caledonia No. 3	"	" "	2789 G. 1	51.65	July 9
Caledonia No. 4	"	" "	5036 G. 1	51.65	July 9
Caledonia No. 5	"	" "	5040 G. 1	36.33	July 9
Card	"	" "	4853 G. 1	51.65	June 5
Cathryn	"	" "	4947 G. 1	51.63	Feb. 4
Cedar	"	" "	4034 G. 1	51.11	Jan 20
Cheam Fraction	"	" "	5067 G. 1	48.65	Dec. 28
Chili Fraction	"	" "	5037 G. 1	35.74	Dec. 28
Clio	"	" "	4766 G. 1	50.17	Jan. 29
Clyde	"	" "	5002 G. 1	51.65	July 7
Columbia Fraction	"	" "	2939 G. 1	51.48	Jan. 19
Cortes	"	" "	4784 G. 1	51 65	Feb. 2
Cross Fraction	"	" "	4873 G. 1	51.46	Feb. 4
Cypress	"	" "	4035 G. 1	51.11	Jan. 20
Cyril	"	Angus Alexander Crowston	3853 G. 1	41.77	Sept. 24
Daimler Fraction	"	Britannia Mining & Smelting Co.	2790 G. 1	42.76	July 12
Dakota Fraction	"	" "	4997 G. 1	43.82	July 6
Dan Fraction	"	" "	4869 G. 1	46.35	Feb. 6
Danube Fraction	"	" "	5005 G. 1	38.89	July 7
Day Fraction	"	" "	4583 G. 1	50.26	Feb. 3
Deed Fraction	"	" "	4951 G. 1	46.49	Feb. 4
Doll Fraction	"	" "	4867 G. 1	48.54	Feb. 2
Don Fraction	"	" "	2778 G. 1	47.09	July 12
Douglas	"	Angus Alexander Crowston	3854 G. 1	29.39	Sept. 24
Eagle	"	Britannia Mining & Smelting Co.	4994 G. 1	49.31	July
Eagle Fraction	"	" "	2918 G. 1	51.57	Jan.

VANCOUVER ISLAND AND COAST—*Continued.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Eden	Vancouver	Angus Alexander Crowston	3855 G. 1	46.93	Sept. 24
Elm	"	George William Campbell and John Wilson Thornton, Executors and Administrators of the estate of Henry Cornwall Stewart, deceased, and William Barker, Robert Bruce Kirk, and Joel Chase Calhoun	5014 G. 1	41.02	Jan. 26
Etna	"	Britannia Mining & Smelting Co.	5068 G. 1	51.65	Dec. 28
Falls	"	Angus Alexander Crowston	3856 G. 1	38.41	Sept. 24
Fir	"	George William Campbell and John Wilson Thornton, Executors and Administrators of the estate of Henry Cornwall Stewart, deceased, and William Barker, Robert Bruce Kirk, and Joel Chase Calhoun	5011 G. 1	51.65	Jan. 26
Fish	"	Britannia Mining & Smelting Co.	4986 G. 1	39.66	Dec. 28
Flue Fraction	"	" "	4871 G. 1	46.16	Feb. 3
Fly	"	" "	4238 G. 1	25.75	Dec. 28
Fox	"	" "	4851 G. 1	51.65	June 11
French	"	" "	4950 G. 1	51.65	Feb. 4
Frisco Fraction	"	" "	5001 G. 1	44.16	Dec. 28
Gold	"	James Archibald	2317 G. 1	51.65	Aug. 23
Guinea Fraction	"	Britannia Mining & Smelting Co.	5035 G. 1	5.04	Jan. 20
Haig	"	" "	4949 G. 1	51.65	Feb. 6
Hard Fraction	"	" "	4767 G. 1	50.17	Jan. 28
Hardy	"	Angus Alexander Crowston	1711 G. 1	31.16	Sept. 24
Hawk Fraction	"	Britannia Mining & Smelting Co.	2917 G. 1	44.31	Jan. 19
Hawk Fraction	"	" "	4995 G. 1	47.59	July 6
Hazel	"	" "	4988 G. 1	49.70	July 7
Heriot Fraction	"	" "	4783 G. 1	42.15	Feb. 2
Hope Fraction	"	" "	4656 G. 1	51.65	Feb. 3
Hornby Fraction	"	" "	4786 G. 1	38.70	Jan. 30
Hose	"	" "	4852 G. 1	51.65	June 5
Humber Fraction	"	" "	5048	51.23	Dec. 28
Index Fraction	"	Arthur R. Tebb, Alexander McTavish, and Geo. F. Hooey	5155 G. 1	14.82	Aug. 13
Ivy	"	Britannia Mining & Smelting Co.	4803 G. 1	51.65	Jan. 29
Jim Fraction	"	" "	4866 G. 1	40.25	Feb. 3
Josephine	"	" "	4989 G. 1	49.09	Dec. 28
Kerry Fraction	"	" "	2126 G. 1	45.68	Feb. 3
Last Fraction	"	" "	2782 G. 1	12.63	Feb. 2
Layon	"	" "	5060 G. 1	49.48	Dec. 28
London No. 1	"	William James Mogridge	3398 G. 1	49.09	Jan. 22
London No. 2	"	"	3399 G. 1	51.35	Jan. 22
London No. 3	"	"	3392 G. 1	51.64	Jan. 22
London No. 4	"	"	3393 G. 1	51.65	Jan. 22
London No. 5	"	"	4880 G. 1	28.17	Jan. 22
Louise Fraction	"	Britannia Mining & Smelting Co.	5076 G. 1	45.08	Dec. 28
Mammoth No. 2	"	Quincy Dunn Chapman	3401 G. 1	49.47	Jan. 27
Manitoba	"	Angus Alexander Crowston and Annie Lee Crowston	3845 G. 1	44.22	Sept. 23
Maple	"	George William Campbell and John Wilson Thornton, Executors and Administrators of the estate of Henry Cornwall Stewart, deceased, and William Barker, Robert Bruce Kirk, and Joel Chase Calhoun	5012 G. 1	29.15	Jan. 26
Mexico	"	Britannia Mining & Smelting Co.	5044	51.32	July 12
Mons	"	" "	2916 G. 1	49.89	Jan. 19
Moss Fraction	"	" "	4802 G. 1	50.99	Jan. 29
Myrtle B No 1	"	William James Mogridge	3396 G. 1	34.55	Jan. 22
Myrtle B No. 2	"	"	3397 G. 1	34.24	Jan. 22
Nanny	"	Britannia Mining & Smelting Co.	4018 G. 1	51.65	Feb. 6
Napier	"	" "	4984	15.68	Dec. 28
Nelson Fraction	"	" "	4785 G. 1	44.18	Jan. 31
Night	"	" "	4652 G. 1	51.51	Feb. 4
Nimmo Fraction	"	" "	4780 G. 1	48.91	Feb. 2
Noon	"	" "	4655 G. 1	47.72	Feb. 6
Noyon Fraction	"	" "	4999 G. 1	45.74	Dec. 28
Ontario	"	" "	3774	48.21	Sept. 23
Otter Fraction	"	" "	4765 G. 1	47.55	Jan. 29
Pender	"	" "	4778 G. 1	51.44	Jan. 28
Peak Fraction	"	" "	4657 G. 1	45.78	Feb. 5
Peru	"	" "	5038 G. 1	16.38	Dec. 28
Plan	"	" "	8454 G. 1	51.65	June 5
Princess No. 2	"	Clarence R. Briggs	3394 G. 1	34.66	April 30
Princess No. 3	"	"	3395 G. 1	22.21	April 30
Quadra	"	Britannia Mining & Smelting Co.	4781 G. 1	51.65	Feb. 2
Quebec	"	" "	3775 G. 1	29.70	Sept. 17
Queen Anne	"	Angus A. Crowston	1716 G. 1	51.65	May 1
Red Mountain	"	Eliza M. Shupe, George F. Hooey, and Alex. McTavish	5153 G. 1	31.48	Aug. 13
Regal	"	Britannia Mining & Smelting Co.	4232 G. 1	51.65	Jan. 20
Reggie Fraction	"	" "	4032 G. 1	50.49	Feb. 6
Rheims	"	" "	4987 G. 1	50.56	Dec. 28
River	"	" "	422 G. 1	49.66	Jan. 19
Rome Fraction	"	" "	5061 G. 1	10.89	Dec. 28
Root Fraction	"	" "	5078 G. 1	48.05	Dec. 28
Roy	"	" "	2771 G. 1	48.37	June 12
Roy No. 7	"	" "	2777 G. 1	50.37	June 12
Roy No. 8	"	" "	2779 G. 1	49.14	Dec. 28
Samy Fraction	"	" "	5079 G. 1	38.17	Dec. 28
San Francisco	"	William Alexander Matheson	4985 G. 1	35.48	Dec. 28
Saskatchewan	"	Angus Alexander Crowston and Annie Lee Crowston	3846 G. 1	50.70	Sept. 17
Saxon Fraction	"	Britannia Mining & Smelting Co.	4996 G. 1	44.18	July 6
Severn	"	" "	5046 G. 1	51.65	Dec. 28
Shasta Fraction	"	" "	5063 G. 1	43.09	Dec. 28

VANCOUVER ISLAND AND COAST—*Continued.*

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Silver	Vancouver	James Archibald	2318 G. 1	51.65	Aug. 28
Skeena Fraction	"	Britannia Mining & Smelting Co.	2773 G. 1	43.93	Dec. 28
Spruce	"	George William Campbell and John Wilson Thornton, Executors and Administrators of the estate of Henry Cornwall Stewart, deceased, and William Barker, Robert Bruce Kirk, and Joel Chase Calhoun	5013 G. 1	32.79	Jan. 26
Taff	"	Britannia Mining & Smelting Co.	2775 G. 1	50.13	July 12
Tees	"	" "	2776 G. 1	51.51	July 12
Texas	"	" "	5062 G. 1	47.57	Dec. 28
Tay Fraction	"	" "	5009 G. 1	49.64	July 8
Thames	"	" "	5045 G. 1	49.54	Dec. 28
Tiber Fraction	"	" "	5054 G. 1	51.58	June 8
Tolmie	"	" "	4779 G. 1	51.38	Feb. 2
Top Fraction	"	" "	4658 G. 1	44.10	Feb. 5
Topaz	"	" "	4772 G. 1	51.65	Jan. 29
Toy Fraction	"	" "	4870 G. 1	42.97	Feb. 3
Trust Fraction	"	" "	4872 G. 1	51.32	Feb. 4
Utah	"	" "	5047 G. 1	51.59	Dec. 28
Venice Fraction	"	" "	5041 G. 1	34.77	Dec. 28
Vermont Fraction	"	" "	5053 G. 1	47.18	Dec. 28
Wallace Fraction	"	" "	2772 G. 1	44.09	June 12
Walter Fraction	"	" "	5006 G. 1	47.27	July 8
Warner Fraction	"	" "	5007 G. 1	45.45	July 12
Watkins Fraction	"	" "	5008 G. 1	46.24	July 8
Willard Fraction	"	" "	2788 G. 1	47.70	July 10
Wind	"	" "	4948 G. 1	51.65	Feb. 4
Winter	"	" "	5003 G. 1	51.65	July 9
Winton Fraction	"	" "	5043 G. 1	41.77	July 12
Yanky	"	" "	5077 G. 1	51.65	Dec. 28
Yew Fraction	"	" "	4033 G. 1	33.95	Jan. 20
York	"	" "	4231 G. 1	51.36	Jan. 20
Black Prince	Victoria	Joseph Dubois	149	40.94	May 17
Blue Grouse	"	Blue Grouse Mines, Ltd.	31G	48.41	April 30
Blue Grouse No. 2	"	"	32G	26.14	April 30
Blue Grouse No. 3	"	"	33G	51.58	April 30
Old Sport No. 17	Alberni	Coast Copper Co., Ltd	1503	47.50	Mar. 22
Old Sport No. 18 Fraction	"	"	1502	37.84	Mar. 22
Shamrock No. 11	"	"	1492	51.65	Mar. 22

DEPARTMENT OF MINES.

VICTORIA, B.C.

HON. WM. SLOAN, *Minister of Mines.*

R. F. TOLMIE, *Deputy Minister.*

WM. FLEET ROBERTSON, *Provincial Mineralogist and Assayer.*

JAS. MCGREGOR, *Chief Inspector of Mines.*

HENRY DEVLIN, *District Inspector*, Nanaimo.

T. R. JACKSON, *District Inspector*, Nanaimo.

ROBERT STRACHAN, *District Inspector*, Fernie.

JOHN MACDONALD, *District Inspector*, Fernie.

JOHN G. BIGGS, *District Inspector*, Merritt.

THOS. J. SHENTON, *District Inspector*, Prince Rupert.

H. H. JOHNSTONE, *Temporary Inspector*, Nelson.

A. G. LANGLEY, *Resident Engineer*, Revelstoke.

D. E. WHITTAKER, *Provincial Analyst and Assistant Assayer.*

J. D. GALLOWAY, *Resident Engineer*, Hazelton.

W. M. BREWER, *Resident Engineer*, Nanaimo.

GEO. A. CLOTHIER, *Resident Engineer*, Prince Rupert.

P. B. FREELAND, *Resident Engineer*, Grand Forks.

R. W. THOMSON, *Resident Engineer*, Kamloops.

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin Mining Division	Atlin	J. A. Fraser	W. G. Paxton	
Sub-office	Telegraph Creek			H. W. Dodd.
"	Haines (U.S.)		(Com. for taking Affidavits)	Risdon M. Odell.
Stikine Mining Division	Telegraph Creek	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary	"	"	John Cargill.
Liard Mining Division	Telegraph Creek	"	"	
Sub-office	Porter			Chas. H. Smith.
"	McDame Creek			Mike Larsen.
"	Fort St. John			F. W. Beatton.
Skeena Mining Division	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Alice Arm			Telka Carney.
"	Kitimat			Rev. S. S. Peat.
"	Port Simpson			J. R. C. Deane.
"	Swanson Bay			S. C. White.
"	Copper City			L. G. Skinner.
"	Terrace			L. H. Kenny.
"	Stewart (Portland Canal)			J. P. Scarlett (Acting).
Nass River	Anyox	J. H. McMullin	J. Conway (Acting).	
Portland Canal M.D.	Stewart	J. H. McMullin (at Prince Rupert)	J. P. Scarlett "	
Bella Coola Mining Div.	Prince Rupert	J. H. McMullin	J. H. McMullin	
Sub-office	Bella Coola			Brynild Brynildsen.
"	Bella Bella			John A. Pauline.
"	Ocean Falls			A. M. Tysom.
Queen Charlotte Min'g D.	Queen Charlotte	J. H. McMullin	John L. Barge	
Sub-office	Jedway			Isaac Thompson.
"	Masset			R. P. Ponder.
"	Lockeport			William Morgan.
Omineca Mining Division	Smithers	Stephen H. Hoskins	Jas. E. Kirby	
Sub-office	Fort Grahame			Einar Ursino.
"	Fort St. James			Alex. C. Murray.
"	Manson Creek			W. B. Steele.
"	Telkwa			T. J. Thorp.
"	Fort St. John			F. W. Beatton.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued.*

Mining Divisions.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca M.D.—*Con.*				
Sub-office	Copper City			L. G. Skinner.
"	Terrace			L. H. Kenny.
"	Fort Fraser			Fred Fraser.
"	Junction Finlay &	Parsnip rivers		A. T. Sherwood.
"	Pacific			T. H. McCubbin.
"	Hazelton			Sperry Cline.
"	Burns Lake			L. Mulvaney.
"	Houston			W. J. Lutley.
"	Usk			Jas. L. Bethurum.
Peace River Mining Div.	Fort St. John	S. H. Hoskins	F. W. Beatton	
Sub-office	Hudson Hope	(at Hazelton)		John Gregg.
"	Pouce Coupe			J. D. Moore.
Cariboo Mining Division	Barkerville	L. A. Dodd		
Sub-office	Quesnel	"		E. C. Lunn.
"	Fort George	"		T. W. Herne.
"	McBride	"		M. Gorman.
Quesnel Mining Division	150-Mile House	L. A. Dodd	R. M. McGusty	R. M. McGusty.
Sub-office	Quesnel	(at Barkerville)		E. C. Lunn.
"	Quesnel Forks			Wm. Lowden.
"	Barkerville			L. A. Dodd.
Clinton Mining Division	Clinton	Geo. Milburn		
Lillooet Mining Division	Lillooet	John Dunlop	John Dunlop	
Kamloops Mining Division	Kamloops	E. Fisher	L. S. Brown	
Sub-office	Chu Chua			George Fennell.
"	Vavenby			Hyde Finley.
"	Albas			C. O. Sjouquist.
Ashcroft Mining Division	Ashcroft	E. Fisher (at Kam.)	J. S. Alexander	
Sub-office	Lytton			Thos. Somerville.
Nicola Mining Division	Merritt	E. Fisher (at Kam.)	J. A. Murchison	
Yale Mining Division	Yale	" "	H. Beech	
Sub-office	Hope	" "		Wm. Greenwood.
Similkameen Mining Div.	Princeton	Hugh Hunter	Hugh Hunter	
Sub-office	Hedley			Jas. Clarke.
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			Owen Wheeler.
"	Beaverdell			E. F. Ketchum.
Grand Forks Min. Div.	Grand Forks	S. R. Almond	S. R. Almond	
Osoyoos Mining Division	Oliver	J. R. Brown		
Sub-office	Olalla			R. W. Northey.
"	Hedley			Jas. Clarke.
Golden Mining Division	Golden	John Bulman	G. E. Sanborn	
Windermere Mining Div.	Wilmer	" (at Golden)	E. M. Sandilands	
Fort Steele Mining Div.	Cranbrook	N. S. A. Wallinger		
Sub-office	Steele			Joseph Walsh.
"	Fernie			R. J. Stenson.
"	Moyie			W. H. Laird.
"				
Ainsworth Mining Div.	Kaslo	Ronald Hewat	A. McQueen	A. W. Anderson.

GOLD COMMISSIONERS AND MINING RECORDERS—*Continued*

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Ainsworth M.D.—*Con.*				
Sub-office	Howser			W. Simpson.
"	Trout Lake			Oscar Jacobson.
"	Crawford Bay			Thos. W. Lytle.
"	Poplar			Arthur G. Johnston.
Slocan Mining Division	New Denver	Ronald Hewat	Angus McInnes	
Sub-office	Sandon	(at Kaslo)		W. J. Parham.
Slocan City Mining Div.	Slocan	Ronald Hewat	Thos. McNeish	
Trout Lake Mining Div.	Trout Lake	"	Oscar Jacobson	
Nelson Mining Division	Nelson	E. Ferguson (Actg.)	E. Ferguson (Actg.)	
Sub-office	Creston			R. Lamont.
"	Ymir			Wm. Dowling.
"	Sheep Creek			Geo. Leece.
"	Salmo			M. C. Donaldson.
Arrow Lake Min. Division	Nakusp	E. Ferguson	Walter Scott	
Sub-office	Vernon	(at Nelson)		H. F. Wilmot.
Revelstoke Mining Div.	Revelstoke	A. Johnson	J. Lee	Newton R. Brown.
Lardeau Mining Division	*Beaton*	" (at Revelstoke)	*Ernest Roberts*	
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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Annual Report of the Minister of Mines for the year ending 31st December, 1920, being an account of mining operations for gold, coal, etc., in the Province. William Fleet Robertson, Provincial Mineralogist. 377 pp., plates, maps, 1920.
Victoria, Government Printing Office, 1921.

Author.

Robertson, William Fleet. *(Provincial Mineralogist.)*

Annual Report of the Minister of Mines of British Columbia for the year ending 31st December, 1920, being an account of mining operations for gold, coal, etc., in the Province. (British Columbia, Bureau of Mines.) 377 pp., plates, maps, 1920.
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