

ANNUAL REPORT
OF THE
MINISTER OF MINES

FOR THE
YEAR ENDING 31ST DECEMBER

1922

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

IN THE
PROVINCE OF BRITISH COLUMBIA.



PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C. :
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1923.

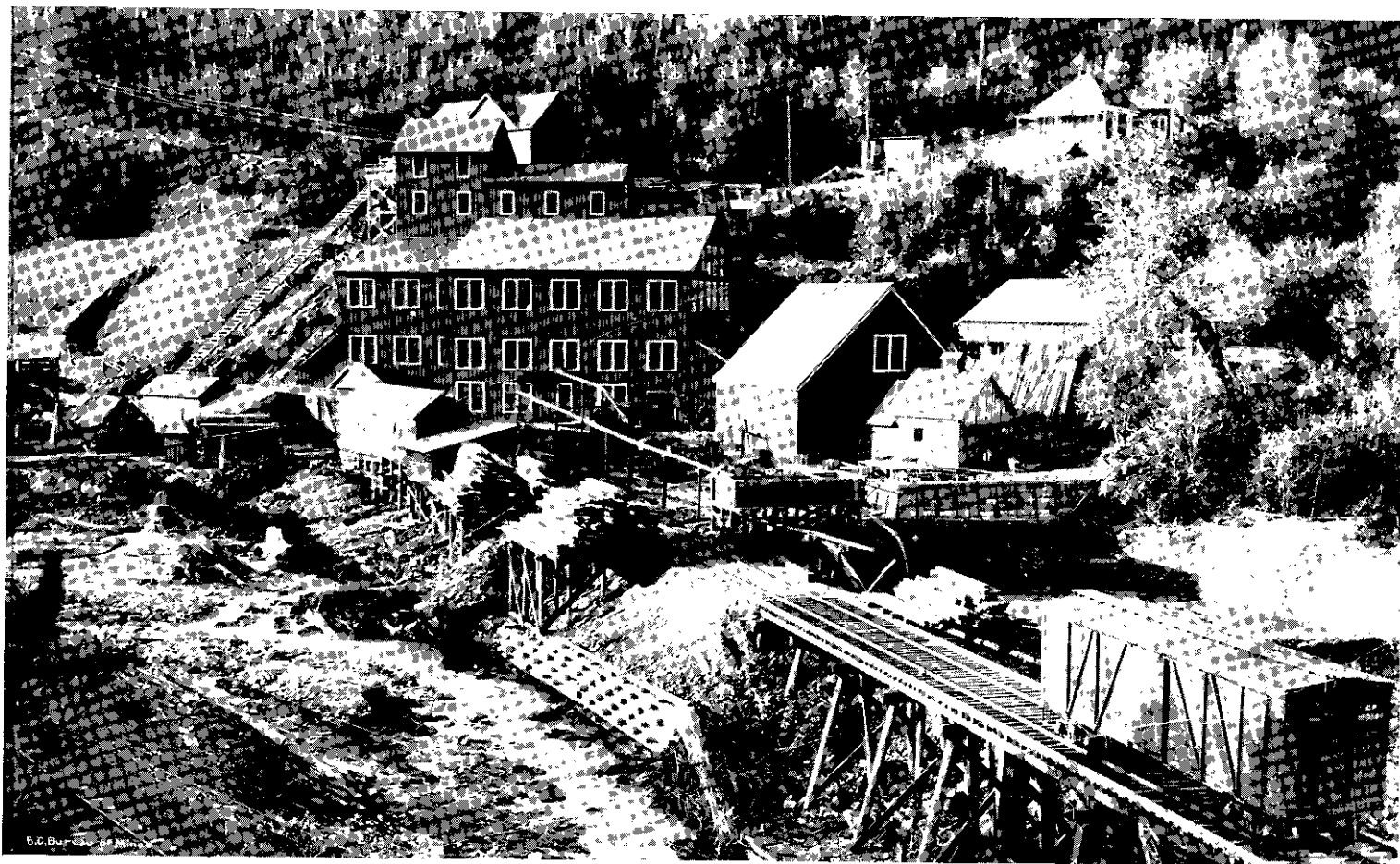
To His Honour WALTER CAMERON NICHOL,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

The Annual Report of the Provincial Mineralogist upon the Mining Industry of the Province for the year 1922 is herewith respectfully submitted.

WILLIAM SLOAN,
Minister of Mines.

Minister of Mines' Office,
February 24th, 1923.



Silversmith Concentrator, Sandon, Slocan M.D.

*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, 1922.

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 ROBERSTON,

Provincial Mineralogist.

Bureau of Mines, Victoria, B.C.,

February 24th, 1923.

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." 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 1922.

Gold, placer	\$ 76,542,203
Gold, lode	109,647,661
Silver	59,814,266
Copper	170,723,242
Lead	51,810,891
Zinc	24,625,853
Coal and coke	238,289,565
Building-stone, bricks, etc.	36,605,942
Miscellaneous minerals, etc.	1,358,839
Total	\$769,418,462

TABLE II.—PRODUCTION FOR EACH YEAR FROM 1852 TO 1922 (INCLUSIVE).

1852 to 1894 (inclusive)	\$ 88,904,199
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
1921	28,066,641
1922	35,158,843
Total	\$769,418,462

Table III. gives a statement in detail of the quantities and value of the different mineral products for the years 1920, 1921, and 1922. 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 1920, 1921, AND 1922.

	Customary Measure.	1920.		1921.		1922.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold placer	Ounces.	11,080	\$ 221,600	11,660	\$ 233,200	18,240	\$ 364,800
" lode.....	"	120,048	2,481,392	135,663	2,804,154	197,856	4,089,684
Silver.....	"	3,377,849	3,235,980	2,673,389	1,591,201	7,101,311	4,554,781
Copper.....	Pounds	44,887,676	7,832,899	39,036,993	4,879,624	32,359,896	4,329,754
Lead	"	39,331,218	2,816,115	41,402,288	1,693,354	67,447,985	3,480,316
Zinc.....	"	47,208,268	3,077,979	49,419,372	1,952,065	57,146,548	2,777,322
Coal.....	Tons, 2,240 lb.	2,595,125	12,975,625	2,483,995	12,419,975	2,511,843	12,559,215
Coke.....	"	67,792	474,544	59,434	416,038	45,835	320,845
Miscellaneous pro- ducts.....	"		2,426,950		2,077,030		2,682,126
			\$35,543,084		\$28,066,641		\$35,158,843

TABLE IV.

OUTPUT OF MINERAL PRODUCTS BY DISTRICTS AND DIVISIONS.

Names.	DIVISIONS.			DISTRICTS.		
	1920.	1921.	1922.	1920.	1921.	1922.
No. 1 District				\$ 7,293,008	\$ 7,323,662	\$10,867,144
Atlin, Stikine, and Liard.....	\$ 138,600	\$ 148,546	\$ 155,271			
Nass River	5,966,392	4,784,945	4,561,185			
Portland Canal.....	121,291	1,530,083	5,288,469			
Skeena, Queen Charlotte, and Bella Coola.....	1,066,725	860,088	862,219			
No. 2 District				222,335	80,807	292,144
Cariboo and Quesnel	66,000	67,400	192,300			
Omineca and Peace River.....	156,335	13,407	99,844			
No. 3 District				832,284	959,095	1,421,850
Nicola and Vernon.....	756,315	936,865	1,383,143			
Yale, Ashcroft, and Kamloops.	59,989	1,500	25,497			
Lillooet and Clinton	15,980	20,730	13,210			
No. 4 District				1,195,499	334,146	636,722
Grand Forks, Greenwood, and Osoyoos.....	1,109,527	334,146	635,722			
Similkameen	85,972		1,000			
No. 5 District				12,478,720	9,291,595	10,761,709
Fort Steele	9,298,948	7,626,214	8,871,647			
Windermere and Golden.....	130,041	26,763	59,406			
Ainsworth.....	558,339	121,760	90,954			
Slocan and Slocan City.....	1,390,563	181,011	1,358,035			
Nelson and Arrow Lake	100,565	76,862	65,925			
Trail Creek.....	982,020	1,250,233	272,967			
Revelstoke, Trout Lake, and Lardeau.....	18,244	8,752	42,775			
No. 6 District				13,521,238	10,077,336	11,179,274
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quat- sino, and Victoria).....	9,773,036	9,144,591	10,614,505			
Mainland (Vancouver and New Westminster).....	3,748,202	932,745	564,769			
				\$35,543,084	\$28,066,641	\$35,158,843

TABLE V.
MISCELLANEOUS PRODUCTS AND TOTALS OF PRODUCTION, 1922.

District and Division.	Cement.	Lime and Lime-stone.	Building-stone.	Riprap.	Crushed Rock, Flax.	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.
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
No. 1 District															10,867,144
Atlin, Stikine, and Liard		19,900			37,621				57,511		57,511		155,271	155,271	
Nass River													4,503,674	4,561,185	
Portland Canal													5,288,469	5,288,469	
Skeena, Queen Charlotte, and Bella Coola				17,309		15,535			32,844		32,844		829,375	862,219	
No. 2 District															292,144
Cariboo and Quesnel													192,300	192,300	
Omineca and Peace River				45,248		26,690			71,938		71,938	5,040	22,866	99,844	
No. 3 District															610,730
Nicola and Vernon		2,550	3,000					10,585	16,185		16,135	643,330	12,558	572,023	
Yale, Ashcroft, and Kamloops								1,920	1,920	13,000	14,920		10,577	25,497	
Lillooet and Clinton													13,210	13,210	
No. 4 District															1,447,842
Grand Forks, Greenwood, and Osoyoos		5,400							5,400	116,210	121,610		514,112	635,722	
Similkameen												811,120	1,000	812,120	
No. 5 District															10,761,709
Fort Steele										10,445	10,445	2,754,120	6,107,082	8,871,647	
Windermere and Golden													59,406	59,406	
Ainsworth													90,954	90,954	
Slocan and Slocan City													1,358,035	1,358,035	
Nelson and Arrow Lake						2,006			2,006		2,006		63,919	65,925	
Trail Creek													272,967	272,967	
Revelstoke, Trout Lake, and Lardau				4,700		30,900			35,600		35,600		7,175	42,775	
No. 6 District															11,179,274
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria)	1,021,917	372,924	151,393			99,658	6,834	92,877	1,745,803	8,545	1,754,348	8,766,450	93,707	10,614,505	
Mainland (Vancouver and New Westminster)			132,329	16,983	111,369	110,621	159,364	166,532	564,769		564,769			564,769	
Totals	1,021,917	400,864	154,593	84,240	148,890	235,310	166,198	271,914	2,533,926	148,200	2,682,126	12,880,060	19,596,657	35,153,843	35,158,643

- Flux
25396
375,474

233,120
- Flux 25390

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	1875.....	\$ 2,474,004	1892.....	399,526	1909.....	\$ 477,000
1859.....	1,615,070	1876.....	1,786,648	1893.....	356,131	1910.....	540,000
1860.....	2,228,543	1877.....	1,608,182	1894.....	405,516	1911.....	426,000
1861.....	2,666,118	1878.....	1,275,204	1895.....	481,683	1912.....	555,500
1862.....	2,656,903	1879.....	1,290,058	1896.....	544,026	1913.....	510,000
1863.....	3,913,563	1880.....	1,013,827	1897.....	513,520	1914.....	565,000
1864.....	3,735,850	1881.....	1,046,737	1898.....	643,346	1915.....	770,000
1865.....	3,491,205	1882.....	954,085	1899.....	1,344,900	1916.....	580,500
1866.....	2,662,106	1883.....	794,252	1900.....	1,278,724	1917.....	496,000
1867.....	2,480,868	1884.....	736,165	1901.....	970,100	1918.....	320,000
1868.....	3,372,972	1885.....	713,738	1902.....	1,073,140	1919.....	286,500
1869.....	1,774,978	1886.....	903,651	1903.....	1,060,420	1920.....	221,600
1870.....	1,336,956	1887.....	693,709	1904.....	1,115,300	1921.....	233,200
1871.....	1,799,440	1888.....	616,731	1905.....	969,300	1922.....	364,800
1872.....	1,610,972	1889.....	588,923	1906.....	948,400		
1873.....	1,305,749	1890.....	490,435	1907.....	828,000		
1874.....	1,844,618	1891.....	429,811	1908.....	647,000		
				Total.....			\$76,542,203

TABLE VII.—PRODUCTION OF LODE MINES.

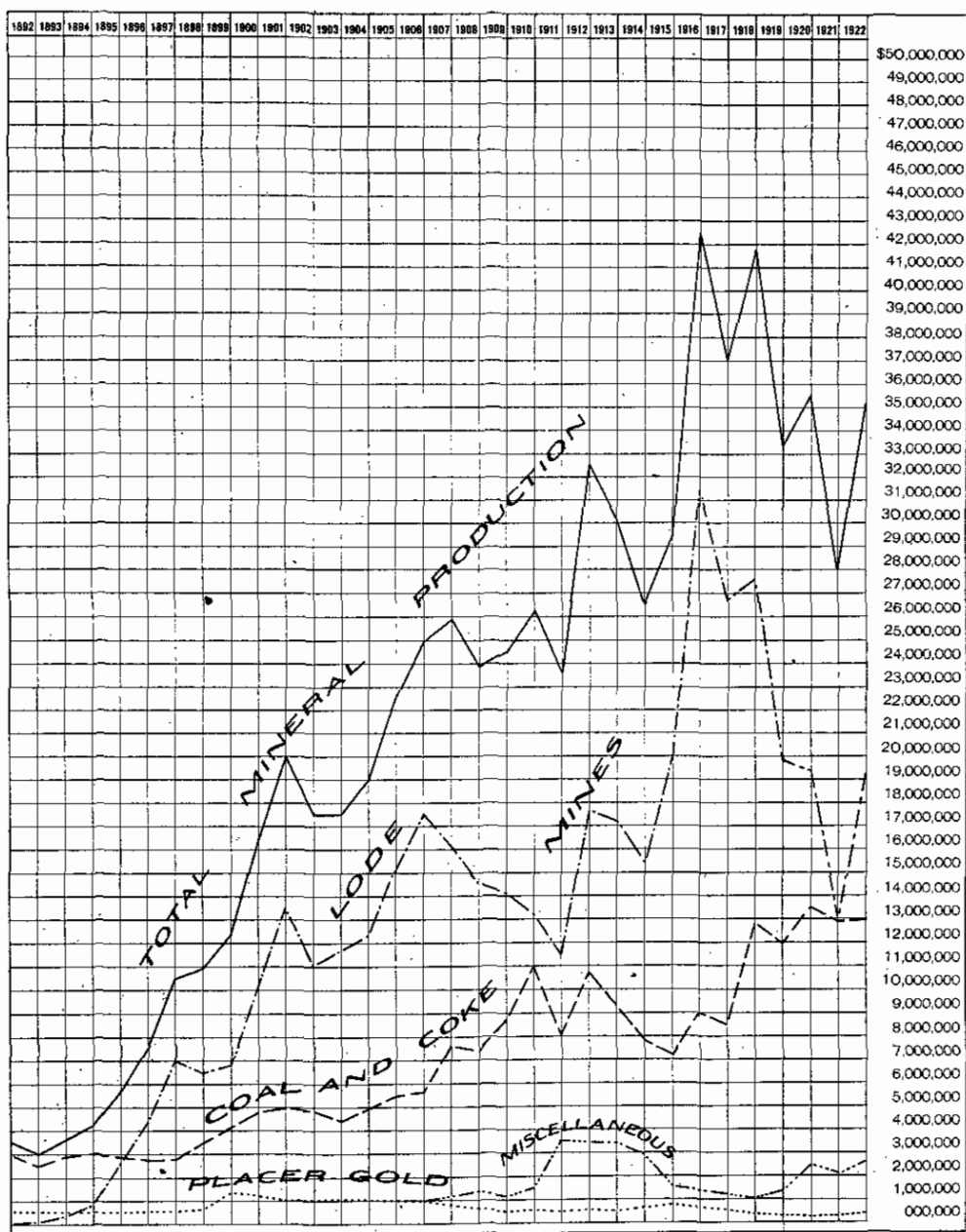
YEAR.	GOLD.		SILVER.		COPPER.		LEAD.		ZINC.		TOTAL VALUE.
	Oz.	Value.	Oz.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	
1887.....		\$		\$		\$		\$		\$	
1888.....			17,690	17,331			204,800	9,216			26,547
1889.....			79,730	75,000			674,500	29,813			104,813
1890.....			53,192	47,873			165,100	6,498			54,371
1891.....			70,427	73,948			Nil.	Nil.			73,948
1892.....			4,500	4,000			Nil.	Nil.			4,000
1893.....	1,170	23,404	227,000	66,935			808,420	33,064			99,999
1894.....	6,252	125,014	746,379	195,000			2,135,023	73,996			297,400
1895.....	39,264	785,271	1,496,522	470,219	324,680	16,234	5,062,523	169,572			781,342
1896.....	62,259	1,244,180	3,136,343	977,229	962,840	47,642	16,475,464	532,255			2,342,397
1897.....	106,141	2,152,820	5,472,971	2,100,689	3,518,556	190,926	24,199,977	721,384			4,257,179
1898.....	110,061	2,201,217	4,292,401	3,272,836	5,325,180	266,258	38,841,136	1,590,517			7,052,481
1899.....	138,315	2,857,578	2,939,413	3,375,841	7,271,678	874,781	31,693,559	1,077,581			8,829,420
1900.....	167,152	3,453,381	3,968,175	1,663,708	7,722,591	1,351,453	21,862,436	878,870			6,751,604
1901.....	210,384	4,348,608	5,151,333	2,309,200	9,997,080	1,615,289	63,358,621	2,601,887			10,069,757
1902.....	236,491	4,888,269	3,917,917	2,884,745	27,603,746	4,446,968	51,582,906	2,002,733			13,683,044
1903.....	232,831	4,812,616	2,996,204	2,884,745	29,636,057	3,446,673	22,536,381	824,832			11,101,102
1904.....	222,042	4,589,608	3,222,481	1,941,328	34,359,921	4,547,535	18,089,283	689,744			11,571,367
1905.....	238,660	4,933,102	3,439,417	1,521,472	35,710,128	4,678,037	36,646,244	1,421,874			12,309,035
1906.....	234,027	4,630,689	2,990,262	1,971,818	37,692,261	5,876,222	56,580,703	2,399,022			15,180,164
1907.....	196,179	4,065,020	2,445,448	1,897,320	42,990,488	8,288,565	52,408,217	2,667,578			17,484,102
1908.....	255,582	5,282,880	2,532,742	1,703,825	40,832,720	5,166,544	47,738,703	2,291,458			16,216,547
1909.....	288,224	6,282,880	2,532,742	1,897,320	45,597,246	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	1,821,483	47,274,614	6,240,249	34,658,746	1,386,350	4,184,192	192,473	13,228,731
1911.....	228,617	4,725,513	1,895,364	1,239,270	38,243,984	4,371,612	26,872,397	1,069,521	41,848,513	129,092	11,454,063
1912.....	267,496	5,322,442	3,132,108	1,921,483	36,927,656	4,671,644	44,371,454	1,805,627	5,358,280	816,139	17,662,766
1913.....	272,254	5,627,490	3,465,856	1,810,045	51,456,587	8,408,613	55,364,677	2,175,232	6,758,768	824,421	17,190,838
1914.....	247,170	5,109,004	3,602,180	1,968,060	46,460,305	7,094,489	50,625,048	1,771,377	7,896,467	346,125	15,225,061
1915.....	250,021	5,167,934	3,366,506	1,588,901	56,918,405	9,335,500	46,503,590	1,939,200	12,982,440	1,460,524	19,992,149
1916.....	221,982	4,587,334	3,301,923	1,876,736	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	1,929,216	2,059,739	59,007,565	16,038,258	37,807,465	2,951,020	41,848,513	3,166,259	26,788,474
1918.....	164,674	3,403,812	3,498,172	2,265,749	61,488,754	15,143,449	43,899,661	2,928,107	41,772,916	2,899,040	27,690,278
1919.....	152,426	3,150,645	3,405,119	1,588,901	42,459,339	7,939,396	29,475,908	1,526,855	56,737,651	3,540,429	19,750,498
1920.....	120,048	2,481,392	3,377,349	3,235,980	44,837,873	7,582,899	39,381,218	2,816,115	47,208,268	3,077,979	19,444,365
1921.....	135,603	2,804,154	2,673,389	1,591,201	39,036,966	4,879,624	41,402,288	1,693,354	49,410,372	1,952,065	12,920,398
1922.....	197,866	4,069,684	7,101,311	4,554,781	32,359,896	4,329,754	67,447,985	3,480,316	57,146,548	2,777,322	19,231,857
Total.....	5,315,407	109,647,661	96,392,380	59,814,266	996,739,898	170,723,242	1,145,744,087	51,810,891	379,586,989	24,625,858	416,821,913

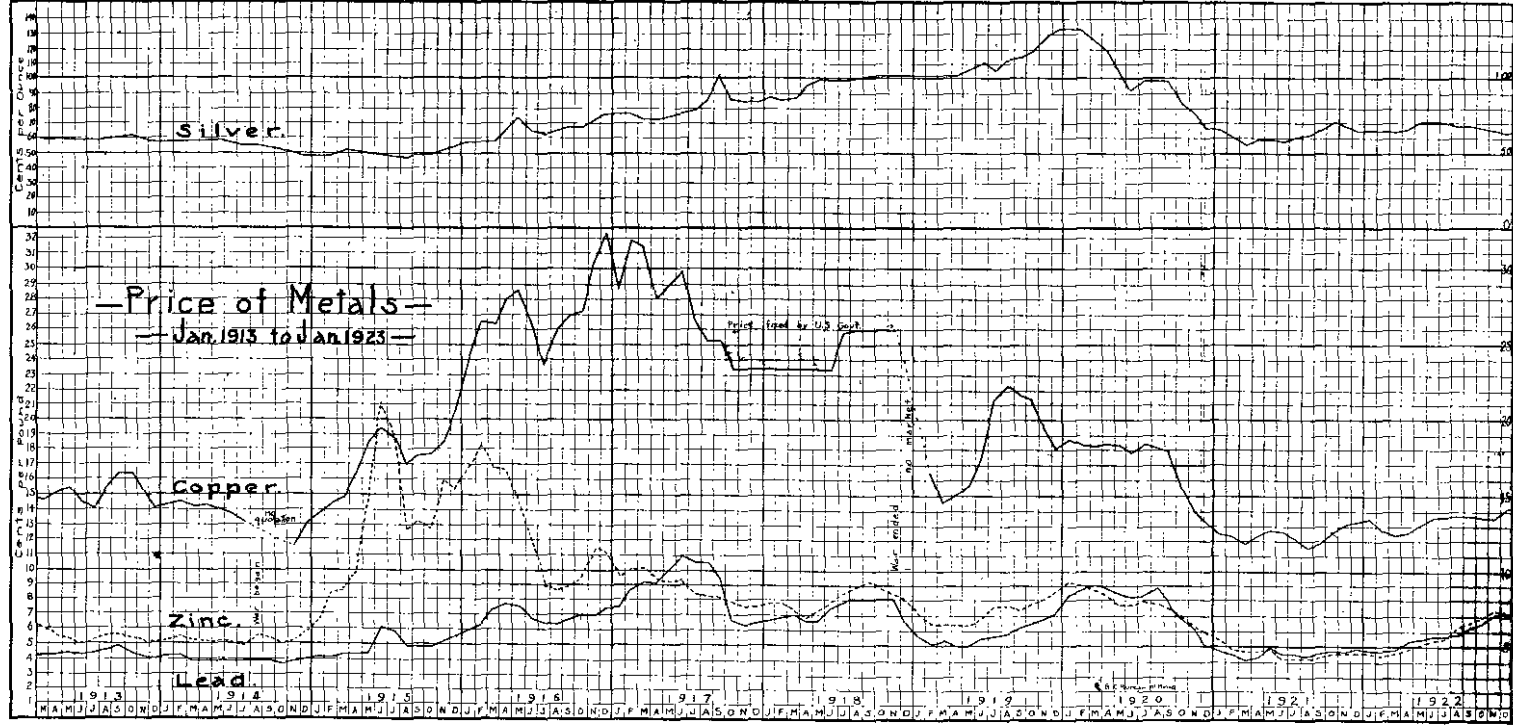
TABLE VIII.—COAL AND COKE PRODUCTION PER YEAR TO DATE.

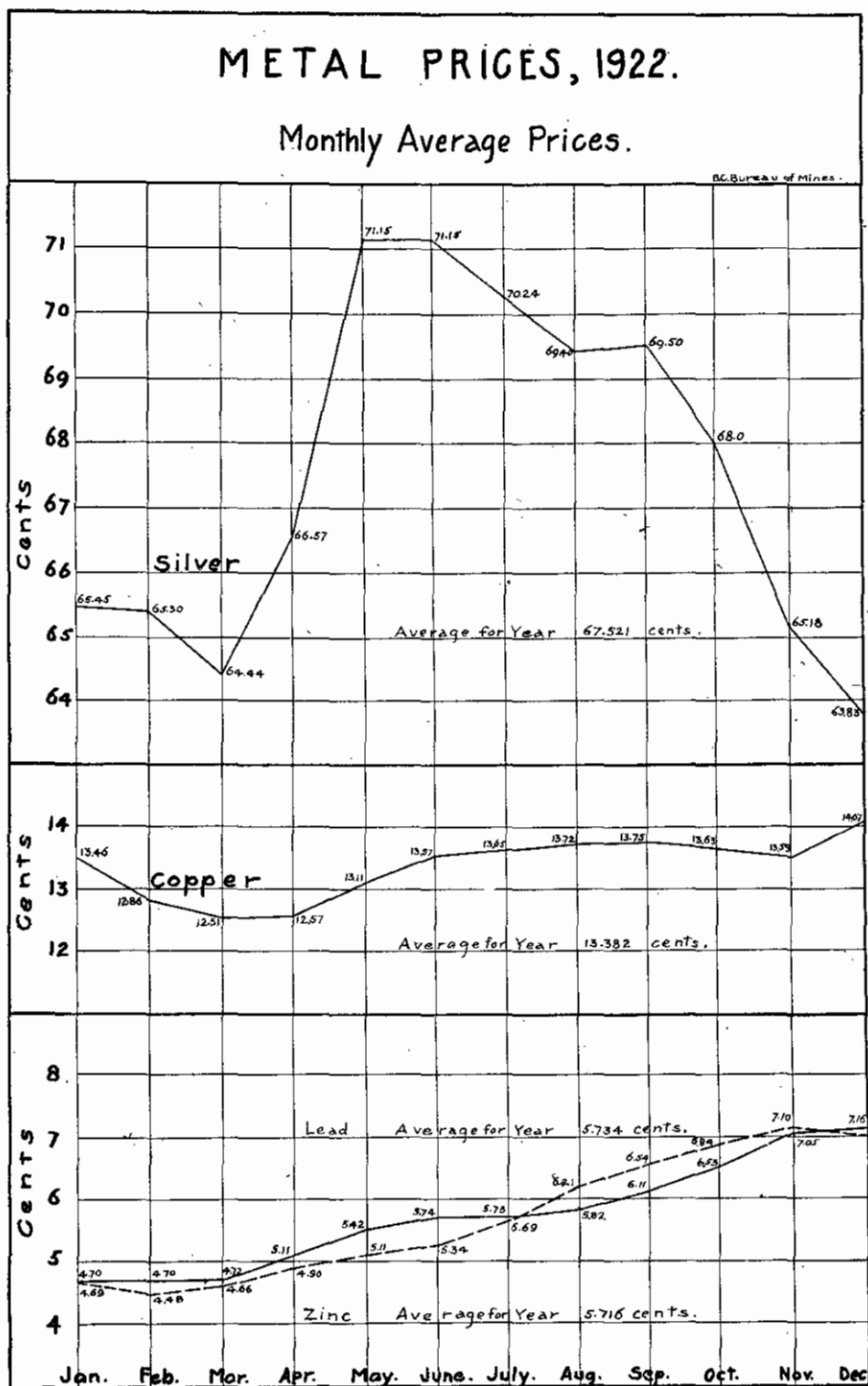
COAL.		
Year.	Tons (2,240 lb.).	Value.
1836-1883.....	2,369,345.	\$ 7,489,559
1884.....	394,070.	1,182,210
1885.....	265,596.	796,788
1886.....	326,636.	979,908
1887.....	413,360.	1,240,080
1888.....	489,301.	1,467,903
1889.....	579,830.	1,739,490
1890.....	678,140.	2,034,420
1891.....	1,029,097.	3,087,291
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
1921.....	2,483,995.	12,419,975
1922.....	2,511,843.	12,559,215
Total.....	59,205,333	\$213,768,998
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.	637,968
1920.....	67,792.	474,544
1921.....	59,434.	416,038
1922.....	45,835.	320,845
Total.....	4,228,536	\$24,520,567

TABLE IX.—PRODUCTION IN DETAIL OF THE

DISTRICT.	YEAR.	TONS.	GOLD—PLACER.		GOLD—LODE.		SILVER.	
			Ounces.	Value.	Ounces.	Value.	Ounces.	Value.
				\$		\$		\$
North-western District (No. 1).								
Atlin, Stikine, and Liard Divisions	1919		3,850	177,000				
	1920		6,980	188,600				
	1921	56	7,210	144,200	8	62	1,808	1,076
	1922	60	7,450	149,000	3	62	4,109	2,635
Nass River Division	1919	655,424			5,067	104,734	780,716	824,206
	1920	834,176			8,094	167,304	1,219,128	1,167,924
	1921	907,964			8,595	177,659	385,240	217,890
	1922	857,373			9,125	188,614	399,481	256,227
Portland Canal Division	1919	488			3,209	66,831	108,285	114,311
	1920	800			2,283	47,189	77,350	74,102
	1921	15,750			40,104	828,949	1,177,978	701,133
	1922	102,343			123,527	2,553,393	4,284,228	2,735,076
Skeena, Queen Charlotte, and Bella Coola Divisions	1919	104,145	850	17,000	51,890	1,070,706	31,412	33,163
	1920	109,232	150	3,000	44,154	912,663	21,854	20,457
	1921	134,574	100	2,000	36,483	754,103	20,781	12,369
	1922	105,982			35,081	725,124	17,126	10,985
North-eastern District (No. 2)								
Cariboo and Quesnel Divisions	1919		3,600	70,000				
	1920		3,800	66,000				
	1921		3,370	67,400				
	1922		9,615	192,300				
Omineca and Peace River Divisions	1919	4,051	400	8,000	147	3,038	72,573	76,615
	1920	4,000	150	3,000	218	4,508	103,020	98,693
	1921	71	150	3,000	13	269	3,745	2,229
	1922	905	275	5,500	66	1,364	20,274	13,004
Central District (No. 3)								
Nicola and Vernon Divisions	1919	137			25	517	6,791	7,199
	1920	62			14	289	1,546	1,480
	1921							
	1922	291	175	3,500	433	8,950	169	108
Yale, Ashcroft, and Kamloops Divisions	1919	29,371	100	2,000	627	12,960	2,096	2,213
	1920	1,025	50	1,000	238	4,919	437	419
	1921		50	1,000				
	1922	72	150	3,000	364	7,524	39	25
Lillooet and Clinton Divisions	1919	4,720	375	7,500	2,508	51,799	365	385
	1920	200	175	3,500	120	2,480		
	1921	500	400	8,000	374	7,730		
	1922	1,588	275	5,500	373	7,710		
Southern District (No. 4.)								
Grand Forks, Greenwood, and Osoyoos Divisions	1919	252,106	50	1,000	32,374	679,606	222,680	235,083
	1920	34,125	25	500	20,368	420,965	385,681	369,482
	1921	41,658	25	500	735	15,192	160,051	95,262
	1922	46,274	225	4,500	17,918	370,365	211,730	135,804
Similkameen Division	1919	17	50	1,000			32	34
	1920	18,934	25	500	69	1,427	3,331	3,191
	1921		50	1,000				
	1922		50	1,000				
Eastern District (No. 5)								
Fort Steele Division	1919	145,039	50	1,000			205,500	219,946
	1920	267,381	175	3,500			362,143	346,933
	1921	298,516	150	3,000	1	20	546,631	325,355
	1922	360,845	150	3,000			956,028	613,196
Windermere and Golden Divisions	1919	2,697					68,684	72,457
	1920	1,977			2	41	58,510	51,263
	1921						18,508	11,016
	1922	852					27,004	17,320
Ainsworth Division	1919	30,157			26	537	167,458	176,780
	1920	18,213			32	661	266,968	255,751
	1921	5,523			11	227	115,772	68,907
	1922	5,265			25	517	53,736	34,466
Slocan and Slocan City Divisions	1919	139,824			95	1,964	1,656,714	1,648,423
	1920	59,768			73	1,509	738,515	707,497
	1921	5,692			19	393	188,142	111,982
	1922	46,454			224	4,630	1,104,628	708,508
Nelson and Arrow Lake Divisions	1919	5,694	25	500	297	6,139	44,280	46,747
	1920	6,189	25	500	1,924	39,769	7,065	6,763
	1921	11,048	50	1,000	3,587	74,143	2,130	1,968
	1922	5,917			2,392	49,443	7,232	4,639
Trail Creek Division	1919	88,266			59,229	1,033,233	27,788	29,339
	1920	67,714			26,425	752,005	36,411	34,882
	1921	39,107			44,980	923,737	60,184	35,822
	1922	18,962			8,256	170,651	16,638	10,672
Revelstoke, Trout Lake, and Lardeau Divisions	1919	47	50	1,000	8	165	2,994	3,161
	1920	91	50	1,000	7	145	7,979	7,844
	1921	31	50	1,000	8	165	3,871	2,304
	1922	73	50	1,000	4	83	4,521	2,500
South-western District (No. 6)								
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria Divisions)	1919	7,657	25	500	1,164	24,090	9,036	10,490
	1920	6,133	25	500	19	393	2,745	2,630
	1921	1,331	25	500	104	2,150	506	960
	1922	19,900	25	500	65	1,344	14,358	9,216
Mainland (Vancouver and New Westminster Divisions)	1919	642,635			4,350	89,915	94,370	100,154
	1920	693,117			6,012	124,288	90,672	86,864
	1921	47,385			646	13,355	7,943	4,728
	1922							
TOTALS	1919	2,112,975	14,225	288,500	152,476	3,150,645	3,403,119	3,592,673
	1920	2,178,187	11,080	221,600	120,048	2,481,892	3,377,849	3,235,980
	1921	1,562,645	11,660	233,200	135,663	2,864,154	2,673,339	1,691,201
	1922	1,573,156	18,240	364,800	197,356	4,039,684	7,101,311	4,554,781







PROGRESS OF MINING.

The gross value of the mineral production of the Province for the year 1922 was \$35,158,843, an increase from that of the preceding year of \$7,092,202, or equivalent to an increase of about 25 per cent.

It is extremely gratifying to note that the above-mentioned output for the year 1922 has only been exceeded three times in the history of mining in the Province, and that was in 1916, when production reached \$42,290,462; in 1918, when the figure of \$41,782,474 was attained; and in 1920, when the value was \$35,543,084. In the first two years the production was the result of the war-time stimulus of output and war-time prices of the metals.

In the face of the explanation of the causes of these higher years, the output of 1922 is very creditable and indicates that normal conditions are returning, and may be expected to remain.

As noted in last year's Report, and equally true as yet, Europe is the world's metal market, to which practically all export metals find their way. As Europe is the consumer, the industrial conditions of Europe regulate the consumption of and demand for the metals.

That Europe is still in a decidedly unsettled condition at the present time cannot be questioned, but, for all that, the consumption of the metals does seem to have increased, and the greatly overstocked metal market on this continent, which accounted for the tremendous drop in the metal prices in 1921, have been somewhat relieved, with the result that metal prices in 1922 have been materially higher than in 1920.

To illustrate what this increase has been during the past year, the following table shows the average market prices of the various metals for the years 1921 and 1922:—

AVERAGE METAL-MARKET PRICES FOR YEARS 1921 AND 1922.

	Silver.	Copper.	Lead.	Zinc.
	Cents.	Cents.	Cents.	Cents.
1921.....	62.65	12.50	4.54	4.65
1922.....	67.52	13.38	5.73	5.72
Percentage increase in 1922.....	7.77	7.04	26.21	23.01

To indicate how fluctuating the market has been, charts have been prepared to accompany this Report (pages 15 and 16) which show the monthly fluctuations of metal-market prices from 1913 to date.

It is quite apparent from the charts 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 1921 are not lower than the normal pre-war prices, at which profitable mining was carried on under pre-war conditions.

During the year 1922, as shown in table, page 16, the market prices have been steadily increasing, and are still increasing during the current year, and have reached a point where a margin of profit for the miner is visible.

During the past year the costs of mining, including wages and supplies, have been materially decreased, so that the outlook for the next year's mining is somewhat brighter, and a reasonable margin of profit seems to be assured to the producers.

During 1921 all the large copper-producers of this continent, by concerted action, reduced their output to about 25 per cent. of normal, or shut down entirely, so as to reduce the stocks of copper on hand; the effect of this movement has now become apparent in the disappearance of the surplus stocks of the metals and the revival of a demand market at a living price.

We now hear that some of these companies have prepared and others are preparing to start up again, which is a sign tending to optimism for the future of the copper market, which reached 14 cents during the last month of 1922, and during the opening months of 1923 very nearly approached 15 cents.

During the copper market depression the larger companies got busy in a propaganda for a more extended use of copper, which has been successful in creating a new and increased domestic market for the metal, particularly in the United States, for builders' use, roofs, etc. Some of our large producers, spurred on by sheer necessity, made economies they had not recognized as possible, and are now assured a more profitable future with the return to more normal conditions.

The copper-output for 1922 was 32,359,896 lb., valued at \$4,329,754, a decrease from last year's output and below the normal output of the Province. This is largely due to the fact that the mill of the Britannia Company, one of our largest producers, was burned down in 1920, and the new mill, now nearing completion, will not be in operation until the summer of 1923.

During most of the year 1921 there was no demand for lead or zinc, and a great amount of such metals in the refined state accumulated at the Trail smelter to an extent that prohibited the further purchase of such ore by the custom smelters, which cause absolutely shut down many of the Slocan mines.

During the latter part of the year the Trail smelter was fortunate in finding an outlet in the Orient for the greater part of its accumulated lead and zinc stocks on hand, which again permitted prompt cash payment for ores of these metals to be made, and thus again started up these mines in the Slocan, so that it is probable next year will see these properties working again on a normal basis.

In 1922 the output of lead was 67,447,985 lb., having a value of \$3,480,316, an increase of 26,045,697 lb., or 63 per cent. over 1921, chiefly due to renewed activity of Slocan District mines, due to the fact that the Trail smelter was again able to receive customs lead ores.

The production of zinc in 1922 was 57,146,548 lb., valued at \$2,777,322, a decided increase over even the preceding year, amounting to 7,727,176 lb., or over 15 per cent. The greater amount of this was mined at the *Sullivan* mine in East Kootenay and refined at Trail.

The collieries of British Columbia held their own, having made a net coal production of 2,511,843 tons (2,240 lb.), as against 2,483,995 tons in 1921, an increase of 27,848 tons, equal to about 1.1 per cent.

With the exception of the year 1920, the net coal-output for 1922 is larger than any other year since 1912, or of any previous year, except 1910.

There was 4,435 tons of coke produced in the Coast District by the collieries. The Anyox smelter converted some coal into coke for their own use.

The Crowsnest District produced 41,400 tons (2,240 lb.) of coke, of which about two-thirds was used in Canada and one-third exported to the United States.

The aggregate of the values of British Columbia colliery products in 1922 was \$12,880,000, this being less than the gross value of this year's metalliferous products of \$19,596,657.

It is noteworthy that the North-western District produced 67.7 per cent. of the tonnage of ore mined in British Columbia in 1922, carrying about 55 per cent. of the total value of the metalliferous output of the Province.

The following table shows the number of mines which shipped ore during the year 1922, 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 1922.

	Tons of Ore shipped.	No. of Mines shipping.	No. of Mines shipping over 100 Tons in 1922.	MEN EMPLOYED IN THESE MINES.		
				Below.	Above.	Total.
No. 1 District.						
Atlin, Stikine, and Liard.....	60	3	..	5	6	11
Nass River.....	857,373	3	3	180	98	278
Portland Canal.....	102,343	3	1	127	182	309
Skeena, Queen Charlotte, and Bella Coola.....	105,982	3	1	143	74	217
No. 2 District.						
Cariboo and Quesnel.	..	..	..	..	..	..
Omineca and Peace River.....	905	2	1	8	10	18
No. 3 District.						
Nicola and Vernon	291	1	1	4	3	7
Yale, Ashcroft, and Kamloops....	72	2	..	7	11	18
Lillooet and Clinton.....	1,588	1	1	2	3	5
No. 4 District.						
Grand Forks, Greenwood, and Osoyoos	46,274	13	4	93	160	253.
Similkameen.....	..	..	..	..	..	..
No. 5 District.						
Fort Steele.....	360,845	1	1	211	200	411
Windermere and Golden.....	862	2	2	15	5	20
Ainsworth	5,265	13	4	49	21	70
Slocan and Slocan City.....	46,454	36	8	149	116	265
Nelson and Arrow Lake	5,917	8	2	54	40	94
Trail Creek.....	18,982	4	3	58	13	71
Revelstoke, Trout Lake, and Lardreau	73	2	..	8	5	13
No. 6 District.						
Vancouver Island (Nanaimo, Alberni, Clayoquot, Quatsino, and Victoria).....	19,900	1	1	33	17	50
Mainland (Vancouver and New Westminster).	..	..	..	..	..	..
Totals	1,573,186	98	33	1,146	964	2,110

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-SHIPING MINES AND MEN EMPLOYED IN 1922.

District.	NUMBER OF MINES.			MEN EMPLOYED.		
	Working.	Idle.	Total.	Below.	Above.	Total.
No. 1.						
North-western Mineral Survey District....	5	8	13	25	25	50
No. 2.						
North-eastern Mineral Survey District....	3	2	5	6	4	10
No. 3.						
Central Mineral Survey District.....	1	8	9	18	15	33
No. 4.						
Southern Mineral Survey District.....	4	16	20	12	11	23
No. 5.						
Eastern Mineral Survey District.....	25	53	78	54	39	93
No. 6.						
Western Mineral Survey District.....	2	9	11	249	181	430
Totals	40	96	136	364	275	639

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 1922, aggregating \$769,418,462. From this table it will be seen that coal-mining has produced more than any other separate class of mining, a total of \$238,289,565; followed next in importance by copper at \$170,723,242, and next in order is lode gold at \$109,647,661, with placer gold in fourth place at \$76,542,203.

TABLE II. shows the value of the total production of the mines of the Province from 1852 to 1894 (inclusive) and for each year from 1895 to 1922 (inclusive), during which period the output increased tenfold, and had a gross production for the year 1922 of \$35,158,843.

The value of the total mineral production of the Province up to the end of 1922 was \$769,418,462.

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 an increase in the production of placer gold of \$131,600 and an increase in output of lode gold of \$1,285,530, making a total increase of \$1,417,130 in the total production of the precious metal.

The amount of silver produced this past year was 7,101,311 oz., having a gross value of \$4,554,781, an increase in the number of ounces produced of 4,427,922.

The table shows an output of lead amounting to 67,447,985 lb., valued at \$3,480,316, an increase in quantity of 26,045,697 lb., and an increase in value of \$1,786,962.

The production of copper this year was 32,359,896 lb., valued at \$4,329,754, a decrease in amount of 6,677,097 lb., or about 17 per cent. The value of the product was less than that of the preceding year by \$549,870.

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 South-western District has again the honour of first place on the list, followed, in order of importance, by the North-western, Eastern, Southern, Central, and North-eastern Districts. The South-western and Eastern 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 South-western 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 \$2,319,117, 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 \$2,682,126. 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 1922, and shows a total production of \$76,542,203. The output for 1922 was \$364,800, an increase, as compared with the previous year, of \$131,600, chiefly due to the new Cedar Creek diggings.

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 \$416,621,913; 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 1922 was 59,205,333 tons (2,240 lb.), worth \$213,768,998. Of this, there was produced in 1922 2,511,843 tons valued at \$12,559,215. 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 1922 was 61,497 tons, from which was made 45,835 tons of coke, having a value of \$320,845, a decrease in amount

from the preceding year of 13,599 tons. The total value of the output of the collieries of the Province in 1922 was \$12,880,060.

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 1919, 1920, 1921, and 1922, 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 1922 was 1,573,186 tons, having a gross value of \$19,231,857, and, with the placer gold, a total value of \$19,596,657.

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

Nass River Mining Division	857,373
Skeena Mining Division	105,982
Portland Canal Mining Division	102,343
Fort Steele Mining Division	360,845
Slocan City Mining Division	46,454
Osoyoos Mining Division	46,274
Other Mining Divisions	53,915

Total 1,573,186

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, in 1920 it reached the \$35,500,000 line, in 1921 it passed the \$28,000,000 line, and in 1922 was over the \$35,000,000 line.

GOLD.

The recovery of placer gold for 1922 was \$364,800, of which practically all was obtained in the North-eastern and North-western Districts, only about one-twentieth of the total coming from the other districts. An approximate apportionment is as follows: From Cariboo District, \$102,300; Atlin, Stikine, and Liard Divisions of North-western District, \$149,000; remaining parts of the Province, \$23,500. This production for 1922 shows an increase over the preceding year of \$131,600, or about 56.43 per cent.

During the previous four years the production of placer gold in the Province steadily decreased from the output of former years of between \$500,000 and \$700,000, which was due largely to the economic conditions of shortage and high prices of labour and supplies. The output for 1922 noted above brings this year's output above any year since 1917. The increase of \$131,600 in 1922 over the previous year or over 56 per cent. is due to the additional output of the recently opened-up placer-digging in the vicinity of Cedar creek, a small stream flowing into Quesnel lake about 5 miles from its mouth.

The information regarding the Atlin Division is not as complete as usual this year, owing to the retirement on superannuation late in the season of J. A. Fraser, for many years the most efficient Gold Commissioner of the district, followed very shortly after by the death of his acting successor, W. G. Paxton, for many years the Mining Recorder of Atlin District.

The value of lode gold produced in 1922 was \$4,089,684, as compared with \$2,804,154 in 1921, an increase of \$1,285,530, or about 45.9 per cent. The **Gold from Lode-mining.** Portland Canal Division, of this, produced a gold value of \$2,553,303, or more than the remainder of the Province. The *Belmont-Surf Inlet* mine in Skeena Division produced \$725,124, and the Osoyoos Division \$370,365, chiefly from the *Nickel Plate*; both of these latter properties being strictly gold-mines.

The Rossland camp produced \$170,651, which is less than 20 per cent. of its normal output, as these mines were shut down in March, pending the preparation of a concentrating plant at Trail.

The very small gold-output of the South-western District is due to the shut-down of the *Britannia* mine owing to fire and flood.

The following table shows the gold production of 1920, 1921, and 1922:—

Mining Division.	1920.	1921.	1922.
	Oz.	Oz.	Oz.
Portland Canal	2,283	40,104	123,527
Skeena	44,127	36,483	35,081
Nass	8,094	8,595	9,125
Trail Creek (Rossland)	36,425	44,980	8,256
Boundary-Yale.	20,687	735	17,918
Coast (Southern)	6,031	750	.....
Nelson	1,924	3,587	2,392
All others	477	429	1,557
Totals	120,048	135,663	197,856

SILVER.

The quantity of silver produced was 7,101,311 oz., worth \$4,554,781, an increase over the production of 1921 in quantity of 4,427,922 oz., and an increase in value of \$2,963,380, or nearly 186.3 per cent.

The market price of silver gradually and steadily fell during the whole year of 1920, but rose again in 1921 and 1922. The average price for the year 1920 was 100.9 cents an ounce, and for 1921 it was 62.65 cents, while for 1922 it was 67.52 cents.

An accompanying diagram illustrates the fluctuations of market prices (pages 15 and 16).

The following table shows the silver production for 1920, 1921, and 1922:—

Mining Division.	1920.	1921.	1922.
	Oz.	Oz.	Oz.
Portland Canal	77,350	1,177,978	4,264,228
Nass	1,219,128	365,240	399,481
Slocan and Slocan City	738,515	188,142	1,104,628
Boundary District	390,994	160,051	211,730
Fort Steele	362,143	546,631	956,028
Ainsworth	266,963	115,772	53,736
Trail Creek .....	.....	60,184	16,638
Coast (Southern)	93,417	8,548	14,368
Omineca	103,020	3,745	20,274
Windermere-Golden	53,510	18,508	27,004
Nelson	7,065	2,130	7,232
All others	65,744	26,460	25,964
Totals	3,377,849	2,673,389	7,101,311

The feature of the year has been the phenomenal silver production of the Portland Canal Mining Division, which amounted to 4,264,228 oz. valued at \$2,735,076, almost entirely by the *Premier* mine.

The Slocan Division produced 1,104,628 oz., followed by the Fort Steele Division with 956,028 oz. and the Nass River Division with almost 400,000 oz.

COPPER.

The amount of copper produced in 1922 shows, as compared with the previous year, a decrease in quantity, but owing to a slightly higher market selling-price the decrease in value is not proportionally so great. The production was 32,359,896 lb., which is 6,677,097 lb. less than the 1921 output; the value for this year is \$4,329,754, which, compared with \$4,879,624 made in 1921, shows a decrease of \$549,890.

The following table shows the production of copper, according to districts, in 1920, 1921, and 1922:—

Mining Division.	1920.	1921.	1922.
	Lb.	Lb.	Lb.
Nass	25,404,950	34,067,185	30,334,584
Skeena	727,368	748,918	697,058
Coast (Southern).....	16,311,962	1,456,146	617,691
Boundary-Yale.....	1,306,515	432,505	.....
Trail Creek Division.....	1,113,085	2,277,392	684,930
All others.....	23,796	54,847	25,633
Totals	44,887,676	39,036,993	32,359,896

The Granby Company at Anyox in 1922 produced 93 per cent. of the total of the Province, even though such production was about 4,000,000 lb. less than that of 1921. The remaining 7 per cent. of the output of the Province was about equally divided between the *Belmont-Surf Inlet* mine in Skeena District, the Rossland camp, and the Tidewater Copper Company, on the west coast of Vancouver island.

The *Britannia*, on Howe sound, produced nothing in 1922, but has just replaced its old mill destroyed by fire in 1920 by a completely new mill, and it is expected that in 1923 its production will approximate that of Anyox.

The market price of copper during the year 1920 dropped from about 19 cents at the beginning of the year to about 13 cents a pound; in 1921 the price remained between 12 and 13 cents, averaging 12.5 cents; while in 1922 the price for year averaged 13.38 cents, or 0.9 cents better than the preceding year, and during the first three months of 1923 gradually rose to about 18 cents, which causes the copper producers to be very optimistic for the coming year.

LEAD.

The total amount of lead produced in 1922 was 67,447,985 lb., valued at \$3,480,316. This represents, as compared with the previous year, an increase in quantity of 26,045,697 lb., and in value of \$1,786,962.

This represents an increase in quantity of 63 per cent. and an increase in value, partly due to higher market, of over 105 per cent. The average market price of lead in 1921 was 4.54 cents a pound, while in 1922 it was 5.73 cents, with the market steady at 8 cents in February, 1923.

The following table shows the production of lead, according to Mining Divisions, for the years 1920, 1921, and 1922:—

Mining Division.	1920.	1921.	1922.
	Lb.	Lb.	Lb.
Fort Steele	26,926,319	38,066,820	57,743,931
Slocan.....	6,135,581	1,614,425	7,633,624
Ainsworth	4,072,807	1,264,845	826,681
Windermere-Golden.....	1,095,486	385,000	815,618
Nelson	719,219	1,301	176,747
Grand Forks.....	.....	51,268	144,251
All others.....	381,806	18,629	107,183
Totals	39,331,218	41,402,288	67,447,985

From the above table it will be seen that there were increases in Fort Steele, Slocan, and Windermere Divisions, and decreases in all other districts.

The Fort Steele District this year made an output of nearly double that of 1921 and leads all the other districts, producing over 90 per cent. of total lead-output of Province. This great increase is due to the great output of the *Sullivan* mine, owned by the Consolidated Mining and Smelting Company, of Trail.

In the Slocan District the heaviest producer in 1922 was the *Silversmith*, followed by the *Bosun* and *Rambler-Cariboo*.

In the Ainsworth Division the largest producer was the *Florence*, with an output of about 420,000 lb., followed by the *Highland*, with approximately 152,000 lb., and eleven smaller shippers.

The production from Windermere-Golden was chiefly from the *Paradise* mine, with a production of about 594,000 lb.

ZINC.

The quantity of zinc produced in 1922 amounted to 57,146,548 lb., which, compared with 49,419,372 lb. produced in 1921, shows an increase of 7,727,176 lb. This production is valued at \$2,777,322, which shows an increase, as compared with the 1921 value, of \$825,257, or about 42.5 per cent.

The zinc market in 1921 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, but dull, with an average price of 4.65 cents a pound, not varying more than $\frac{3}{10}$ cent during the year. In 1922 the market opened the year at 4.5 cents and rose gradually to 7 cents at the end of the year.

The following table shows the production of zinc, according to Mining Divisions, for the years 1920, 1921, and 1922.

Mining Division.	1920.	1921.	1922.
	Lb.	Lb.	Lb.
Fort Steele.....	42,881,092	49,319,198	51,672,816
Slocan.....	3,715,471	65,984	5,164,661
Omineca.....	453,512	11,561	21,071
Ainsworth.....	158,193	22,629	273,949
All others.....			14,051
Totals.....	47,208,268	49,419,372	57,146,548

From the above table it would seem that practically 90 per cent. 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 the *Bosun*, with a production of 1,825,000 lb. The next largest shipper was the *Standard*.

The figures for Ainsworth show an increased production.

The Omineca production is entirely 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.

The only shipments of iron ore made this past year were 1,200 tons from the *Good Hope*, Texada island.

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 \$100 worth from the Similkameen District.

Molybdenite. Since the Armistice the market is dormant, like other metal prices, but nominal quotations vary from 45 to 50 cents 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 since that date.

Manganese.—No manganese was produced in 1922.

Non-metallic Minerals. About 5,044 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. 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, which produced concentrates carrying about 88.5 per cent. calcium fluoride and 5.3 per cent. silica, and having a total value of about \$100,000. The mineral is shipped to 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.

The Lillooet Soda Company produced 1,300 tons of sodium carbonate.

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.

Arsenic.—The *Nickel Plate* mine recovered 511 tons of oxide arsenic in 1922.

Talc.—Some 277 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 2,089 tons of iron pyrites was mined and shipped to Trail.

COAL.

The gross production of coal in 1922 was 2,580,915 long tons, of which 69,072 tons was made into coke, leaving the net production at 2,511,843 tons. These figures show an increase, as compared with 1921, of 11,276 tons gross and of 27,848 tons net. The quantity of coke made was 45,835 tons, which is a decrease of 13,599 tons as compared with 1921. For purposes of comparison the following table is shown:—

	1917.	1918.	1919.	1920.	1921.	1922.
Coal, gross.....tons, 2,240 lb..	2,398,715	2,578,724	2,408,948	2,696,774	2,569,639	2,580,915
Less made into coke "	248,740	276,479	141,407	101,649	85,644	69,072
Coal, net. "	2,149,975	2,302,245	2,267,541	2,595,125	2,483,995	2,511,843
Coke made. "	159,905	188,967	91,138	67,792	59,434	45,835

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

	1919.	1920.	1921.	1922.
Vancouver Island mines tons, 2,240 lb.	1,699,348	1,698,254	1,625,931	1,754,656
Nicola and Similkameen mines..... "	149,042	149,731	183,153	270,890
Crowsnest mines..... "	558,806	847,389	759,755	554,361
Omineca-Telkwa "	1,752	1,400	800	1,008
Total quantity of coal mined.. "	2,408,948	2,696,774	2,569,639	2,580,915
Less made into coke..... "	141,407	101,649	85,644	69,072
Net quantity of coal produced "	2,267,541	2,595,125	2,483,995	2,511,843

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

	1919.	1920.	1921.	1922.
Vancouver Island collieries tons, 2,240 lb.	34,071	<i>Nil</i>	<i>Nil</i>	4,435
Nicola and Similkameen collieries... "	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>
Crowsnest District collieries..... "	57,067	67,792	59,434	41,400
Total coke production... "	91,138	67,792	59,434	45,835

As will be seen from the above figures, the net coal production this year is 27,848 tons more than it was in 1921, and greater than it has been since 1912, except in 1920.

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 Western Fuel Corporation of Vancouver island, which mined, collectively, 72 per cent. of the gross output.

Of the other collieries: In the Coast District, on Vancouver island, the Pacific Coast Coal Mines, Limited, now in liquidation, mined no coal, but recovered 4,752 tons of slack from one of the old dumps at the Morden mines; the Nanoose Collieries, Limited, 99,049 tons; the Granby Company, from their colliery near Cassidy, produced 276,919 tons; and King & Foster, conducting operations at the Old Wellington, made a production of 9,148 tons. In the Nicola Valley section of the district, the Middlesboro Colliery Company mined 69,330 tons; the Fleming Coal Company, 38,485 tons; the Princeton Coal and Land Company, 19,418 tons; the Coalmont Colliery, 142,806 tons; the Chu Chua Colliery, 618 tons; and the Community Coal and Coke Company, Limited, 233 tons of coal.

A new coalfield has been opened up in the Omineca District, where two small collieries are being developed on the Telkwa river. The Aveling coal-mine shipped in 1922 669 tons of coal and the Telkwa Collieries 339 tons, making a total for that section of 1,008 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 508,339 tons, the Corbin Coal and Coke Company produced 46,022 tons.

The collieries of the Coast District, including the Nicola-Princeton and Telkwa fields, are to be credited this year with about 78 per cent. of the total coal-output.

The gross output of the collieries of the Province for the past year was, as already stated, 2,580,915 tons; there was also 29,441 tons of coal taken from stock.

Of this gross amount, there was sold for consumption in Canada, 1,397,918 tons; sold for consumption in the United States, 762,118 tons; sold in other countries, *nil*; making the total coal sales for the year 2,160,036 tons of 2,240 lb.

In addition to the coal sold, there was used in the manufacture of coke 69,072 tons, and used under companies' boilers, etc., 205,529 tons; while 175,719 tons was lost in washing and screening.

The coke sales of the Province for the past year amounted to 45,393 tons, which, together with 409 tons added to stock and 33 tons used under companies' boilers, make a total production of 45,835 tons.

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.	1,259,183	138,735	1,397,918
" export to United States "	428,667	333,451	762,118
" export to other countries ..... "	.....	.....	.....
Total coal sales.....	1,687,850	472,186	2,160,036
COKE.			
Sold for consumption in Canada tons, 2,240 lb.	4,127	25,742	29,869
" export to United States ..... "	.....	15,524	15,524
" export to other countries ..... "	.....	.....	.....
Total coke sales.....	4,127	41,266	45,393

COLLIERIES OF COAST DISTRICT.

The collieries of the Coast District, which includes those on Vancouver island and in the Nicola-Princeton fields, and two small collieries on Telkwa river mined 2,026,554 tons of coal in 1922, in addition to which 8,330 tons was taken from stock, making 2,034,893 tons distributed from these collieries in 1922. This amount was distributed thus:—

	Tons.	Tons.
Sold as coal in Canada	1,259,183	
Sold as coal in United States	428,667	
Sold as coal in other countries	NIL.	
Total sold as coal	1,687,850	
Used under companies' boilers, etc.	163,749	
Used in making coke	7,515	
Lost in washing, etc.	175,719	
	2,034,893	
Minus coal taken from stock	8,339	
Gross output	2,026,554	

The total coal sales of the Coast collieries for the year show, as compared with the sales of the previous year, an increase of 202,435 tons, equivalent to about 13 per cent.

The coal sold in Canada by the collieries of the Coast District this year shows an increase of 93,878 tons, or about 8 per cent. more than the preceding year; the amount exported to the United States was 108,557 tons more than the preceding year, an increase of about 33 per cent.

There was 4,435 tons of coke produced in the Coast District this year.

On Vancouver island five companies produced coal this year—the Canadian Collieries (D.), Limited, the Western Fuel Corporation of Canada, Limited, the Granby Consolidated Mining, Smelting, and Power Company, the Nanoose Collieries, Limited, and the Old Wellington; the majority of these companies each operate two, or more, collieries. The combined gross output of the Island collieries was 1,754,656 tons.

In the Nicola and Princeton coalfields of the Coast District, the Middlesboro Colliery Company produced 69,330 tons of coal; the Fleming Coal Company, 38,485 tons, the Princeton Colliery, 19,418 tons; the Coalmont Collieries, 142,806 tons; the Chu Chua Collieries, 618 tons; and the Community Coal and Coke Company, 233 tons.

The total output of this portion of the sub-district was 270,890 tons. The Telkwa Collieries produced 339 tons and the Aveling coal property 669 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, which together mined 508,339 tons; and the Corbin Coal and Coke Company, which mined 46,022 tons; making a gross output for the district for 1922 of 554,361 tons of coal.

The amount of coal actually distributed was 575,463 tons, but as 21,102 tons of this was taken from stock, the gross amount of coal actually mined was 554,361 tons.

Of this gross tonnage, 61,497 tons was used in the manufacture of coke, of which there was produced 41,400 tons (2,240 lb.), of which 41,266 tons were sold and 134 tons added to stock.

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

	Tons.	Tons.
Sold as coal in Canada	138,735	
Sold as coal in United States	333,451	
Total sold as coal		472,186
Used by the companies in making coke		61,497
Used by the companies under boilers, etc.		41,780
		575,463
Minus coal taken from stock		21,102
Gross output		554,361

BUILDING MATERIALS.

The output during 1922 of structural materials, such as cement, lime, building-stone, sand and gravel, brick and other clay products, was more than in the preceding year, being \$2,533,926 as against \$1,903,799.

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 \$1,500,000 represents the steady yearly demand for these materials for use in repairs, renewals, and various small demands, with a little more construction-work in 1922.

Cement production is greater than 1921.

Public works and several large buildings have caused the quarrying of a good

Building-stone. deal of building-stone, and the production in 1922 is valued at \$154,593.

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 7,500 M.; the price varies from \$12 to \$18 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 are two kilns 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 1922 is valued at \$400,864, as compared with \$299,191 in 1921; of this about \$25,390 worth of limestone was quarried for use as smelter flux by the Granby and Consolidated Companies and \$372,924 worth quarried by the paper and pulp mills for their own use.

There were two large and well-equipped cement plants in the Province, both **Portland Cement.** situated on Saanich inlet. These two concerns have recently been amalgamated under the name of the British Columbia Cement Company, with plant at Tod inlet, which made a production in 1922 of over \$1,000,000. 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 H. Pearson, 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 Mining Engineer with headquarters at a centrally located point in such district.

In the district to which he was appointed the Resident Mining 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 Mining 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 Mining 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 Mining 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 Mining 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 Mining 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. The Resident Mining Engineer is Angus W. Davis.

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 Mining 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 Mining 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 Mining 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 1922 as reported by the Assistant Provincial Assayer, D. E. Whittaker:—

During the year 1922 there were made by the staff in the Government Assay Office, 3,976 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	\$ 243 45
Fees for assaying	101 40
Fees for assayers' examinations	210 00
Total cash receipts	\$ 554 85
Determinations and examinations made for other Government departments for which no fees were collected—	
Attorney-General's Department	\$ 300 00
Agricultural Department	1,020 00
Board of Health	420 00
Treasury Department	38 35
Other departments	222 00
	\$2,000 35

Value of work done outside of Mines Department work \$2,553 20

The value of gold melted during the year 1922 was \$4,895 in 17 lots, as against \$775 in 11 lots in 1921.

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

EXAMINATIONS FOR ASSAYERS.

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

I have the honour, as Secretary, to submit the Annual Report for the year 1922 of the Board of Examiners for Certificates of Competency and Licence to Practise Assaying in British Columbia, as established under the "Bureau of Mines Act Amendment Act, 1899."

Examinations were held in Victoria, in the Government Laboratory, on May 15th and December 11th and the following days. Five candidates came up for examination, each of

whom 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 recommendation of the Board, Certificates have been duly issued by the Honourable the Minister of Mines to the eight 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.	Locke, V. F.	Vancouver.
Archer, E. G.	Anyox.	Longworth, F. J.	Boyd's, Wash.
Armstrong, N.	Vancouver.	Manning, S. M.	Trail.
Ayres, D. A.		Martin, S. J.	
Austin, John W.	Vancouver.	Marsh, Richard	Republic, Wash.
Backus, Geo. S.	Britannia Beach.	Marshall, H. Jukes	Vancouver.
Baker, C. S. H.		Marshall, William S.	Ladysmith.
Bagus, N. J.	Vancouver.	Meal, Eric A.	East Helena, Mont.
Barke, A. C.		Merrifield, T. T.	Trail.
Beilby, E. B.	Vancouver.	Miles, Arthur D.	
Bernard, Pierre	Monte Christo, Wash.	Milne, A. S.	Vancouver.
Bishop, Walter	Grand Forks.	Mitchell, Charles T.	Copper Cliff, Ont.
Boulding, J. D.	Vancouver.	McCormick, Alan F.	Ruth, Nevada.
Broughton, F. W.	Vancouver.	MacDonald, Alec. C.	Vancouver.
Buchanan, James	Trail.	MacDonald, J. S.	Vancouver.
Buehman, A. S.	Trail.	McLellan, R. D.	Vancouver.
Campbell, Colin	New Denver.	Morgan, Richard	Trail.
Carmichael, Norman	Clifton, Arizona.	Nicholls, Frank	Norway.
Church, George B.		Okell, S. E.	Vancouver.
Clarke, E. R.	Vancouver.	Parker, Robt. H.	
Cobeldick, W. M.	Scotland.	Parsenow, W. L.	
Collison, H.	Cobham, England.	Perkins, Walter G.	
Comrie, George H.	Vancouver.	Pickard, T. D.	Vancouver.
Cotton, G. W.	Trail.	Pirrie, Noble W.	Ottawa, Ont.
Craufurd, A. J. F.	Rosslund.	Poole, H. W.	Vancouver.
Crerar, George		Prior, C. E.	Hedley.
Crompton, S. V.	Vancouver.	Raht, K.	Trail.
Cruikshank, G.		Richmond, Leigh	Duncan.
Davidson, J. R.	Vancouver.	Robertson, T. R.	
Day, Athelstan	Dawson.	Rodgers, Ch. B.	Vancouver.
Dedolph, Ed.		Rogers, G. J.	South Vancouver.
Dockrill, Walter R.	Chemainus.	Rombauer, A. B.	Butte, Mont.
Dunn, G. W.	Rosslund.	Schroeder, Curt A.	
Farguhar, J. B.	Vancouver.	Segsworth, Walter	Toronto, Ont.
Fingland, John J.	Kaslo.	Shepherd, G. H.	North Vancouver.
Gardner, C. S.	Victoria.	Sharpe, Bert N.	
Grosvenor, F. E.	Vancouver.	Shore, J. T.	Vancouver.
Hamilton, Wm. J.	Anyox.	Sim, Chas. John	Monte Carlo.
Hannay, W. H.	Rosslund.	Sloan, Wm.	Vancouver.
Harsant, R. C. C.	Port Essington.	Snyder, Blanchard M.	
Hart, P. E.		Steven, Wm. Gordon	
Hawkins, Francis	Silverton.	Stimmel, B. A.	Trail.
Hawes, F. B.	Vancouver.	Stockly, Galt	Princeton.
Hodgson, A. R.	Anyox.	Sundberg, Gustave	Mexico City.
Hook, A. Harry	Greenwood.	Tally, Robert E.	Spokane, Wash.
Hurter, C. S.	Prince Rupert.	Taylor, E. S.	Vancouver.
Irwin, George E.	Vancouver.	Taylor, H. L.	Vancouver.
John, D.	Haileybury, Ont.	Teed, A. J.	Vancouver.
Kiddie, Geo. R.	California.	Thirkell, V. R.	Vancouver.
King, R.		Thomas, Percival W.	Vancouver.
Kitto, Geoffrey B.	Victoria.	Tretheway, John H.	
Lang, T. F.	Vancouver.	Turner, H. A.	Vancouver.
Langley, A. S.	Crofton.	Vance, John F. C. B.	Vancouver.
Laucks, I. F.	Seattle.	Van Agnew, Frank	Siberia.
Lee, Fred E.	Trail.	Vaughan-Williams, V. L.	California.
Lee, Geo. M.	Grand Forks.	Wales, Roland T.	
Ley, Richard H.	Victoria.	Watson, Wm. J.	Ladysmith.
Levy, Frank		Watson, Thomas	Vancouver.
Lindsay, W. W.	Kimberley.	Welsh, J. Cuthbert	Butte, Mont.

Under section 2, subsection (1)—Continued.

Wells, Ben T.	Williams, W. A. Vancouver.
West, Geo. G. Vancouver.	Williams, Eliot H.
Wenerstrom, L. H. Anyox.	Williams, J. R. Vancouver.
Whittaker, Delbert E. Victoria.	Wimberley, S. H. Nevada, U.S.A.
Widdowson, E. Walter Nelson.	Youngs, T. N. Victoria.
Willemar, Douglas R. New Hazelton.	

Under section 2, subsection (2).

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

Under section 2, subsection (3).

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

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Pinder, B.	Thompson, James B. Vancouver.

NORTH-WESTERN DISTRICT (No. 1).

REPORT BY GEORGE A. CLOTHIER, RESIDENT MINING ENGINEER.

INTRODUCTORY.

The No. 1 or North-western District is comprised of the following eight Mining Divisions of the Province: Queen Charlotte, Bella Coola, Skeena, Nass River, Portland Canal, Stikine, Liard, and Atlin, totalling in length about 700 miles and, in the north, including the full width of the Province.

The southern portion of the district, from Seymour inlet, opposite the head of Vancouver island, to Portland inlet, lies west of the Coast Range summit. The northern portion lies east of the Coast Range summit, which from Portland canal northward is the Alaska-British Columbia boundary-line; consequently this part of the Province is fenced in behind the Alaska strip.

The district therefore affords every phase of geological condition, as well as every geographical condition, from ideal transportation on the Coast to the more inaccessible areas of the Interior. It should be the most satisfying country in the world for a prospector, for he can have any rock formation or location he prefers, if he is not too particular in requiring them in combination.

The chief geological features to be noted in the district are the three immense zones or belts, paralleling the Coast in a north-westerly and south-easterly direction and extending the full length of the Province.

For the purposes of this report, the three belts may be termed the "Coast Range Belt" in the centre, the "Eastern Contact Belt" on the eastern flank of the Coast range, and the "Western Contact Belt" on its western flank.

The granodiorite Coast range whose upthrust through the overlying sedimentaries caused these flanking belts, is, for that reason alone, the most important one of the three, and from a mineral-producing standpoint it still holds first place, with its two producers—the Granby Consolidated at Anyox and the Belmont-Surf Inlet Company at Surf inlet, on Princess Royal island. In addition to these two producing properties, the number of meritorious prospects, such as the *Drum Lummon* on Douglas channel, the pyrite-chalcopryrite deposits on the *Ecstall* river, the magnetite-deposits on Seymour inlet, Deau and other channels, the *Outsider* and *Maple Bay* properties at Maple bay on Portland canal, and the Georgia River showings, also on Portland canal, are further evidence that the granodiorite of the Coast range contains valuable mineral-deposits, and therefore should not be overlooked by the prospector, because the formation is "nothing but granite."

Apropos of this, F. E. and C. W. Wright, of United States Geological Survey, in their report on the South-eastern Alaska district, say: "Within the granite area itself are occasional belts of sedimentary rocks in a highly metamorphosed condition. They vary from argillites to mica, hornblende, and calcareous schists of various types, even marble, and occur in long bands intensely folded. These included schist-belts are usually not wide and more appear near the mountain-tops than at sea-level. They are usually intensely mineralized with sulphides, especially pyrite, and near the mountain-tops show abundant evidence of contact metamorphism. They were directly above the intrusive mass and were evidently in the most favourable position to be affected by magmatic waters and heat escaping from the intrusives, so that they are the most heavily mineralized bodies."

The Western Contact Belt in this report includes all the inshore islands west of the granodiorite and the outlying Queen Charlotte islands. The islands close in along the coast are related in every way to the Coast range, while those farther out combine features of both Coast Range and Queen Charlotte mountains.

The following is excerpted from F. E. and C. W. Wright's report*: "It is probable that at many points along the western flanks of the batholiths 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 the intrusion should

* F. E. and C. W. Wright, U.S. Geol. Survey, Bull. 347.

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 the invasion in many localities show traces of contact metamorphism, as in spotted schists, and contain valuable metalliferous deposits."

While no large producers have been developed in this belt, there are numerous fair-looking prospects, both on the off-shore islands and the Queen Charlottes, in which the gold values warrant their exploration. The present outlook for copper is hardly an incentive to open up new properties.

With the installation of a steel plant somewhere on the British Columbia coast, which appears to be reasonably probable, the immense deposits of magnetite found throughout this belt would become marketable ore, and the magnetite-chalcopyrite ores will then be desirable for milling propositions.

The one outstanding favourable feature of both the Western Contact and the Coast Range Belts is their accessibility and ideal shipping facilities. Mineral-deposits in the Interior that would not pay for transportation could make profitable mines on the Coast.

The Eastern Contact Belt borders the Coast range on its eastern side the entire length of the Province, and in this district from Terrace, on the Canadian National Railway, north to the Yukon boundary-line, a distance of 450 miles.

The general geological characteristics of this belt can best be expressed by the following excerpt:* "The character of the invaded sedimentaries east of the inland border of the granite is noticeably different from the west. The slates and sandstones are less altered and typical schists are rare. Folding and particularly faulting are common and characteristic of the whole complex. The intruded rocks are often indurated and heavily mineralized with sulphides near the contact and show evidence of metamorphism by the intrusives. The geological interpretation of these data indicates clearly that the rocks east of the massifs were less deeply burned at the time of intrusion than those on the coastal side. In other words, the inland rocks were then above the zone of deep-seated metamorphism or rock-flowage, and were therefore profoundly affected by the invading intrusions and accompanying pneumatolytic solutions. Furthermore, the mineral-bearing solutions emanating from the granite encountered new conditions of temperature and pressure on entering the adjacent sedimentary rocks, and deposited as super-saturated solutions in these new environments a portion of their dissolved contents, especially metallic sulphides and silicates."

The belt has been investigated in several places in this district by the Geological Survey of Canada. The Atlin district by D. D. Cairnes, Memoir No. 37; the Unuk River mining region by F. E. Wright, Summary Report, 1905, and U.S. Geological Survey Bulletin 347; the Portland Canal district by R. G. McConnell, Memoir 32; Salmon River District by J. J. O'Neil, Summary Report, 1918, and S. J. Schofield and George Hanson, Summary Report, 1920; the Upper Kitsault valley, Alice arm, by Geo. Hanson, Summary Report, 1921; and the Eutsuk Lake district, by R. W. Brock, Summary Report, 1920.

Further investigations have been made this year by George Hanson on the Kitsault and Illiance rivers at Alice arm, and from the Nass river south to Kitsumgallum lake, which will be published at an early date. This reconnaissance will furnish very useful information on that stretch of country and link up the geological data for many miles along this belt.

These investigations and reports by the Geological Survey are, needless to say, of first importance, and especially valuable are those of areas in which sufficient prospecting and development work has been done to enable the geologists to make more detailed examinations of rock formations and ore-deposits for the information and guidance of prospectors and operators.

The writer made a reconnaissance trip through from Stewart to Alice arm, which is referred to under the Portland Canal Mining Division.

The growing importance of the Eastern Contact Belt is emphasized this year by the remarkable output and profits of the *Premier* mine in the Salmon River section. This mine this year produced nearly as much gold and nearly double the amount of silver as the whole Province, including the *Premier* itself, last year. It is worthy of consideration that where there has been any extensive prospecting and development work along this belt the results have been

* U.S. Geol. Survey, Bull. 347.

encouraging. At Kitsumgallum lake; at the head of Alice arm, on the Kitsault and Illiance rivers; at the head of Portland canal, on the Bear, Salmon, and Marmot rivers; and in the Atlin section, in the *Engineer* mine vicinity, are the only *spots* that this mineral-belt has been explored to any extent. In these isolated places, aggregating probably 60 miles along the belt, there have been developed the *Dolly Varden*, *Premier*, and *Engineer* mines. There remains a distance of over 300 miles in this district alone, along identically the same belt, in which, as yet, has never been heard the sound of a prospector's pick. From the head of Portland canal, north to the Atlin section, is a distance of 250 miles, which, although it may seem to be looking a long way into the future, I think the Provincial Government should make a continuous effort to render available for exploration.

The granite Coast range is penetrated from tide-water to this belt, north of Portland canal, by the Unuk river, the Stikine river and its tributary, the Iskut river, and by Taku arm and river. Inexpensive "exploration trails" could be cut from these waterways, north and south along the mineral-zone, by parties of prospectors at a cost to the Government of from \$75 to \$100 a mile. A comparatively small yearly appropriation for such work would enable the pioneering prospector to make his grub-stake as he went along, do some preliminary prospecting, and at the same time would be making accessible an appreciable amount of country each year for those following.

Much has been heard and read about the "passing of the prospector," but I believe that is applicable mainly to the older prospected countries and the old-time plodding type of prospector. There are plenty of prospectors in this country who would be prospecting if they felt or could see that they were "getting anywhere."

An experiment was made this year along the lines suggested in my report of 1921, in the operation of a hydroplane with its base at Hazelton. Sufficient experience and data were gained to practically assure the success of the enterprise. I am informed that additional equipment is to be provided for next year. The possibilities in the exploration of such a vast unknown country as the Northern Interior portion of this Province would seem to be unlimited, and it is to be hoped that ample support will be obtained for a thorough try-out of the enterprise. It is without doubt the only means whereby the Interior can be explored within the next few years, otherwise it will remain a sealed book for many years to come.

HEADQUARTERS OFFICE OF RESIDENT MINING ENGINEER.

The Resident Engineer for this district has been provided with a very suitable office in the new Court-house in Prince Rupert. A small room is being utilized as an office, and an adjoining larger room, 14 by 18 feet, has been fitted up, under the supervision of the writer, for a display-room of the rocks, mineral, ores, and mining products of the northern part of the Province. For this purpose a cabinet has been built, 5 feet high and a total length of 24 feet, fitted with sloping shelving for specimens and front with sliding glass doors. This cabinet now contains a reference set of specimens consisting of 125 samples of rocks and 200 samples of minerals. This set is of especial benefit to prospectors and others interested in mining, who want to see what certain minerals look like or compare them with minerals they have found or seen in their prospecting travels. In addition to this set there are, so far, samples from ten properties on Queen Charlotte islands; 15 from the Coast and Coast islands; thirty from the Kitsumgallum Lake-Thornhill Mountain sections and along the Canadian National Railway; twenty-five from the Alice Arm country; twenty-five from the Stewart country; and fifteen from the Atlin country. This is a good start and, now that space has been provided, will gradually be added to from field-work. Samples not larger than 3 by 4 inches square will be gladly received from prospectors of their showings.

My object is to get together a permanent display of ores from the operating properties and worthy prospects in the northern part of the Province that will be interesting and informative to prospectors, examining mining engineers, mining operators, and investors. Prospectors and others can now get, any time during office hours, useful information by examining and studying the specimens and instructive reading in the mining magazines, reports, and text-books in this office.

THE MINING INDUSTRY.

This will be reviewed under the three main phases of the industry—namely, prospecting, development, and production.

PROSPECTING.

This year has been a very active one for the prospector in nearly all parts of the district. While the number of claims staked may not compare with former years, on account of no new sections having been explored, yet there has been a gradual extension of what may be called the known mineral areas, and this accounts for an appreciable number of new stakings. Prospecting has been confined rather to showings already discovered and to a more thorough searching on claims already staked.

Naturally, since mining in the district has been more or less centralized in the Portland Canal country, a greater proportion of prospecting and staking has been done in that area. Government office statistics show a distinct increase, both in the number of claims staked and assessments done.

Though the Alice Arm section has been quiet in so far as productive mining is concerned, the prospectors in that locality have not lost their optimism and a great deal of work has been done on individual claims. The records show that over 1,200 assessments were done during the year, about 1,000 prospectors' certificates issued, and over 700 claims recorded in this district alone.

The Kitsumgallum Lake and Thornhill Mountain sections have had considerably more than the necessary assessments done. The Coast and Coast islands are showing more prospects and prospectors every year. The Queen Charlotte islands are very quiet so far as mining is concerned. One property on the west coast of Moresby island is about the only one being developed to any extent.

The Mines Department has made a good start on "exploration trails" built by prospectors along the lines suggested in my introductory remarks. These will be more fully described under the Portland Canal Mining Division, where they are located. It took fifteen years from the discovery of the *Premier* mine until it was a producer, and it therefore behoves us to look ahead that length of time in opening up new fields for prospecting.

Much appreciated assistance was also granted to prospectors in nearly all sections of the district for trail-building to their claims under the provisions of the "Mines Development Act." This appears to be about the best form of encouragement to prospectors.

I would again call the attention of claim-owners to Part III., section 14, of the "Mineral Survey and Development Act," as follows: "Every person giving or making a bond or option for the sale of any mineral claim or mine shall insert therein a provision that during the currency of such bond or option all free miners and wage-earners employed in, on, and about the claim or mine shall be paid semi-monthly, and shall demand and receive a letter from a Gold Commissioner, or Government Agent, or Mining Recorder that security for wages has been given, otherwise he shall be under personal liability to pay all such wages.

"Every person taking a right or option to purchase any mineral claim or mine or mining property shall furnish to the nearest Gold Commissioner, or Government Agent, or Mining Recorder adequate security from time to time for the payment of all wages semi-monthly on the terms that every such security may be forthwith realized and payment of wages made upon any default, and every Gold Commissioner, Government Agent, and Mining Recorder is given full power and authority to and shall realize upon the proper security lodged with him so as to make payment of any wages in default, and shall make payment thereof up to the amount realized."

The strict enforcement of this clause in making agreements with the purchaser would save a lot of subsequent trouble.

DEVELOPMENT.

The development phase or branch of the mining industry depends practically entirely on the general financial conditions of the country. Prospecting and production can be maintained during times of depression, but generally development ceases. The present more stable or rising metal markets and improvement in general financial conditions have had a very stimulating effect on mining this year. More properties have been under development in this district than ever before. The following mining properties are being continuously developed through the winter: *Drum Lummon* mine on Douglas channel; *Patterson* group on Porcher island; *Esperanza* group at Alice arm; and in the Portland Canal country, the *Outsider* group at Maple bay; the *Sunshine* group on Glacier creek; *Mobile* and *Prince John* groups on Bear river; the Indian and B.C. Silver Mines as well as several properties on the Alaska side on Salmon river; the Atlin silver-lead

mines and the *Engineer* mine in Atlin; and the *Maid of Erin* group in Rainy Hollow. Several of these properties have developed large tonnages of ore, and may therefore be expected to become shippers in the near future.

A number of properties were operated during the summer months, but are closed down for the winter. These include the *Bolton* group on Klekane inlet; the *Rivers Bight* claims on Rivers bight, off Whale channel; *Motherlode* and *Silver Dollar* groups at Kitsumgallum lake; the *Sunset* group on Roundy creek, Alice arm; the *Standard* group on McGrath mountain; the *Alice* and *Lone Maid* groups at Alice arm; the *Last Chance* group on Trout creek, Alice arm; Ingraham's claims on Illiance river, Alice arm; *Wild Cat* group on Homestead creek, Alice arm; other properties in the Alice Arm country; the *Patricia* and *Idaho* groups on Marmot river; the *Silverado* group at Stewart; the *Mimico* and *Evening Sun* groups, Glacier creek, Stewart; the *George* group, Bear river; the *Outland*, *Betty*, *Big Missouri*, *Unicorn*, and others in the Salmon River valley; while over 1,200 claims have been prospected and yearly assessments done.

The above are mentioned to show the intense activity in exploration-work all over the district and are indicative of what may be expected the coming year. The outlook for this branch of mining certainly has never been brighter. A very important factor, and one that promises a thorough and intelligent investigation of the different areas and properties, is the class of mining men who are carrying on operations throughout the district.

The "shoe-stringer," *alias* "promoter," whose continued operations depended solely on striking high-grade ore to boost his name, is giving place to the competent experienced mining operator, who has ample financial backing to go through with a comprehensive plan of development-work, and thus place the low-grade properties, the real mines, on a producing basis.

PRODUCTION.

The following is a list of the shipping properties in District No. 1 and their outputs for 1922:—

Name of Property.	Location.	Ore Mined.	Gold.	Silver.	Copper.	Lead.
		Tons.	Oz.	Oz.	Lb.	Lb.
Maid of Erin	Rainy Hollow.	47	3	1,509	21,693	.....
Granby Consolidated	Anyox	854,714	8,901	386,264	30,334,180	.....
Premier	Portland canal.	102,334	123,527	4,261,368	.....	.....
Belmont-Surf Inlet	Surf inlet	105,971	35,015	17,106	697,058	.....
Esperanza	Alice arm	231	22	12,128	404	1,285
Patterson group	Porcher island.	10	45	20	.....	.....
Sunshine	Portland canal.	2	.....	770	.....	.....
Golskeish	Anyox	2,428	202	1,089	.....	.....
Early Bird	Gold harbour	1	21	.....	.....	.....
Silverado	Portland canal.	7	2,090	675	.....	.....
Cherokee	Atlin	10	.....	2,000	.....	10,000
Barber	Atlin	3	.....	600	.....	3,000
Totals for 1922 (exclusive of placer).	.....	1,065,758	167,736	4,684,944	31,054,010	14,285
Totals for 1921 (exclusive of placer).	.....	1,061,343	85,185	1,565,807	34,841,767	.....
Increase .....	.....	4,415	82,551	3,119,137	.....	14,285
Decrease .....	.....	.....	.....	.....	3,787,757	.....

It was pointed out in last year's report that the production of the district was the greatest in the history of the Cassiar District, and an optimistic forecast was made for the year 1922.

The above totals show the very remarkable increase of 50 per cent. over last year's production, reaching a mark hardly dreamed of a few years ago. The tonnage is greater than 1921 by 4,415 tons and is over the 1,000,000-ton mark.

The gold-output has practically doubled that of last year and is three times the amount produced in 1920. It is the greatest production ever made in one year by any one district in the Province. This remarkable increase is due to the Premier Gold Mining Company at Stewart and the Granby Company, the Belmont-Surf Inlet falling slightly short of last year.

The phenomenal output of silver, 4,684,944 oz., or three times the output of last year, is also due to the sensational production of the Premier Gold Mining Company. The Granby Consolidated contributed an increase of 72,060 oz.; while the Belmont-Surf Inlet fell a little below its 1921 output.

This is also the greatest production of silver ever made in one year by any one district in the Province, the nearest approach to it being that of West Kootenay District in 1913, of 2,527,000

oz. In fact, it is over 1,000,000 oz. greater than the silver-output of the entire Province in any one year since 1902.

The production of copper has decreased by about 4,000,000 lb., due to the decreased output of the Granby Consolidated. Belmont-Surf Inlet shows a slight falling-off from last year.

The grand totals give a value output of \$10,867,144, an increase of \$3,672,980 over 1921, or about 51 per cent. It is outstanding as the highest yearly value production ever made by one district.

It will be noted that the value of the three metals produced in the district each amounted to over \$3,000,000, a remarkably even division.

Altogether, the district produced 67 per cent. of the total tonnage mined, yielding 84.7 per cent. of the total gold, 65.9 per cent. of the total silver, and 95 per cent. of the total copper produced in the Province in 1922.

The above figures certainly represent a wonderful expansion of the mining industry in the north-western portion of the Province in the past eight or ten years, and, as a matter of fact, in the last two or three years.

The question naturally comes up as to whether this output may be expected to be maintained, or possibly increased. The three great producers, Belmont-Surf Inlet, the Granby Consolidated, and the Premier Gold Mining Company, give every reason to believe that their present outputs can be maintained for some years to come, but are probably up to capacity production under present conditions. Any material increase in output must therefore be looked for from new shippers. The one that appears to give the most promise for the near future, from all reports, is the *Engineer* mine at Atlin. This property is now free of litigation and in all probability will be put under active operation.

The *Maid of Erin* in the Rainy Hollow section, while under a heavy handicap of long transportation by motor-truck, or tractor and trailers, is developing at considerable depth a fine showing of bornite and chalcocite, and gives one good reasons to believe that it will become an important shipper of high-grade copper ores.

The *Indian* mines in the Salmon River section is looking very promising for the amount of work done and is developing large bodies of milling-grade ore. Indications are that this property will justify its being equipped with a concentrating plant within a year.

The B.C. Silver Mines' recent strike in cutting the extension of one of the important ore-producing fissures of the *Premier* mine, and the satisfactory values obtained across a width of 25 feet, practically indicates its developing into a very important producer.

The acquisition of the *Dolly Varden* by the George Wingfield interests, by the foreclosure of a mortgage, clears the air somewhat, and this property may be expected to resume operations, with a good chance of opening up a tonnage of milling-ore and of finding more shoots of high-grade silver ores.

The *Drum Lummon* on Douglas channel is in good shape for handling ore now, and the management has announced that regular, substantial shipments will be made to the Granby smelter at Anyox from now on.

The *Big Missouri* on Salmon river underwent considerable development this summer, with encouraging results. It is the opinion of many that former exploratory work was not at all conclusive as to the possibilities of the property. Further geological data relative to the ore-deposits may put an entirely different complexion on things.

The development of the *Prince John* group on Bear river and the *Dunwell* mines on Glacier creek is being followed with great interest.

The *George* group on Bear river and *Sunshine* group on Glacier creek, both copper properties, are under bond to the Granby Company and will be thoroughly explored. They each have sufficiently encouraging surface exposures to warrant their further development.

The Mobile Mines, Limited, is developing the *Mobile* group on Bear river, which has the appearance of a profitable undertaking.

The *Esperanza* mine at Alice arm is making steady, small shipments of high-grade silver ore to Granby smelter, and doubtless will make a profitable small shipper for some time to come.

There are others of the smaller properties that will gradually become shippers.

Summarizing the whole situation, it seems reasonable to expect that, with the present large producers at least maintaining their present outputs for some years to come, there will be other

producers made out of the array of very promising-looking properties now under development, which will mean the gradual and continued growth of the output of the district.

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

Queen Charlotte Mining Division—Graham Island section; Moresby Island section.
 Bella Coola Mining Division.
 Skeena Mining Division—Coast section; Canadian National Railway section; Kitsumgallum Valley section; Lakelse Lake section.
 Nass River Mining Division—Observatory Inlet section; Hastings Arm section; Alice Arm (proper) section; Kitsault River section; Illiance River section.
 Portland Canal Mining Division—Portland Canal (proper) section; Marmot River section; Bear River section; Meziadin Lake section; Salmon River section; Unuk River section.
 Stikine Mining Division—Stikine River section; Iskut River section.
 Liard Mining Division—Dease Lake section.
 Atlin Mining Division—Rainy Hollow section; Atlin Lake section.

QUEEN CHARLOTTE MINING DIVISION.

There has been very little mining activity on the islands this year, the office statistics of the Mining Recorder showing a slight falling-off from last year.

The greatest possibility for the Queen Charlotte islands, in so far as mining is concerned, would appear to depend largely on an iron production on the Coast. There are immense deposits of magnetite, both pure and carrying a percentage of chalcopyrite. In the event of the establishment of a steel plant, the latter class of ore would doubtless pay for the extraction of the copper contents, leaving a marketable iron ore.

Nothing further has been done toward the investigation of the oil-shales.

Owing to lack of time the writer was unable to make any examination of the coal areas as requested. The majority of the coal-measures were examined by the late J. D. Mackenzie and reported in Memoir 88 of the Geological Survey of Canada.

It is reported that some further exploratory work will be done in the areas up Salt Chuck creek, which flows into Skidegate inlet.

The east coast (gold coast) has had the usual quota of black-sand operators this year. The majority of them seem to be perfectly willing to wait for a heavy south-easter to wash the gold-bearing black sand up on the beach, but none apparently are equipped to take advantage of the situation before the next high tide washes it all away again. A thorough testing of the sands back of the beach-line might furnish some advantageous information.

MORESBY ISLAND SECTION.

Early Bird Group.

A number of assessments were done on various claims and groups, but any excess development was very limited. This property, situated on Gold harbour, on the west coast, and owned by J. G. McLellan, of Queen Charlotte City, was worked under a lease by Davey & Pearson in the early part of the year. I understand that wages were the best results that could be obtained, and the lease was therefore abandoned.

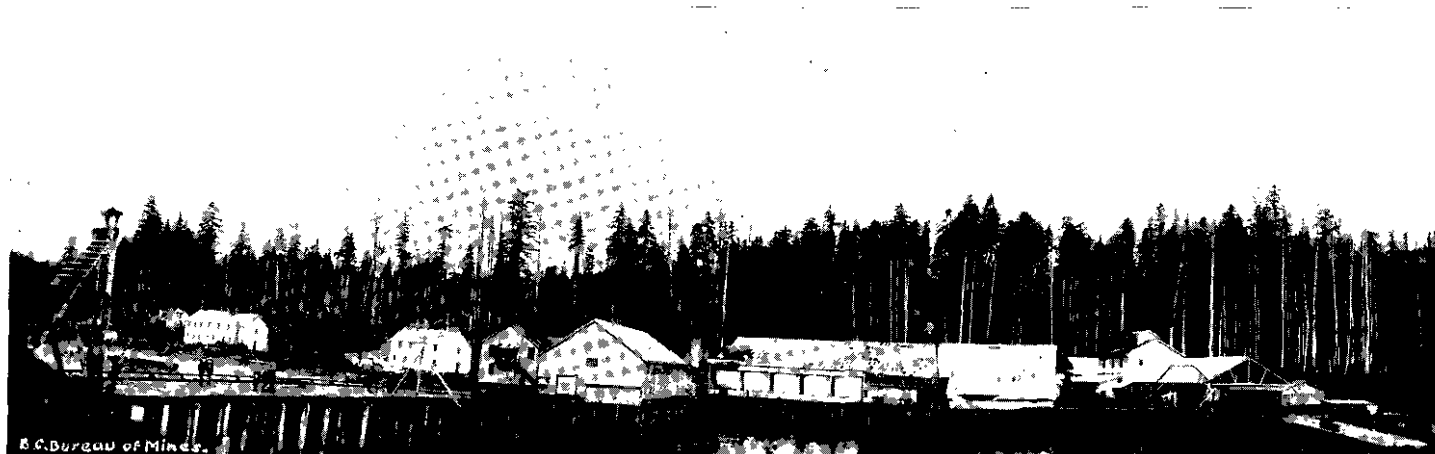
Blue Mule Group.

This group consists of three claims—*Blue Mule*, *Paystreak No. 1*, and *Paystreak No. 2*—owned respectively by Messrs. Jones, Wiggs, and McRae, of Skidegate. The property is reached by launch from Queen Charlotte City. It is about a day's trip each way in favourable weather, but I would advise, from experience, a good-sized, seaworthy launch in charge of a white man who knows the west coast and at least a week's supplies.

The lowest claim in this group is about a half mile from the cabin on the beach. The rock formation from the beach to the foot of the hill is a belt of dark, bluish-grey limestone. The predominating formation of the mountain on which the claims are located is andesitic rock. In this formation are parallel shear-zones filled with a breccia of quartz and country-rock, all more or less pyritized and varying from straight country-rock with stringers of quartz in it to pure quartz. The main values are gold, contained partly in the pyrite and partly as free gold in



Massey Indian Village, Massey Inlet, Graham Inlet, Queen Charlotte M.D.



Naden Harbour Whaling Station, Graham Island, Queen Charlotte M.D.

both quartz and pyrite. Specks of free gold can frequently be seen in the quartz and "colours" can be panned at almost any place along the vein.

There are three veins on the property, paralleling each other on a strike of N. 60° E. and dipping from 65° to 75° E. The greatest amount of work has been done on the highest, which is also the largest vein, consisting of open-cutting and stripping, which has traced and opened up the vein for a length of 600 or 700 feet.

This year Jones and Larsen took a lease and option on the property and did an extraordinary amount of work for two men. A new cabin was built on a favourable site along the upper vein and a new blacksmith-shop put up where the work was commenced. At the time of my examination at the end of May an open crosscut had been run at a distance of 40 feet, with a width of about 6 feet at the bottom, obtaining in that distance a depth of about 15 feet. From the face a tunnel was to be driven a further 15 or 20 feet to get under the vein cropping on the surface above. The vein at this point is about 2 feet wide. A sample of several hundred pounds of the ore sent out for testing purposes assayed \$23.60 in gold, of which \$14 was recoverable free gold.

Just above the open-cut the vein appears to have been faulted, as the portion of the vein south of this point is about 30 feet higher on the hill. This portion can be traced for 300 feet along the surface and has the same strike and dip as that portion north of the cut.

Though the crosscut tunnel will not gain a great deal of depth where it intersects the vein, a drift northward will gain depth rapidly. Should this drift prove the vein and values to be satisfactory, the crosscut tunnel will be extended to intersect the upper-faulted portion of the vein, which can then also be explored by drifting.

I have not been able to get any information as to later developments, but I understand that a small Ross-type mill with a capacity of 10 tons a day, was taken in to the property later in the season.

It is certainly worth getting some depth on the vein and then drifting to obtain average values. As stated, free gold can be obtained by panning almost anywhere along the vein on the surface, but whether the average vein content will be sufficient for profitable working can only be determined by drifting. There is plenty of water-power for a small milling plant and all kinds of timber.

Iron Duke Group. This property consists of nine claims, situated on Louise island and owned by Rogers, Bensen & Larson, of Lockeport. The camp on the claims is at an elevation of 625 feet, about a half-hour's walk over a fair foot-trail from the

Cumshewa Inlet side of the island. The showing is an immense body of magnetite. A tunnel at an elevation of 1,025 feet had been driven into the ore to a dyke cutting the ore-body and followed along the dyke for some distance. The last work this year consisted in crossing this dyke and encountering the ore on the other side of it. The owners report that the tunnel is now in clean, solid magnetite. Various open-cuts demonstrate the ore-body to be at least 60 feet in width, consisting of clean magnetite ore. At one place, a sample across 75 feet of solid ore, taken with a small pick, gave assay returns of: Iron, 57 per cent.; silica, 6.5 per cent.; sulphur, trace; phosphorous, trace.

There is an abundance of timber on the claims and sufficient water for all purposes except power. Applications have been made by the owners for a Crown grant to the claims.

Sewell Inlet.—Five claims—*Star, Bear, South-east, Reaver, and Motherlode*—were staked early in the year by Jesse Collier and associates at the head of Sewell inlet. A sample taken by the owners had given assay returns of \$21.60 in gold and silver, which resulted in the ground being staked. I went over the ground carefully and took several samples from what was supposed to be the vein, but obtained no values. Only one sample, and that from a small seam of ore crossing the "vein," showed any value, and that only \$6 of silver to the ton. More samples, taken farther along on the extension of this belt by different prospectors, failed to show any values. I have not heard of any later developments.

Alder Island.—This is a small island off the north end of Burnaby island, which is just north of Jedway harbour. Good weather must be chosen to visit the island, as there is no harbour and it is exposed to Hecate Strait. The showing on the claims is a small calcite vein, following a 4-foot basaltic dyke which is intruding the sedimentaries overlying the basalt-flow. The dyke and vein strike north and south (mag.) and dip about 75° W.

Small veins of calcite of a few inches in thickness lie on both walls of the dyke for a short distance to a cross-fracture in the dyke, through which the hanging-wall vein crosses to and combines with the foot-wall vein. The vein then extends along the foot-wall of the dyke for probably 50 feet, where it is lost under the overburden. Small amounts of native arsenic show in the calcite, but neither the vein nor mineralization is extensive enough to be of any importance.

Copper Island.—In the absence of the owner, A. Heino, at the time I made my trip, I did not examine the showings again, which have been reported on previously. I am informed that Mr. Heino has been working on his holdings all season.

Hope Group.—This group, about a mile back from the head of Houston inlet, is owned by Hugh McEachern. It is reported that the property was bonded later in the summer and considerable work done on it. However, I have not been able to obtain any detailed information.

Ikeda Mines.—Operations have not yet been resumed. Only yearly assessments have been done on properties in the vicinity of Jedway.

Shuttle Island.—The gold-quartz showings were examined during the summer and some negotiations carried on, but the property has not been operated this year so far as I can learn. About 6 oz. of placer gold was taken from the beach claim.

BELLA COOLA MINING DIVISION.

I made a trip to Bella Coola in August of this year, reaching there by launch from Ocean Falls. There has been little or no prospecting done in the Bella Coola valley of late years, the essential industry being farming and fruit-raising. It is surely a wonderful valley for agricultural purposes and there is a surprising number of fine, well-ordered ranches and beautiful homes. However, the valley needs a big, low-grade, operating mining property, employing about a thousand men, to provide a local market for the varied produce.

For that reason it would be an ideal locality to operate a mine within a few miles back from the main valley. There is an excellent motor-road as far as Hagensborg, and I believe it extends on up the valley for about 40 miles on practically a level grade.

This was the only property examined; in fact, the only one brought to my attention. It is situated about 12 miles up the Saloomt river, which empties into the Bella Coola river from the west 12 miles from tide-water. The property is reached from the town of Bella Coola, which is on tide-water at the mouth of the river of the same name at the head of North Bentinck arm, a branch of Burke channel, by auto to Sylvester's ranch; thence by foot-trail up the Saloomt river. The trail up the river has not been used to any extent for several years and has consequently become badly overgrown, but could be inexpensively put in good condition for pack-horses up to the cabin at the foot of the hill below the claims. (Since my examination of the property \$500 has been granted by the Department of Mines on my recommendation to assist in improving the trail.)

The property is one of the oldest on the Coast, having been staked over twenty years ago. There are now four claims in the group—*Sulphur*, *Chief*, *Red Deer*, and *Queen*. The *Sulphur* was purchased from the estate of H. B. Christiansen; the *Chief*, *Red Deer*, and *Queen* are the original stakings by O. Imeson, O. Callollog, and Torgersen Olsen. The property is now owned by Brynild Brynildsen, of Bella Coola, Torgerson Olsen, and G. Clauson, each holding a one-third interest.

The elevation at Sylvester's ranch, 12 miles from Bella Coola, is 125 feet; the cabin at the foot of the hill, 1,125 feet; and the tunnels on the claims, 2,250 feet.

The general rock formation is the granodiorite of the Coast range. On this property there is a mineralized outcropping about 200 feet in width, consisting of quartz, quartz porphyry, and decomposed granite, striking S. 60° E. into the hill. About the centre of this surface exposure is a diorite dyke about 3 feet in width, which, coming up the hill, appears to break up at this point and spread out in forms and spurs in all directions.

Two tunnels have been driven into the outcrop on the south side of the dyke. The tunnel nearest the dyke is in about 16 feet, and the other, on the same level and about 50 feet south, is in 60 feet. Each shows a broken-up dioritic formation in which are small veins and bunches of quartz, quartz porphyry, and quartz diorite, all more or less mineralized with chalcopyrite. In places where the quartz has become decomposed it has been replaced with pure chalcopyrite. Yet the whole does not contain sufficient copper to make it a commercial ore. There are from

50 to 60 tons of ore on the dump, obtained from surface cuts and the tunnels, that will assay from 8 to 10 per cent. copper.

The mineralization both in the surface exposures and in the tunnels is most irregular and erratic, a jumbled mass of quartz, quartz porphyry, dyke, and country-rock, in which are bunches of chalcopyrite.

On the north side of the dyke there is a fairly well-defined, sparingly mineralized out-cropping of quartz across a width of about 50 feet, and I would therefore suggest that the north tunnel, the one next the dyke, be swung to the left through the dyke to explore the ground under the mineralized quartz outcrop.

This is the only place on the property where there has been any considerable work done, and because of the width over which mineralization is scattered it will take extensive exploration to find out whether there is any concentration of chalcopyrite or whether the whole would pay to concentrate, which is doubtful, judging from the surface and ground exposed in the tunnels.

SKEENA MINING DIVISION.

COAST SECTION.

(See previous Annual Reports.) The mining property of this company is **Belmont-Surf In-let Mines, Ltd.** situated 7 miles back from the head of Surf inlet, on the west coast of Princess Royal island. The property has been steadily operated all year, sending a total of 105,971 tons of mine ore to the concentrator, which has therefore averaged about 300 tons a day. The bulk of this ore was furnished from the *Surf Inlet* mine from all levels. Only a sufficient tonnage, amounting to from 50 to 75 tons a day, was taken from the *Pugsley* mine to maintain the average milling capacity. The 105,971 tons milled produced 9,642 tons of concentrates that yielded 35,015 oz. gold, 17,106 oz. silver, and 697,058 lb. copper, slightly less than last year's output.

The underground development-work for the year totalled 6,539 feet, segregated as follows: 2,085 feet of raising, 883 feet of crosscutting, 3,023 feet of drifting, and 548 feet of sinking, to which can be added 730 cubic feet of rock in-place taken out in cutting stations, pockets, etc.

The shaft has been sunk to the 1,100-foot level, at sea-level, and the ore-bodies are being developed at that depth. A tunnel is being driven from the surface, at the level of the office buildings, following along the main shear in the granite, to connect with the 1,000-foot level in the mine. This will facilitate pumping, handling of waste, etc.

F. H. Penn is general superintendent; E. Hawkins, auditor; P. W. Racey, mine superintendent; and Fred Collins, mine foreman.

This group is comprised of six claims—*Royal, Bight, Landslide, Mountain Cordila Group. View, Counder, and Present.* They were staked in July, 1920, by Cordila & Koski, and are situated about a mile from the cabin on the beach, which is about 2 miles from the mouth of Rivers bight on a right arm going in. The mouth of the bight is narrow and can only be entered at slack tide. The showing is a shear in granodiorite country-rock, in which are lenses of pyritized quartz, very similar to the *Surf Inlet* mine, except that the quartz-lenses are small.

The property was under option last year and a portion of this year, when a tunnel was driven in 300 feet following the shear-zone. The work could only be examined for about 100 feet in, on account of a cave-in at that point. Very little quartz or mineralization was noted in that distance, and, judging from the dump, the widest pyritized quartz was only a few inches anywhere.

The surface croppings are exposed in the bed of a small creek above the tunnel, but on account of the heavy rains the creek was running full of water at the time of my examination and little could be seen.

The 300 feet of tunnelling was not at all encouraging and it is doubtful if improved conditions will be found farther in on the shear. A sample of the heavy pyrite taken from the dump assayed \$2.40 in gold and 2 oz. in silver to the ton.

This group is a restaking of an old location and at present consists of the **Gold Bug Group.** *Gold Bug Nos. 1, 2, and 3,* staked in September, 1920, by J. E. Halley, of Prince Rupert. The claims are situated on Pitt Island, on the west slope of Noble mountain, about $1\frac{1}{2}$ miles from the beach and at an elevation of 950 feet. There is a fairly good, old foot-trail from the beach to the showings.

The general rock formation is granodiorite and the showing consists of a quartz vein in a shear-zone in the granite. The vein is well defined, traceable on the surface for several hundred feet, and is from 4 to 6 feet wide where best exposed on the surface. It strikes along the hill north and south and dips to the east or into the hill at from 40° to 50°. A tunnel has just been started which will cross the vein, and at present the face is all in quartz and showing the vein to be straightening up.

The quartz is very heavily pyritized in bunches and parallel seams and disseminated through the quartz. Good gold values are said to have been obtained from the surface. A few pieces from different places assay \$18 in gold to the ton. It would make a very desirable little concentrating property if the sulphides carried sufficient values. The vein should be stripped along the side-hill for a sufficient distance to find out whether the average values would make it a profitable undertaking. It is certainly ideally situated for mining and shipping.

There are four claims in the group—*Copper-Cliff*, *New Crown*, *Lily*, and *Pink Rose*. They are situated about 2 miles from the beach on the north side of Klekane inlet, about 7 miles from Butedale cannery. The owners are W. H. Mason and Alexander McLeod, Vancouver; R. E. Honeyman, Victoria; and F. A. Nicol, at the property. A very creditable road has been built by the owners from the beach camp to within half a mile of the workings. The property was under development all last summer, but work suspended during the winter. A small cabin has been built at the workings, at 1,750 feet elevation, and considerable work done on the showings.

The deposit is of the contact-metamorphic type, formed by the replacement of limestone along and near the contact with the Coast Range granodiorite. Work done is an open-cut and a tunnel 30 feet below. The open-cut shows a width of from 12 to 15 feet of lenses and bunches of crystalline limestone, and its alteration products epidote, hornblende, garnetite, etc., all more or less mineralized with chalcocite and bornite. About 2 feet of ore-body is fairly well mineralized and from this high-grade ore could be sorted. The contact appears to strike about east-west, although it is very irregular.

The tunnel below this, at 2,200 feet elevation, has been driven on a bearing of N. 10° W. 65 feet, cutting across the granite and schists; then for 30 feet as a drift on the vein, which discloses about the same conditions as in the open-cut above. The mineralization exposed so far is probably a low-grade milling-ore, but further work is warranted along the contact in search of shoots of high-grade ore. Operations will likely be resumed next summer.

This group consists of two claims—*Red Rose No. 1* and *Red Rose No. 2*—**Red Rose Group.** staked by James Lydden in July of this year. The claims are located on Princess Royal island, about 2½ miles up a creek emptying into Tohnie channel, about 12 miles south of Swanson bay. In the absence of the owner I was unable to find the showings, but from description I judge the pyritized quartz and rock formation are typical of Princess Royal island.

This group of claims was staked several years ago by T. Stewart, who **Stewart Group.** disposed of his interests to Stephens & Babington, of Prince Rupert. The claims are five in number—*Minnie*, *Teckla*, *Venia*, *Vane*, and *Chief*—and are situated about 2 miles up Pocklington creek, a small stream emptying into the Kemano river about 6 miles from its mouth; the Kemano flowing into Gardner canal about 20 miles from its head.

To get to the property a time of low water in the Kemano should be selected, as it is necessary to procure Indians at the Indian village at the mouth of the river to pole and line a canoe up to Pocklington creek. It takes a full day to go up the 6 miles, but the return trip is made in about an hour and a half. From the old camp on the north side of the mouth of Pocklington creek there is a good foot-trail to the camp at the lower edge of the showings, an elevation of 1,930 feet.

As the locality of the claims is in the heart of the Coast range, the general formation is granodiorite. The ore-showing is a broad quartzose belt, probably quartz porphyry, striking N. 60° W. (mag.) and dipping about S. 60° W., with the slope of the hill. On its strike the vein cuts under the granodiorite hanging-wall, and on its dip similarly lies under the granodiorite at an elevation of about 1,900 feet. From that elevation up for hundreds of feet, and for hundreds of feet along the strike, the hanging-wall of granodiorite has been eroded, exposing the vein for a considerable area. In one place it is deeply cut by a gulch, which, however, does not

expose the foot-wall, and I therefore judge the dyke or vein must be well over 100 feet wide. On the hanging-wall, next to the granodiorite, there is a vein of several feet in width of white, barren-looking quartz. A considerable portion of the immense area of the vein exposed was examined, but the only mineralization found was an occasional speck or small bunch of bornite, the whole obviously too sparsely mineralized to have any possible chance of being workable ore.

On the side of the gulch a patch of quartz about 2 feet in diameter, filled with small bunches and specks of bornite and beautifully encrusted with malachite and azurite, was the best showing seen. A tunnel was driven in about 6 feet under this "blossom," but showed nothing but an occasional speck of bornite. I was not favourably impressed with the possibilities of the property, because of the lack of any commercial ore whatever in such a large proportion of the vein exposed for examination.

This group, consisting of two claims—the *Payroll* and *Payroll No. 2*—is owned **Payroll Group.** by Jas. Hickey, of Prince Rupert, and partner. The claims are situated at the head of Long Inlet, off Gardner canal, extending from the beach up the hill. The showing, which is a wide quartz vein lying in a country-rock of schist, is exposed on the beach. A little work was done this year, exposing the vein, 12 feet in width, of heavily pyritized quartz carrying in places a fair percentage of chalcopryite. Average samples, however, show it to be too low grade, on the surface at least, for commercial ore.

The old Drum Lummon Copper Mines, Ltd., incorporated in 1915, was last **Drum Lummon** year reorganized into a new company registered as the Drum Lummon Mines, **Mines, Ltd.** Limited (Non-personal Liability), of which Glenville A. Collins, of Vancouver, is general manager. The office of the company is in the Credit Foncier Building, Vancouver. The property is situated on Drum Lummon bay, on the north side of Douglas channel about 26 miles from Hartley Bay, a port of call for the Union steamships. Altogether there has been extensive development-work done on the property, described from year to year in these reports; consequently it will only be necessary to review this year's work. This has been confined mainly to outside construction-work in equipping the mine with suitable shipping facilities, etc., with the view of its becoming a regular shipper. Arrangements have been made to ship the ore to the Granby smelter at Anyox for treatment, at a very reasonable freight and treatment charge.

Early in July work was started on the construction of a wharf and approach, and at the time of my trip to the property at the end of August it was practically completed. The main dock is 32 by 50 feet and the approach from the shore is 1,000 feet. All this is pile-driven and of a very substantial construction. A good-sized freight-shed has been built on the dock and a standard-gauge railway-track laid from the dock to the lower terminal of the tramway at the foot of the hill, a distance of 3,600 feet. A Ford truck of 2-ton capacity will be utilized on the railway. A jig-back gravity tramway from the foot of the hill to the mine carrying buckets of 15 cubic feet capacity has been erected for the transportation of ore. The length of the tram is 2,100 feet and the difference in elevation between terminals is 385 feet.

Excavating was being done when I was there for the foundations of a compressor and engine, about 200 feet below the mouth of the tunnel. Since then a 120-horse-power full-Diesel engine has been installed and a compressor of 500 cubic feet a minute capacity that will operate eight drills.

It is estimated that ore can be delivered from the mine to a scow at the dock for not to exceed 25 cents a ton. Mr. Collins figures that the cost of mining and the rate of the Granby Company for freight and treatment will total about \$8 a ton. This will leave a comfortable margin of profit on his average values of ore available for shipment.

Four men were steadily employed in the mine while all this construction-work was being done. A winze has been sunk to a depth of 50 feet on a 45° angle, following down on the first little dyke that cuts the main crosscut tunnel. At this depth a drift was being driven along the dyke to its intersection with the main vein. The ore-shoot in the main vein shows about 90 feet west of the main crosscut tunnel, and should the rake of the ore be to the west the drift on the winze level will have to be driven a considerable distance before encountering the ore-shoot.

The main ore-shoot is about 200 feet in length and the additional depth of 50 feet obtained in the winze will greatly increase the available tonnage. The raise has been completed through from the main vein to the surface for ventilation.

Mr. Collins states that he expects the mine to ship at least 1,000 tons a month from now on. The recent appointment of Dan Williams as manager at the mine augurs well for the success of the property.

This property is situated on the north end of Porcher island, about a mile from the beach at Welcome harbour. This group consists of three claims—**Patterson Group.** *Trizie*, *Jeanie*, and *Western Hope*—located and owned by Frank Patterson. The claims are worked by the owner in the winter, when ore can be sledged to the beach over the snow. Assistance for a trail from the beach to the showings has been recommended by me. This would enable shipments to be made any time of the year, with which the property could probably be developed up to a small milling proposition. Ten tons of ore was sorted and shipped this year, from which the returns were a little under \$1,000.

There are three similar, parallel veins on the claims, which have been opened up by several extensive open-cuts varying up to 3 feet in width. The ore is a pyritized quartz, occurring in a solid granite formation, carrying gold values which are all contained in the pyrites, making an ideal concentrating-ore. The ratio of concentration would, I judge, be from 10 to 15 into 1, producing a concentrate assaying \$150 or better in gold. There is a small silver content. Altogether this a very promising little property and might easily develop into a profitable small producer.

These are *I.X.L.*, *I.X.L. Frac.*, *Nabob*, and *Klim*, owned by A. E. Wright, **Wright's Claims.** P.L.S., of Prince Rupert. They adjoin the *Patterson* group and the *Eagle* claim, owned by Joe Dawson. There are several parallel pyritized quartz veins on the claims, striking N. 80° E. and dipping 75° S., the same as the veins on the *Patterson* group, and occurring in the granodiorite. On the *I.X.L.* claim, at an elevation of 600 feet, two open-cuts have been put in—the upper one 20 feet long with a face 10 feet high and one immediately below with a face 6 feet high and about 20 feet long. These show a shear in the granite 4 feet wide, altered to a chlorite-schist, in which are small bunches, stringers, and kidneys of quartz slightly mineralized with pyrites and showing traces of chalcopyrite. Assays of picked samples from these cuts gave \$28.40 in gold and 5.6 oz. in silver to the ton, and 12.6 per cent. copper.

Below these cuts, at 340 feet elevation, a trench has been dug for 40 feet along a small 8-inch quartz vein lying in solid granodiorite. The quartz is well pyritized and concentrated samples from it have assayed up to \$160 in gold to the ton. This may be the downward continuation of the vein exposed in the open-cuts at 600 feet elevation.

At an elevation of 540 feet another outcrop has been broken into with a few shots, exposing a 4-foot vein of yellow-stained, slightly pyritized quartz in granodiorite. This vein is probably 100 feet south of the vein described above and has the same strike and dip. This is a strong, regular vein and warrants some depth being obtained, as the pyrite content may improve beneath the surface, as is frequently the case. North of this, probably 1,000 feet, are a number of small pyritized stringers of quartz, while beyond these a further 200 feet is another cropping of sparsely mineralized quartz.

The similarity of the showings on this property to those on the adjoining *Patterson* group justifies considerable development-work. A small mill, advantageously situated, would serve both properties.

This is the *Eagle* claim, situated west of and adjoining the *Trizie* claim of the **Dawson's Claim.** *Patterson* group, and owned by Joe Dawson. The work done consists of an open-cut at 240 feet elevation, about 20 feet long, continued as a tunnel a further 16 feet, following a 2-inch well-mineralized quartz vein up to a basic cross-dyke 6 feet wide, which cut off the vein entirely. The tunnel was then turned to the left at almost right angles and has been driven 135 feet along the wall of the dyke, through a soft black gangue a foot or two in width, finding no ore of any account.

I think there is no doubt that the dyke is later than the vein and has therefore cut through. My advice has been to continue the main tunnel through the dyke and, if the vein has faulted, crosscut both ways on that side of the dyke until it is picked up. Very probably the vein will be found in place, as no evidence of faulting could be found on the surface.

Very good gold values were found in the portion of the vein drifted on, and there are about 50 tons of sortable ore on the dump, a grab sample of which gave assays of 1.88 oz. in gold and 3 oz. in silver to the ton. The owner has a good cabin, blacksmith-shop, etc., on the dump

at the mouth of the tunnel. If the vein could be picked up beyond the dyke and its values held, it would make an ideal little shipping property.

CANADIAN NATIONAL RAILWAY SECTION.

This section includes all the country contiguous to the railway from Prince Rupert to Terrace, a distance of 95 miles. With the exception of about 10 miles of a schist-belt from Rupert, the whole section is in the granodiorite or quartz-diorite Coast range. There has been little or no prospecting along the railway and Skeena river since the early boat-days, when a great number of claims were staked. None of the prospects, however, developed into anything of importance.

The only property on which anything was done this year was at Amesbury, where Mr. Alger has done considerable prospecting-work. I regret that I was unable to make an examination of the property this year.

KITSUMGALLUM VALLEY SECTION.

This section lies along the Eastern Contact Belt and is very accessible from Terrace, on the Canadian National Railway, up to the head of the valley, a distance of about 40 miles, as well as through to the Nass valley, a stretch of 30 miles along the Government Telegraph trail from Cedar river. A reconnaissance of this portion of the mineral-belt was made this year by Geo. Hanson and party, of the Geological Survey of Canada, who worked through from Kitsumgallum lake to the Illiance river and Alice arm.

Prospecting in the vicinity of Kitsumgallum lake has been fairly active this season. In the early spring a Seattle operator installed a Ross mill on the *Bear* group. I am informed that only about 10 tons were milled, or at least put through the mill, obtaining some amalgam. No data can be obtained as to the results of the "test."

The oil fever in this area has apparently considerably abated. A great many of the stakings have run out. A diamond-drill hole was started in the neighbourhood of Terrace and I believe was drilled 300 or 400 feet in surface wash, when for some unknown reason the work was discontinued.

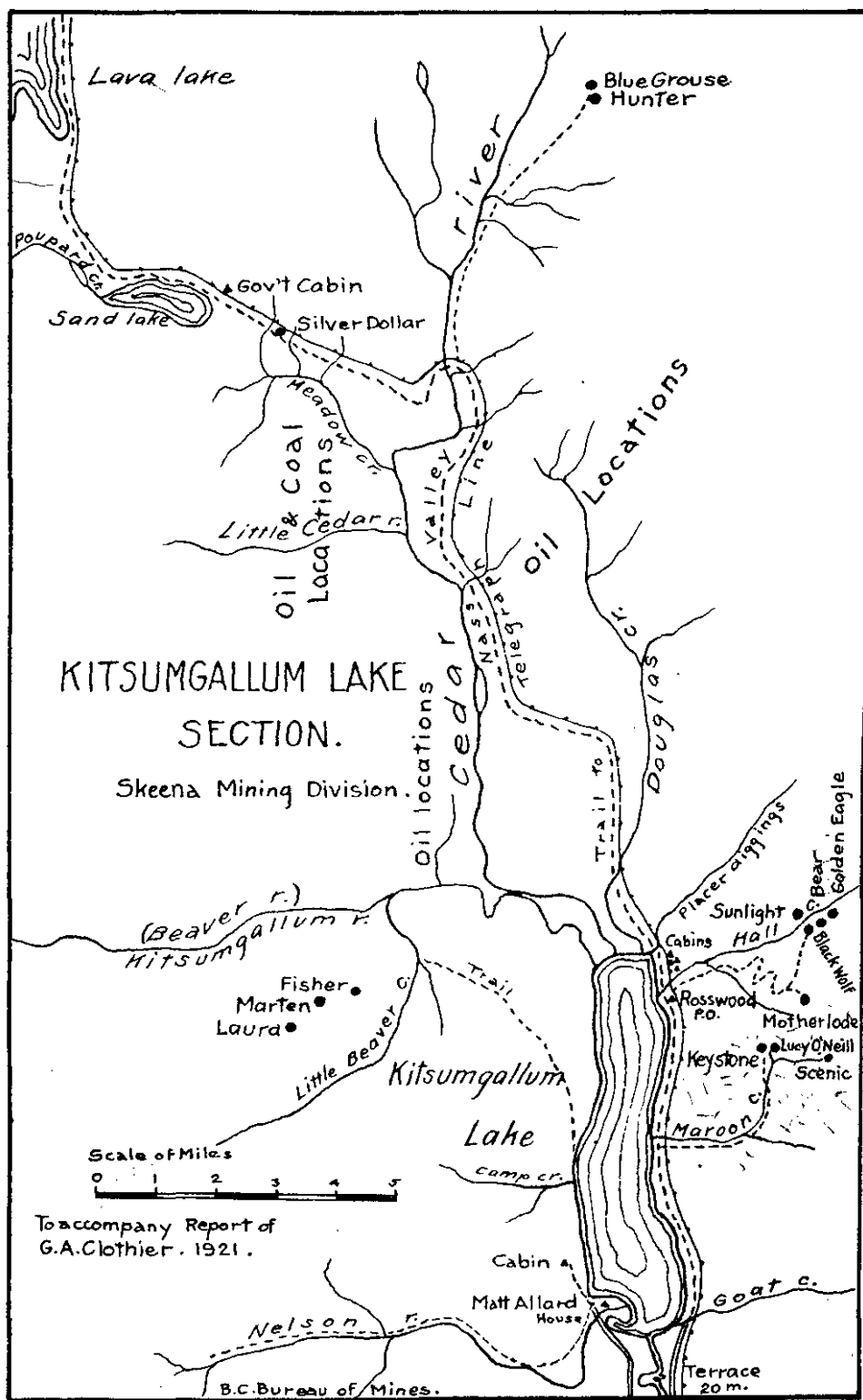
The holdings of the Kitsumgallum Basin Petroleum Company, Limited, have been kept in good standing, but the maintenance of the promoter appears to be the extent of the company's operations. No standard drilling-rig nor the "special-make" cable have reached the company's fields yet.

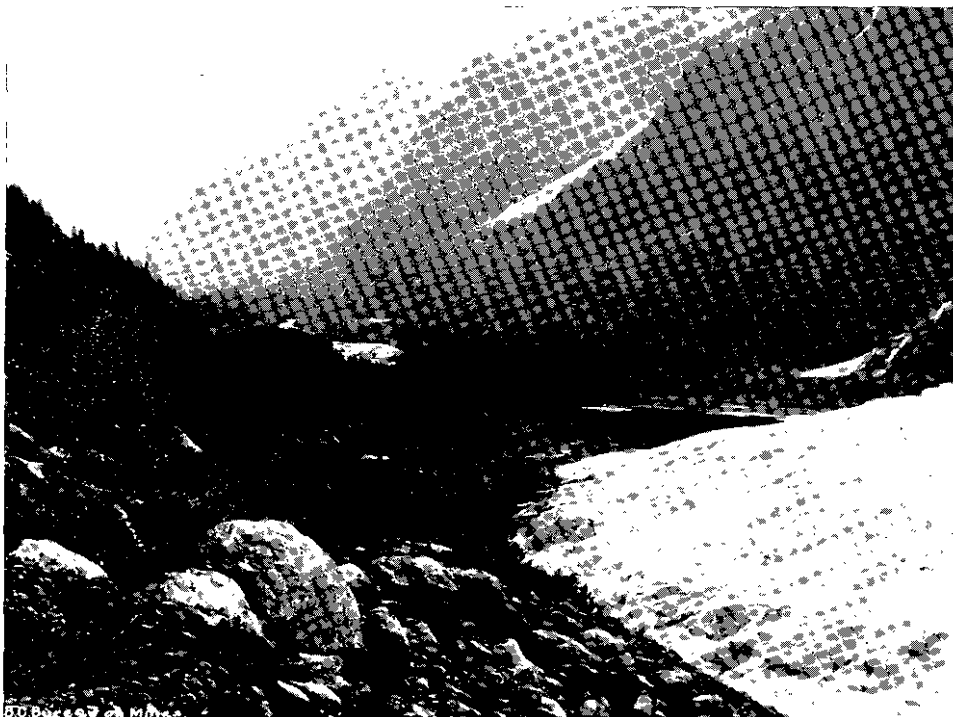
The coal areas north of Kitsumgallum lake and west of the Cedar river have been restaked. Favourable reports were made on this section several years ago, but no prospecting or development work has been done since. It is reported that a company will be incorporated and sufficient capital subscribed by the promoters to go ahead and thoroughly explore the ground by diamond-drilling.

A brief trip only was made to the Kitsumgallum lake country this year and the reader is referred to former reports for information on that section.

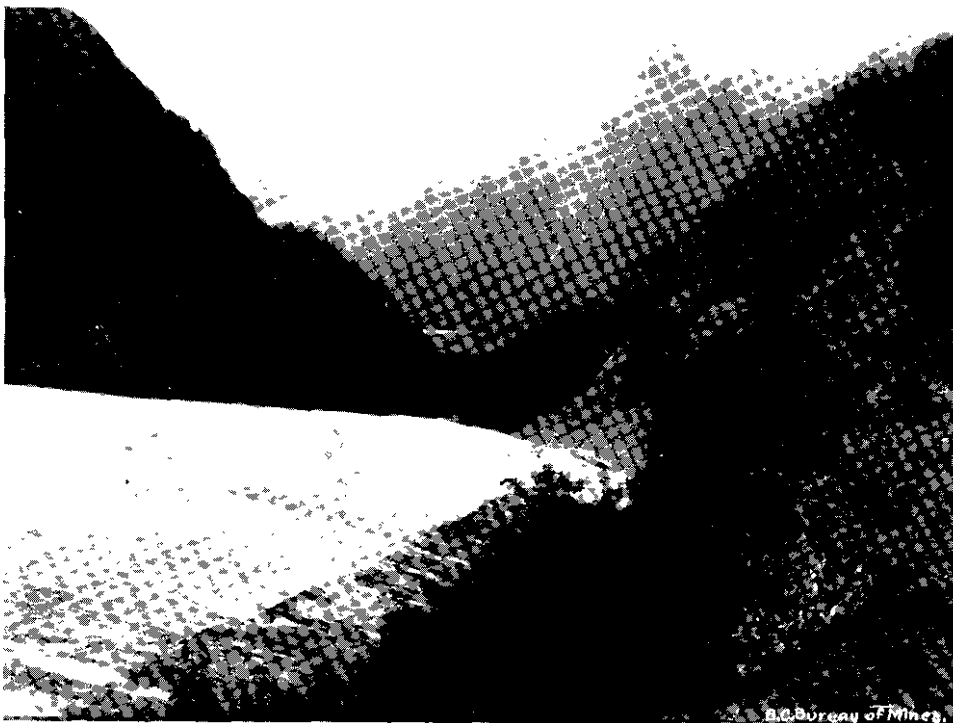
There are three claims (not incorporated) in a group—*Lake Side*, located in 1919, and *Portland* and *West Portland*, located in 1922—situated on the west side of Kitsumgallum lake about half-way up the lake. The claims are owned by the Smiths, who have a ranch near the foot of the lake. The showing consists of a pyritized quartz vein which has opened up from an oxidized seam on the surface to a foot of ore at the bottom of a 20-foot shaft sunk on it. The collar of the shaft is about 20 feet above the lake-level and about 50 feet back from the beach. There would appear to be little chance of any seepage through from the lake, unless, of course, the work be extended out under it, as the rock is very solid. The country-rock here is granodiorite, in which is a network of small barren quartz veins, but striking mainly at right angles from the mineralized fissure-vein, which strikes N. 20° E. (mag.) into the hill and dips 45° W.

The quartz carries pyrites in bands and disseminated, some chalcopyrite, and traces of grey-copper. The heavy sulphides assay up to \$120 a ton in gold, and free gold can be seen both in the quartz and sulphides. I judge that the average ore would concentrate about 10 into 1 and produce a concentrate assaying from \$150 to \$200 a ton. Its ideal location on the beach and the promising values and size disclosed by the shaft make it worth further exploration. There is a flat bench for 100 feet to the foot of the hill: consequently sinking would be the only way





Bear River-Nuss River Pass, Portland Canal M.D., looking East.



Bear River-Nuss River Pass, Portland Canal M.D., looking down Bear River.

to open it up, unless the vein were uncovered at the base of the hill, where it could be drifted on. A good leasing proposition.

This group consists of two claims—*Keystone* and *Log Cabin*—owned by J.

Scenic Group. Garland, Terrace. They are situated 12 miles from the Kitsumgallum lake, on the north side of the head of Garland creek, a small creek emptying into Maroon creek about 10 miles from the lake. There is a good trail from the lake, following Maroon creek up to the *Lucy O'Neill* cabin at the mouth of Garland creek. From there the owner has built a fair foot-trail to the claims. A small expenditure would put the trail in condition for a pack-horse, and supplies could then be brought by wagon from Terrace to Cobb's hotel at the foot of the lake, and from there by pack-horse along the east side of the lake and up Maroon creek to the claims.

The country up Garland creek consists of greenstone on the south side of the creek and greenstone overlain by altered sedimentaries on the north side. The whole is intruded by granite spurs from the main range and a variety of dykes running in all directions.

The sedimentaries, judging from the float in the creek, are all more or less impregnated with pyrite. The dykes are, for the greater part, light-coloured porphyrys, and on the north or Skeena slope of the mountain form a perfect network in the sedimentary rocks. Though bunches of mineral can be found here and there in the sedimentaries, the interlacing of the dykes gives no chance for any continuous bodies of ore. The best chances for ore-bodies are in the mineralized dykes.

Mr. Garland has done a lot of prospecting and work under adverse conditions. His first showing is just above the cabin at an elevation of 4,200 feet. Here he has sunk a shallow shaft about 6 feet deep in a dark, fine-grained rock resembling a chert limestone, in which are veinlets and small bunches of pyrite and chalcopryrite. The average copper content is low. I suggested trenching across the full width of the cropping to get some idea of the mineralization before commencing a tunnel lower down. Between this work and the summit of the pass, 4,500 feet elevation, there are several small showings in the sedimentaries, which are unimportant.

Over the divide about half a mile and about 400 feet lower than the summit some more work has been done. At one place a short crosscut tunnel has been driven in about 15 feet to cut a small outcropping. This shows the vein to be brecciated quartz and slate of about a foot in width, very slightly mineralized and of no importance.

Farther along the hill and at about the same elevation an open-cut of about 5 feet has been put into a greenstone dyke, about 6 feet thick, lying almost horizontally on the schists. On the top side of the dyke there is a quartz vein about 8 inches thick, well mineralized with chalcopryrite. The balance of the dyke is more or less silicified and sparingly mineralized with pyrite and chalcopryrite. There are a number of small chalcopryritized quartz veins in the hanging-wall schist, and some further work in tracing the dyke along on the surface and breaking into it at intervals should be done. This impressed me as the best showing and possibility on the property.

Farther along the hill several bunches of chalcopryrite have been found in the schists, but there is no extent to any of them on account of the maze of dykes. Because of its location it will require a large body of good-grade milling-ore which can be concentrated to a high-grade shipping-ore, or a good body of shipping-grade ore, to pay from this property. There is little use wasting time on low-grade ore.

Motherlode Group.—(See Reports, 1920-21.) During the summer season both tunnels were continued by the owners. I understand that both are in the andesitic dyke yet. The upper one should be made the main drivage to get beyond the dyke.

Assessment-work was done on the *Sunlight* group, at the head of Falls creek, by the owners, A. Egan and partner; on the *Black Wolf* and *Golden Eagle* by Gendron, Couture, Olander, and Brodine; on the *Silver Dollar* group, west of Cedar creek on the Telegraph trail, by the same owners, who hoped to be able to ship some ore this winter; and on the *Blue Grouse* and *Hunter* groups up Cedar creek by the owners, O. Wickstrom and O. Olander. Nothing was done on the *Lucy O'Neill* this year.

LAKELSE VALLEY (THORNHILL MOUNTAIN) SECTION.

I did not get up Thornhill Mountain at all this year, but nothing further than assessment-work has been done on any of the properties. A trip was made up Williams creek, but

unfortunately I was about a day late and could not examine the higher ground because of a fall of snow the previous day. The trail up the creek starts from Jack Bell's ranch, and for the first 5 miles to an old trapper's cabin was a fair foot-trail until the fires this year, which left it in bad shape. From there to Bell's claims is 7 miles over a blazed trail.

This group is owned by J. H. Bell and J. Catt, of Terrace, and consists of the following claims: *Monte Christo, Copper Queen, New Find, Surprise, Blue Bell, Hidden Trail, and Lucky Seven*. They are situated about 12 miles up Williams creek from the Lakelse valley. Owing to the snow being on the higher ground, where the greatest mineralization is, only a general idea of the formations and topography of the country could be obtained. The prevailing rock formation appears to be a grey, medium-grained, even-textured rock, probably andesite. Overlying and intruding this are a variety of rocks in broad bands and masses. The owners claim to have extensive showings of copper-bearing garnetite high up. There is a wide epidote dyke, striking S. 40° E. into the mountain, in a gulch just across a rock-slide from the camp, mineralized with chalcopyrite apparently across a width of 100 feet. A sample of this, more to get the proportionate values than as a sample of the ore, gave: Gold, trace; silver, 3.2 oz. to the ton; copper, 1.7 per cent.

The whole section in around William creek looks like a very promising copper-belt. Assistance to the amount of \$1,000 was obtained from the Department of Mines toward putting a horse-trail in early next year for a distance of 12 miles to enable present prospectors and others to get in and do some exploratory work. I expect to make a trip over this belt next season, coming out at the head of Kitimat arm.

NASS RIVER MINING DIVISION.

This Division extends from the mouth of Portland Inlet north to the head of the Kitsault river, a distance of about 70 miles. The two chief mining centres are Anyox and Alice Arm, the Government offices being at the former. These towns are reached by the Canadian National ships once a week, and also the Union steamships once a week. Alice Arm is the distributing-point for the Kitsault River valley and its tributaries, the Illiance river and Alice Arm proper. From the town of Alice Arm the Dolly Varden Railway extends up the Kitsault valley for 18 miles to the *Dolly Varden* mine. From there is a good pack-trail to the head of the Kitsault river, with good pack-trails up the main tributary creeks and to the more important prospects. There is also a first-class pack-trail up the Illiance river for 16 miles, built with assistance from the Mines Department.

From Aiyansh there are roads throughout the Nass valley, trails up the Nass river to Meziadin lake, a trail across to the Illiance river, and another south to the Kitsumgallum valley. All parts of the Division are therefore very accessible for prospecting and operating.

The reconnaissance made by George Hanson and party, of the Geological Survey of Canada, this year from the Illiance through to Kitsumgallum lake will furnish reliable information regarding rock formations and possibilities of mineral-deposits. A summary of his report on the upper Kitsault river is contained in the Summary Report, 1921, Part A, of the Geological Survey of Canada.

While there has been considerable prospecting and development work by individuals, especially in the Alice Arm country, there has been no extensive development by even small operators, such as is being done in the Portland Canal section. This is no doubt due to the closing-down of the *Dolly Varden*. It has just been learned, however, that the George Wingfield interests have acquired the *Dolly Varden* property by the foreclosure of a mortgage, and consequently there is now some hope for the resumption of operations and the restoration of faith in that section of the Division.

A great deal of staking was done this year in the Nass valley under the "Coal and Petroleum Act." Government office statistics show a slight falling-off of claims recorded and assessments done from last year. There were 213 free miners' certificates issued, 151 claims recorded, and assessment-work done on 435 claims.

OBSERVATORY INLET SECTION.

This company has maintained steady production throughout the year, employing an average of about 1,100 men in all departments. The tonnage mined from the company's *Hidden Creek* mines was 854,714 tons, producing 30,334.180 lb. of copper, 386,264 oz. of silver, and 8,901 oz. of gold; less tonnage producing

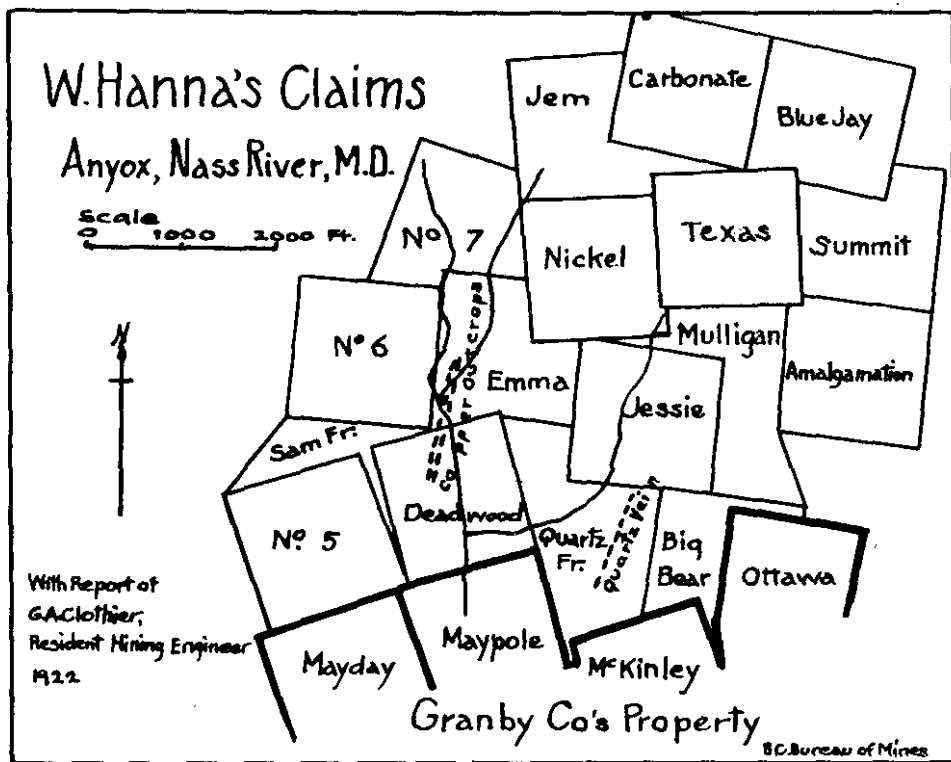
**Granby C.M.S.
& P. Co.**

greater quantities in metals. The coke and by-product plant was also in continuous operation, producing 52,305 tons of coke. The by-products output has not been furnished me.

New work undertaken consists of a dam, now under construction and which will be completed early next summer, and additions to the power-plant equipment. It is reported that the erection of a 1,000-ton concentrator, one of three units, will be undertaken and commenced in the coming year.

The company has under bond three copper properties in the Portland Canal section—the *Outsider*, at Maple bay, the *Sunshine* group on Glacier creek, and the *George* group near the head of Bear river. That a policy of expansion has been decided on is evidenced by the fact that the company has recently increased its capital stock and purchased the property and plant of the Canada Copper Company at Allenby.

H. S. Munroe is general manager and L. R. Clapp assistant manager at the Anyox plant; J. A. Bancroft, the former assistant manager, returning to his professorship at McGill University.



Golskeish Mines, Ltd.

This company, whose registered office is 507 Yorkshire Building, Vancouver, owns the group of four claims—*Golskeish No. 1*, *Golskeish No. 2*, *Silver Cup Fraction*, and *Silver Cup Fraction No. 4*—situated on Deep bay, 3 miles below Anyox. The mine, under the management of H. W. Heidman, was operated only a portion of the year, producing 2,428 tons of ore which gave 202 oz. of gold and 1,089 oz. of silver. The ore was shipped to the Granby smelter at Anyox at a fixed price to the ton and is used for fluxing purposes. A large percentage of barren quartz accounts for the low values. Further development of the mine consisted of an incline shaft of 150 feet and 180 feet of drifting on the lower level. Mr. Heidman informed me that this work has shown the vein to be stronger and with increased values. The mine is closed down for the winter.

W. Hanna's Claims.

There were fourteen claims in Hanna's holdings at the time of my examination in late June. They lie north of and adjoining the *Mayday*, *Maypole*, *McKinley*, and *Ottawa* claims of the *Granby Consolidated Company*. None of the claims are Crown-granted, though sufficient work has been recorded and they have all been surveyed. Some of the claims have been held since 1913.

There are two main showings on the property, on which considerable prospecting-work has been done. The first one is on the west side of Hidden creek on the *Deadwood* mineral claim. Here the country-rock is greenstone and the showing consists of a mineralized schist belt or shear in the country-rock, traceable on the surface north for probably 1,500 feet. Its southern extension would be on the *Mayday* mineral claim of the Granby property. Its strike N. 10° W. (mag.) and apparently dips at a medium angle to the west or into the hill. The belt has been exposed by stripping off the overburden for a width of 40 feet and along the side-hill for a length of about 100 feet. The wall-rock at this point appears to be an andesite porphyry.

The schistose vein gangue has been somewhat silicified and has small veinlets of quartz running in all directions through it. The mineralization consists mainly of pyrrhotite with which is associated a small percentage of chalcopyrite, occurring in small veinlets in the rock-seams, in the small quartz-seams, and sparsely disseminated throughout the gangue. Traces of chalcopyrite have been redeposited in the oxidized-iron seams. Only a few shots had been put in at the time I was on the property, and these did not get deep enough to show any changed conditions from the surface. Judging by the surface, the tenor of the ore would be very low. Cross-trenching should be done at intervals to get below the surface and facilitate sampling. Lenses of ore will probably be found, but it will require extensive exploratory work to prove the importance of the deposit. Farther north the shear-zone gradually lessens in width and the mineralization becomes more meagre.

East of this, probably 1,500 feet, is the contact between the greenstone and the Granby altered sedimentary rock formation. A further 300 or 400 feet east in the altered sedimentaries a wide, well-defined quartz vein has been opened up on the surface for a distance of 2,000 feet by open-cuts and stripping. This shows the vein to vary from 12 to 18 feet in width and strike N. 10° W., or parallel with the copper shear-zone on the west side of the creek, and conforming with the general strike of the country-rock. It extends southward into the Granby Company's ground.

The quartz as exposed on the surface is barren, but at several places where it has been broken into, it is sparingly mineralized with pyrrhotite, frequently showing small amounts of chalcopyrite, and occasional bunches of pyrrhotite, galena, and zinc-blende. So far as exposed the quartz is not of commercial value, except possibly for fluxing purposes. Deeper development, however, may prove the presence of ore-shoots, and some depth should be obtained at some point where surface mineralization is the strongest.

Because of the low values in both showings it will require a comprehensive scale of development to find out whether there is any profitable ore or not.

HASTINGS ARM SECTION.

This section lies up from the head of Hastings arm, the west arm from the head of Observatory inlet, and is reached by launch from Anyox, a distance of about 18 miles. From the head of the arm there is a foot-trail for 12 miles up the O'Neill river, which has heretofore been called the East fork of Sutton river, though it empties into the head of the arm. Assistance was granted last year by the Mines Department for the improvement of this trail, but the amount was inadequate and only about 5 miles of the trail was benefited. Under present conditions it takes about ten hours to make the 12 miles.

The general rock formation the length of the arm and up O'Neill river for about 5 miles is granodiorite of the main Coast range. From this point north are tufaceous rocks of the Dolly Varden formation, in which are isolated hills and areas of argillites of the Kitsault River formation.

Carpenter's Claims.

There are, I think, five claims in this group—*Dyke, Canyon*, and three others—others—of which I have not the names. The group is owned by H. Carpenter and partners and is situated on the east side of O'Neill river, about 12 miles from tide-water at the head of Hastings arm. There is a good cabin at the river at 2,300 feet elevation, from which there is a trail up to the claims, which lie at from 3,500 to 4,200 feet elevation. The pass at the head of the river is about 4,500 feet and leads through to "railway flats," which lie south of the West fork of the Kitsault river, about the head of Black Bear creek, on the west side of the Kitsault valley, and therefore probably 3 or 4 miles east of the granodiorite and in the same general formation as the *Dolly Varden*.

The showings on the claims are fractures filled with a mineralized breccia of quartz and country-rock, and in places all quartz. There have been two or three veins found striking

N. 60° W. (mag.), and at least one striking diagonally to these. Free gold is said to have been found in the cross-vein. The chief mineralization in the parallel veins is pyrite, with which is associated some chalcopryite. There has been no work done except surface prospecting and a shot put in here and there where the outcroppings were most prominent. Little idea can be gained of the possibilities of the property, and about all that can be said is that the surface showings are sufficiently strong and mineralized to warrant some exploratory work.

J. Settingington and partners have another group about 2 miles beyond this, which is said to be a big exposure of siliceous rock carrying very low values. I did not go up to examine it.

This group is situated about 6 miles from tide-water, or about half-way to Vimy Ridge Carpenter's claim. There are four claims—*Vimy Ridge No. 1*, *Vimy Ridge Group. No. 2*, *Vimy Ridge No. 3*, and *Vimy Ridge No. 4*—owned by Barney O'Neill,

who is one of the first prospectors in this section. Barney was just completing a cabin, which will make a good cache and a very welcome half-way house on such a trail. The elevation at the cabin is 900 feet.

The showings on the claims are reached by coming down the trail about half a mile from the cabin, where the river is crossed on a snowslide. The trail is up to the head of the slide and from there by goat-trail to an elevation of 1,900 feet. Here a vein composed of brecciated quartz diorite and country-rock can be traced along a precipitous bluff for 100 feet or more. It is from 2 to 6 feet wide and heavily mineralized with galena, zinc-blende, pyrite, and chalcopryite.

An open-cut from 10 to 15 feet long has been made in a small gulch, crosscutting some stringers of decomposed quartz and iron, in which are bunches of solid galena and sphalerite. As the open-cut parallels the main vein, it looks as if the cross-seams were only local cracks mineralized from the main vein. The vein itself could be attacked by dropping down the gulch about 15 feet below the open-cut, crosscutting into the vein, and then drifting on it to the west to get under the cross-fracturing. The owner intended starting this work as soon as his camp was finished, but I have no later information. It is a showing well worth opening up a little.

Some further work will be done on the trail next season. It should be improved to a good foot-trail to give prospectors a chance to get in and explore this area, which undoubtedly is a very favourable one for prospecting. I estimated roughly that such a trail could be done for \$100 a mile, as it would consist mainly of cutting out brush and down timber, with some side-hill grading and very little rock-work.

ALICE ARM SECTION.

This section includes the country tributary to Alice arm up to its head and refers to the inlet and not the town of Alice Arm. The most important area in this section is at the heads of Lime and Roundy creeks, where a great many claims were staked in the earlier days of the camp, but prospecting was somewhat neglected when the Kitsault River area came into prominence.

There is an old foot-trail up Lime creek and also one up Roundy creek, both starting from "Silver City." The latter trail was improved a little this year with assistance from the Mines Department, so that a pack-horse could be taken up as far as the old *Mohawk* camp.

This is about the only property in this section on which anything greater than **Sunset Group.** assessment-work was being done at the time of my trip. The group is owned by G. W. Morley and partners and contains eight claims—*Sunset No. 1*, *Sunset No. 3*, *4 Aces*, *45*, *Crackerjack*, *Mollie Darling*, *Violet*, and *Storm King*—situated on Roundy creek, 1½ miles from tide-water in an air-line and at 2,300 feet elevation.

The showings apparently lie in gneissoid granite, a belt about 50 feet wide lying between the Coast Range granodiorite on the south side and argillite on the north side, striking N. 45° W. (mag.). The belt shows a schistose structure on both walls, but is apparently more irregular and broken up in the central portion. Within this width are lenses of mineralized quartz and quartz and feldspar, and further development is showing quartz veins cutting diagonally across from wall to wall or from argillite to granite. Some very promising seams and lenses, well mineralized with galena, zinc-blende, and pyrite, assaying up to over 100 oz. in silver to the ton, have been exposed.

Mr. Morley has done a great deal of work in stripping, open-cutting, and short tunnels, but it is slow work trying to explore such a width by hand-work. I think there is a good chance

of developing a large tonnage of milling-ore, with good possibilities of striking shoots of high grade.

This group is composed of two claims—*Verona* and *Verona No. 1*—owned by **Verona Group.** Tom McCrosbie, of Alice Arm. They are situated at the head of the South-west fork of Lime creek, at 3,250 feet elevation, and can be reached either by way of Roundy creek or Lime creek. The predominant country-rock is argillite, here intruded by a felsitic dyke about 6 feet wide. Lying on the hanging-wall of the dyke is a quartz vein of from 6 to 24 inches wide, well mineralized with pyrite and bands and bunches of mixed pyrite, galena, and zinc-blende. The vein conforms with the strike, S. 10° W. (mag.), and dip, W. 65°, of the dyke and evidently will be as persistent as the dyke.

This year's assessment was done on the vein farther up the creek; samples of the ore from here assayed up to 65 oz. in silver and \$4 in gold to the ton. It is a small vein, but worth spending some money on, with the hope of finding a shipping-grade ore in sufficient quantity to ship.

KITSULT RIVER SECTION.

This section has had a very quiet and discouraging year in mining. However, as stated before, the transfer of the *Dolly Varden* to the George Wingfield interests will very probably result in the reopening of the property, which will have a good effect on the whole section.

Very little outside capital has been invested during the past two years, but a remarkable amount of exploratory work has been done by individual claim-owners, and several properties are in good shape for operators to take hold of, and I think that, assured of transportation, development capital will be interested.

The railway was put in repair early in the year, sufficiently to permit of the use of a hand-car from the beach to the *Dolly Varden*, proving of great assistance to the prospectors and others up the valley. The only producing and shipping property in this section this year was the *Esperanza*.

The report and geological map by George Hanson, of the Geological Survey of Canada, issued during the year, gives helpful geological information of the upper Kitsault valley. Briefly, the rocks are classified into two formations—the *Dolly Varden* formation, consisting of massive and fragmental volcanic rocks, and the *Kitsault River* formation, overlying the former, composed of argillites, conglomerates, etc. The copper-belt is classified with the *Dolly Varden* formation. The volcanic rocks, or *Dolly Varden* formation, are known locally as green (or grey) and purple andesites, the former containing in themselves, or along the contact with the purple andesites, all the silver-bearing veins. The high-grade silver values occur chiefly in quartz veins.

In the copper-belt the veins have mostly been formed along shear-zones. They are quartz and carry low silver values, but in places good values in copper. The quartz veins in the sedimentary rocks, or *Kitsault River* formation, contain low values in gold and silver, although the *Esperanza*, in the same formation, has very high-grade silver ore.

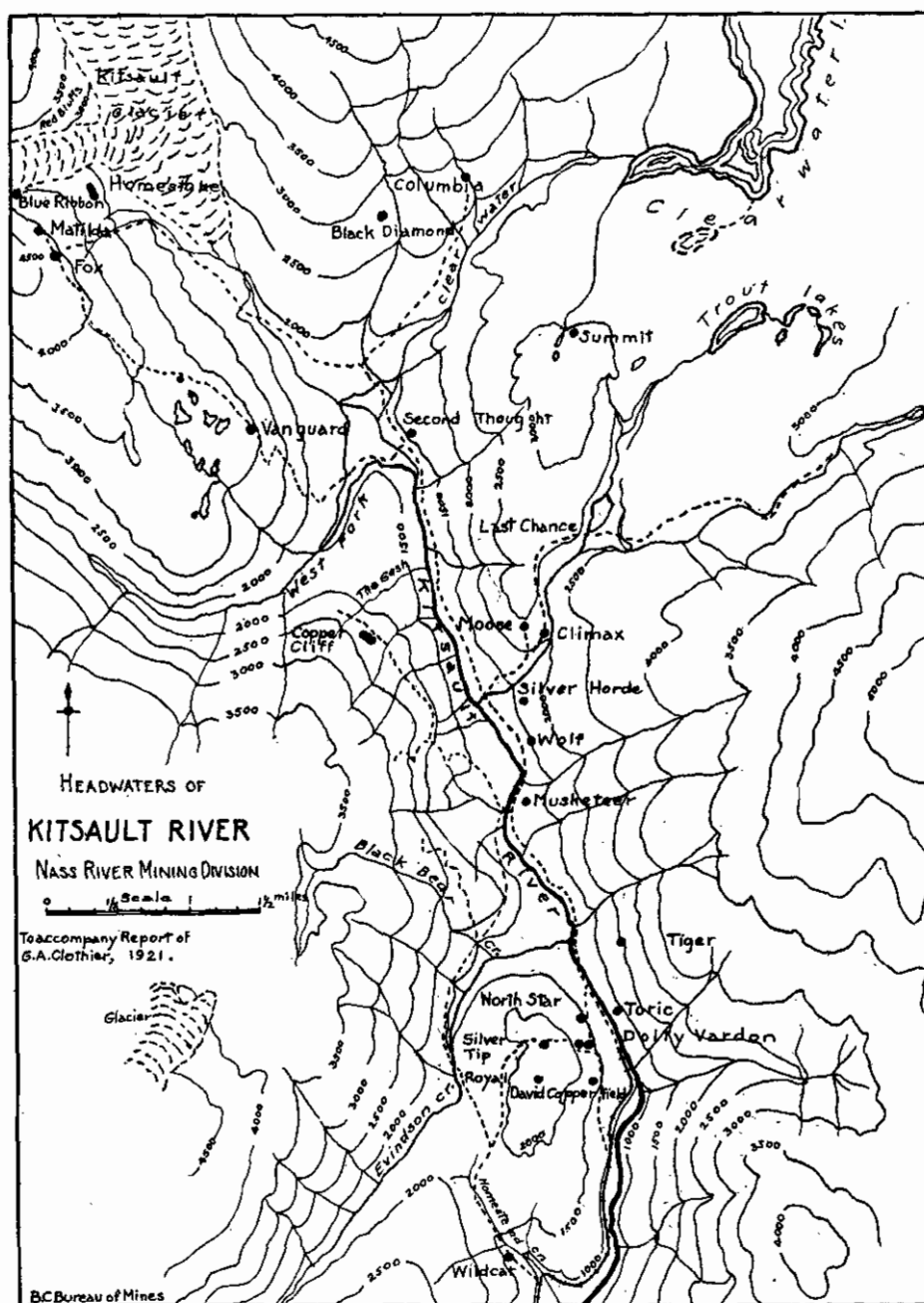
The conclusion is: "The volcanic fragmental rocks of the *Dolly Varden* formation are worth prospecting for silver-bearing veins. The purple and red members of this formation do not appear to contain any silver veins, the grey and green members containing all the known silver veins in the district.

"Secondary enrichment has not proceeded at a uniform rate throughout any area, nor even in any particular vein. Consequently, if a vein is stripped in a few isolated places and found to be too low grade for mining in these places, it does not follow that the intervening parts of the vein are also of low grade, and vice versa. In prospecting the silver-bearing veins in the district, thorough surface examination is of the greatest value. Surface prospecting would probably be of value along the *Dolly Varden* mineral-zone, the *North Star*, *Toric*, *Ruby* mineral-zone, and the extension of the *Ruby* zone.

"If the values are contained in a native silver or ruby-silver ore, it is probable the silver content will decrease in depth. Where the silver is contained in grey-copper or galena ore the values will probably be more persistent in depth.

"Where surface ores contain thick plates and leaves of silver and similar seams of ruby-silver, and where fracturing has been extensive, high values can be expected to continue to greater depth than where surface ores contain very thin flakes of native silver, etc.

"It is worthy of note that the high-grade silver values are obtained from a siliceous ore. In barite veins the higher-grade vein-matter is found in quartzose shoots."



**Esperanza
Group.**

This group is composed of three claims—*Black Bear*, *Aldebaran*, and *I Chance II*—situated about a mile from Alice Arm. It is one of the oldest properties in this section of the Province, having been staked by Frank Roundy, who was one of the first men at the head of Alice Arm. Several thousand dollars' worth of high-grade silver ore was shipped in the early days. Later it was acquired by Salinas Bros. on a wage claim of a few hundred dollars, and they shipped probably \$20,000 worth of

ore. In 1921 it was bought by Mr. Elge, who undertook rather extensive development, and shipped to Anyox about 60 tons of ore, giving returns of \$4,500. About the middle of 1922 it was taken over by a syndicate of Anyox men and placed under the management of James Peacock.

It has been steadily operated since, employing from five to ten men, and has shipped 231 tons of ore to Anyox, yielding 22 oz. of gold, 12,128 oz. of silver, and 404 lb. of copper. The present owners evidently find it more profitable to ship a lower-grade ore rather than hand-sort too closely. Very probably a better smelting rate is allowed because of the lower silver contents of the ore.

Lone Maid Group.

This group, owned by G. Chambers, of Nass River Cannery, lies north of and adjoining the *Esperanza* and without doubt has the extension of the *Esperanza* vein. It is reported that the property has been bonded to an Anyox syndicate for \$10,000. With the *Esperanza* vein traced up to the end line of this group, and again picked up beyond in the *Alice* group of claims, development-work on this group should result in finding the vein. It seems very reasonable to suppose that there will be found shoots of high grade the same as the properties on either end of it. A tunnel is being driven on the property this winter.

Alice Group.

This property is owned by J. Smith and associates, of Anyox. There are four claims in the group—*Alice*, *Butte*, *Silver Ridge*, and *Progress*, situated north of and adjoining the *Lone Maid* group, which in turn adjoins the *Esperanza* group. The rock formation in this locality is argillite, probably of the Kitsault River formation, as classified by George Hanson in his report.

At an elevation of 1,375 feet, and about a mile beyond the *Esperanza* workings, George Matheson, while doing the annual assessment-work for the owners, uncovered and stripped for a short distance a quartz vein from 14 to 20 inches wide, striking N. 60° W. (mag.) and dipping slightly to the west at this point, and doubtless it is a continuation of the *Esperanza* vein. It has since been traced for several hundred feet farther on the surface, although this is the only point yet where high-grade ore has been found.

The quartz here is well mineralized with galena, pyrite, and some zinc-blende, carrying high silver values in silver sulphides. Beautiful specimens of ruby-silver were seen. There is a band of solid sulphides 3 or 4 inches thick in one place and the balance of the quartz is well sprinkled with mineral. The vein, where broken into, would average several hundred ounces of silver to the ton, and hand-sorted shipping product would probably assay up to 500 ounces of silver to the ton. It is a splendid showing of high-grade ore and, with the *Esperanza* road extended about a mile, could be profitably worked.

Later development was done on the property by way of a crosscut tunnel of about 25 feet, which cut the vein at a depth of 20 feet, finding high-grade ore. Higher up the hill several cuts were put in on the vein years ago by former owners, but no high grade in any amount was found. This property gives every promise of making a very profitable small producer.

There are two claims in this group—*Midway* and *Midway No. 1*—owned by **Midway Group.** R. Ingraham and situated west of and adjoining the *Esperanza*. I am informed that this group has also been bonded to an Anyox syndicate.

Some work was done on this property in earlier days.

This group is owned by Neil Forbes, Fred Martinsen, H. H. McColl, and **Lyon Group.** Matt Drager. There are six claims in the group—*Lyon*, *Lyon No. 2*, *Owl*,

Owl No. 2, *Owl No. 4*, and *U.S.*—situated on Falls creek about 3 miles from Alice Arm. It was reported earlier in the season that a 16-foot vein, carrying high-grade silver in places, had been cut 100 feet in the tunnel. No further information is obtainable.

This property, situated on Paul Kladuc creek, was a small shipper of high-grade grey-copper-silver ore before the incorporation of the company. Since **Alice Arm** then it has only been operated one season. Nothing was done this year. **LaRose Mining Co.** There is high-grade ore showing in the old workings, a good trail from the

railroad to the property, and a good camp. It should therefore make a good leasing proposition.

Wild Cat Group.—Yearly assessment is being done on this group, now consisting of the *Wild Cat*, *Montana*, *Shoshonc*, *Dundee No. 2*, and *Copper Bill* mineral claims, lying in the copper-belt. The owners are C. Gustafson and A. Davidson, of Alice Arm.

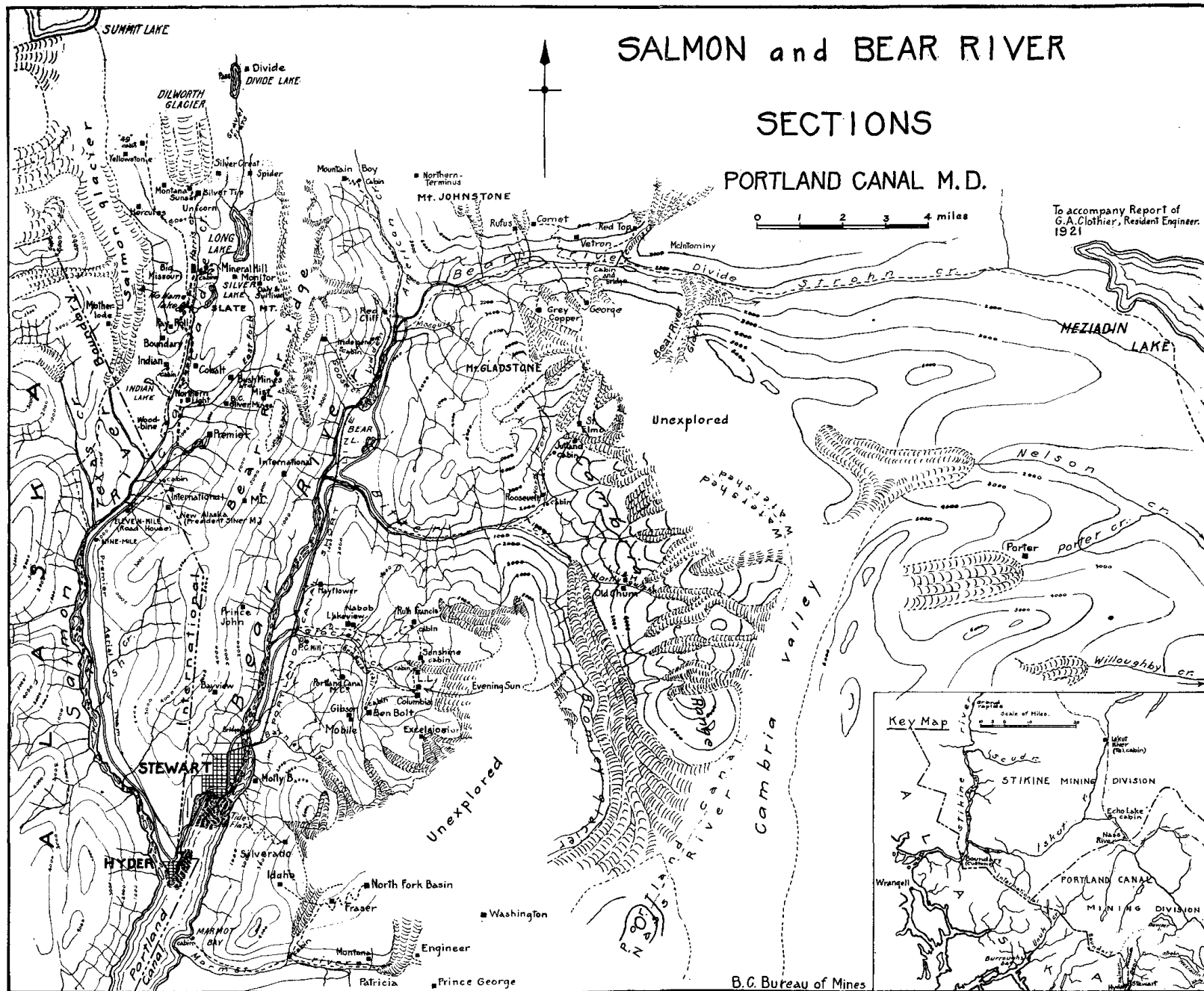
SALMON and BEAR RIVER

SECTIONS

PORTLAND CANAL M.D.

0 1 2 3 4 miles

To accompany Report of
G.A. Clothier, Resident Engineer.
1921



B.C. Bureau of Mines

Other groups along the copper-belt, such as the *Copper Cliff*, owned by A. Davidson, G. A. Young, and J. Wells; *Red Point*, owned by O. Evindsen and partners; *Racehorse* and *Combination*, owned by Charles Swanson and partners, have had very little work done on them since the earlier days of the camp.

Vanguard Group. This property is owned by Morris Peterson and the Strombeck Bros. It is comprised of four claims—*Vanguard*, *Motherlode*, *Nero*, and *Nimrod*—situated in the copper-belt about 4 miles north of the *Dolly Varden* mine. It is reached by a good trail branching from the main Kitsault River trail at the *Second Thought* cabin. The cabin on the property is at an elevation of 2,850 feet, or about 1,000 feet above the river. The workings are above the cabin.

There is an exceptionally fine surface showing of chalcopyrite at 3,000 feet elevation, exposed by open-cuts and stripping; at one point 8 feet in width of practically solid copper sulphide is exposed. A crosscut tunnel was run underneath this showing and a drift driven on a vein which appeared to be the downward extension of the surface showings. The crosscut is now in about 90 feet, or about 40 feet beyond the drift. There is a small vein of quartz about 8 inches wide at the face, showing some mineralization of pyrite and galena, which might be worth drifting on. The main drift, 50 feet in from the collar of the crosscut tunnel, is in about 60 feet, the face now showing about 4 feet in width of scattered pyrite and chalcopyrite. This drift should be continued beyond the surface showing, to be sure that the ore-shoot does not rake into the hill and away from the drift.

Peterson and his partners have done a lot of work on these claims in prospecting, building trails, and development.

Lucky Strike Group. This group consists of the following eight claims, starting from south: *Rambler*, owned by J. Hauber; *Sunnyside*, by W. McLean; *Porcupine*, by Angus McLeod; *Cascade Fall*, by Hauber & McLean; *Lucky Strike* and *Lucky Strike Fraction*, by Hauber; *Silver Crown*, by McLean & McGinnis; and *Siren*, by O'Hara & Hauber. They are situated along the ridge running north from the West fork of the Kitsault river to Homestake mountain and in the copper-belt.

On the *Rambler* claim a tunnel has been driven across a vein that strikes N. 28° W. (mag.), showing its width to be about 16 feet. The hanging-wall is a fine grey breccia and the foot-wall at this point is argillite. The vein-filling consists of a breccia of slate and grey rock, cemented with feldspar, calcite, and quartz, which are liberally sprinkled with pyrite and chalcopyrite, assaying from \$2 to \$5 a ton in gold values.

Ribs of sulphide in the decomposed surface rock would assay up to 7 or 8 per cent. copper, but the average of the whole would be low on account of so much oxidization. Sufficient depth to get below surface effects might show some good lenses of ore and a fair average value. This shear-zone has been traced north for over 600 feet, but, as the surface along the vein is comparatively level, depth on the vein could only be obtained by sinking.

On the *Porcupine Fraction*, just north of the cabin, an open-cut exposed a vein similar to the one in the *Rambler* claim, badly broken up on the surface. It is from 10 to 12 feet wide and shows considerable pyrite and chalcopyrite. About 250 feet east of this showing another vein has been uncovered, striking N. 70° E., or towards the other two parallel ones. This vein is also a filled shear-zone, stands vertically, is from 10 to 12 feet wide, and consists of quartz and calcite heavily mineralized with pyrite and chalcopyrite. There is also a little galena and zinc-blende showing in places. About 4 feet on the west wall is exceptionally well mineralized with mixed sulphides of iron and copper. Altogether this is a very good showing for an out-cropping and warrants going down on for some depth. Unfortunately the ground is so flat here that there is no chance to gain much depth by tunnelling. A few pieces of fairly well-mineralized quartz were taken as a sample to get an idea of the proportionate values. The sample assayed \$2.40 in gold and 8.6 oz. in silver to the ton, and 2 per cent. copper. There are several isolated croppings on the flat which have not been traced anywhere.

On the *Lucky Strike* claim, at an elevation of 3,800 feet, is the largest showing on any of the claims. Here a trench has been made across another breccia-zone, showing it to be at least 20 feet wide. Like the others, the vein gangue is quartz and calcite cementing the country-rock fragments, the whole well mineralized with pyrite, chalcopyrite, and some galena and zinc-blende. Either the galena carries high silver values, or there is present some grey-copper or silver sulphides from surface enrichment, for the owners claim to have had assays up to 3 oz.

in gold and 65 oz. in silver to the ton. The open-cut gives a depth of 8 feet, but the ground is still full of oxidized seams.

On the strike of the *Lucky Strike* and *Cascade Falls* croppings, and at 4,300 feet elevation, an open-cut and shallow shaft exposes a width of several feet of decomposed material, in which are ribs of stibnite and arsenical iron, with specks of galena and zinc-blende. This cropping is on the West Fork slope and appears to strike N. 70° E. A grab sample, to get possible silver values, gave a trace of gold and 0.4 oz. in silver to the ton.

Farther north, on the *Lucky Strike* claim, at 4,600 feet elevation, an open-cut exposes a width of 12 feet of brecciated grey country-rock, quartz, feldspar and calcite, in the centre of which are about 2 feet of calcite well mineralized with chalcopyrite. It is a strong, well-defined vein in grey andesite, in which it would be very possible to find a good shoot of copper sulphide. On the higher levels there are a number of slate-cappings which can be seen to the top of the mountain.

From the exposures on these claims, and farther north on the *Vanguard* and *Homestake* groups, it would appear that in the copper-belt there are two series of parallel shear-zones, one striking parallel with the ridge at about N. 28° W. (mag.) and the other at N. 70° E. (mag.), with such strong mineralization in each fracture-zone that it would be interesting to explore them at their intersections.

While the owners, as prospectors, have done a lot of work on this property, it is altogether inadequate to show up the property to any advantage. It would seem that the exposures made on the different veins showing their sizes and the amount and possibilities of the mineralization would warrant their extensive exploration by larger operators.

On the *Fox* and *Matilda* mineral claims and the *Blue Ribbon* group (see 1921 Minister of Mines' Report) assessments were done this year.

The Consolidated Homestake Mining and Development Company, Limited (see Minister of Mines' Report, 1921) did nothing this year on its holdings west of the Kitsault glacier.

There are eight claims in this group, owned by J. Hauber, of Alice Arm. They are *Black Diamond No. 1*, *Black Diamond No. 2*, *Black Diamond No. 3*, *Black Diamond No. 5*, *Black Diamond No. 7*, *Black Diamond No. 8*, *Southern Cross*, and *Surprise*, and are situated on the west side of Clearwater creek, about a mile from the main Kitsault trail, from which there is a branch trail to this and the *Columbia* groups. There are four claims below these on the same vein, also owned by J. Hauber—namely, *Livewire No. 1*, *Livewire No. 2*, *Eyeopener No. 1*, and *Eyeopener No. 2*.

There is a good cabin on the *Black Diamond* group at 2,100 feet elevation. The tunnel is 150 feet up the creek from the cabin and at about the same elevation. The tunnel has been driven in slate a distance of 80 feet on a bearing of N. 15° W. (mag.), cutting in that distance three small stringers of quartz.

The vein on the surface is about 16 feet wide, striking N. 50° W. and dipping to the west. On the foot-wall side of the vein is a width of 10 to 12 feet of brecciated quartz and slate, showing no mineralization. The balance of the vein is banded quartz and slate. The wall-rock argillite has a general strike of east-west (mag.) and dips very flatly. The vein therefore cuts the formation on both strike and dip.

The stringers of quartz crossed in the tunnel strike N. 65° W. and are therefore cutting diagonally across the vein-filling to the hanging-wall, which has not yet been reached. These quartz stringers show an occasional speck of argentite and the owner claims to have assays of 60 oz. in silver to the ton in the second stringer. I advised following this stringer to the hanging-wall of main shear-zone instead of continuing crosscut. The showings are not encouraging.

The owner of this group, Pete Anderson, continued the tunnel (see 1921 *Columbia Group*. Report) another 50 feet, finding nothing. The tunnel is now in about 135 feet in barren quartz. I again suggested that he abandon this work. I went a further 2 miles, climbing to 3,200 feet elevation over a fair foot-trail that Pete had built himself, starting just across the creek from his cabin and saw several croppings of brecciated quartz and andesite in andesite formation. No mineral of any kind shows in any of them. The best showing Pete had was a boulder from anywhere assaying \$2 in gold and 17 oz. in silver to the ton.

Second Thought Group.—(See Reports, 1918 and 1921.) Nothing was done on the property this year. It is owned by George Casey and Jack Graham, of Alice Arm.

The Dolly Varden Mines, Limited, acquired the eight claims comprising the **Dolly Varden**. *Dolly Varden* group from the original stakers, and a little later bought the *Wolf* group, 2½ miles farther up the valley, consisting of four claims, from Dan Cameron, the original staker. Extensive exploratory and development work in underground work and diamond-drilling was done by this company, bringing the property to the stage that it justified the construction of a railway from tide-water to the mine, a distance of 18 miles. The contract for this was let to the Taylor Engineering Company, of Vancouver, on a cost-plus basis, and 16 miles of the railway was finished up to the end of 1918. However, a dispute arose between the two companies, which was finally settled by the Provincial Government in favour of the Taylor Engineering Company, to whom the property was turned over for operation. The mining department of the Taylor Engineering Company was then formed to operate the property, and in 1919 completed the remaining 2 miles of the railway to the mine, and that year shipped 6,709 tons of ore, containing 423,952 oz. of silver. The following year, under intensive mining, the company shipped 93 tons, yielding 82,298 oz. of silver, and also 27,944 tons, yielding 749,340 oz. of silver, and the property closed down early in the winter. In 1921 a little development-work was done while the balance of the broken ore was being shipped, amounting to 1,874 tons, yielding 45,648 oz. of silver. She was then closed down tight and is still closed. The total output of the mine to date has been 36,620 tons of ore, yielding 1,301,229 oz. of silver.

The property is now equipped with an 18-mile railway to the beach, with rolling-stock, etc., complete; capacious ore-bunkers and spur line at the beach; wharf, office, shops, etc., at the beach terminal of the railway; 500-horse-power plant, situated at the *Wolf* mine; an aerial tramway from the *Dolly Varden* mine to the railway, with adequate bunkering at each terminal; and a complete equipment of mining machinery, camps, offices, etc., at the mine.

Though the *Dolly Varden* vein has been traced for 1,500 feet on the surface, the above tonnage was extracted from a faulted area in a horizontal distance of about 300 feet, and proved the enriched, secondary ores to extend to a depth of about 250 feet below the surface. Two lower tunnels east of this enriched area have developed appreciable tonnages of low-grade primary ore. West of the enriched area, up the hill, has not been explored by underground work, but has had some diamond-drilling done. It would seem that this portion of the vein, where erosion has been comparatively small, would be well worth exhaustive exploration in search of other enriched ore-shoots. The amount of work done on the primary ores is not conclusive that there are not shoots of commercial ore in them.

Early this year the property was acquired, on the foreclosure of a mortgage, by the George Wingfield interests. Mr. Wingfield, with other creditors, then incorporated the Northern Mining Properties, Limited, in which he holds the controlling interest. The company, incorporated as a limited company, is capitalized at \$417,000, shares at \$1 par value each, and has its registered office at Vancouver. I am informed that Mr. Taylor has been granted an option on the property for one year.

This property is owned by the Alice Arm Silver Mining Company, Limited, whose affairs are in charge of James McAleenan, of Prince Rupert. The work done consists of open-cuts, a short tunnel at an elevation of 1,600 feet, and another 250-foot tunnel about 100 feet below this. The vein is from 4 to 20 feet wide, in grey andesite. The 4-foot portion is pyritized quartz, carrying silver values in ruby-silver, native silver, and argentite. The balance of the vein is silicified country-rock of low grade. Altogether, 112 tons of ore has been shipped, yielding 2,838 oz. of silver. The property is equipped with a small compressor, machines, drills, cars, etc., and is provided with a camp suitable for six to ten men. It has not been in operation this year.

This group is comprised of four claims—*Toric*, *Anglo*, *Moose*, and *Lamb*—owned by Strombeck Bros. and situated on the east side of the Kitsault river, just opposite the *North Star*, in the silver-belt. There are two veins on the claims; one, exposed by a 20-foot open-cut and 10 feet of tunnel, shows a 24-inch vein of quartz and country-rock, mineralized with pyrite and a little galena. The values in silver are low.

The main vein has first been opened up at a point about 150 feet above the railway-grade, disclosing 20 feet in width, as follows: 5 feet of well-mineralized, banded jasper, barite, and quartz on the foot-wall; then 8 feet of country-rock; then about 4 feet of similar ore to the

foot-wall vein. A grab sample of the ore on the dump gave 17 oz. in silver to the ton. This vein lies in the grey andesite country-rock of the vicinity, strikes N. 80° E. (mag.), and dips 65° N., the same as the *Dolly Varden* vein, and at right angles to the *North Star* vein. Three open-cuts have been put in on the vein, tracing it for about 500 feet up the hill from the tunnel. One of these shows about a foot of quartz, in a vein width of 4 feet, carrying high values in native silver, ruby-silver, and argentite.

There is a camp on the upper end of the claims, but in the absence of the owner I did not see the important showings, which are said to be very promising.

There are two claims in this group—the *Tiger* and *Lion*—situated in the silver-belt, north of and adjoining the *Toric*, and are owned by Ed. Pickett.

The owner has done a lot of work in stripping and open-cutting the vein, exposing it several hundred feet along the surface. It strikes about north-south (mag.), the same as the *North Star* vein, dipping 68° E., and lies in a country-rock of hard, grey, fine-grained andesite. The vein is a hard, vitreous quartz, up to 12 feet in width, mineralized chiefly with pyrite, but showing in places some galena and traces of ruby-silver and native-silver, but the average would be low grade. This I would consider a typical sample of a vein of "primary ore" in the silver-belt. Whether these veins contain shoots of richer ore has not been proved by sufficient drifting on any one of them.

The upper end of this vein has been faulted down the hill into three or four blocks by an east-west trending fault. Higher values have been found in the vicinity of these faulted blocks. Some diamond-drilling was done on this vein, but I doubt its efficiency in this type of vein and

This group is comprised of five claims—*Athos*, *Porthos*, *D'Artagnan*, *Armes*, **Musketeer Group.** and *D'Artagnan No. 1*—situated north of the *Tiger* group and south of the *Wolf* group of the *Dolly Varden* holdings. The property is owned by A. D. Meenach, of Seattle, Wash., by purchase from the original stakers of the claims, Miles Donald and Al. Miner, of Alice Arm. A great deal of work has been done by way of open-cutting, tunnelling, and crosscutting, but very little definite information has been derived from it.

About 50 feet above the railway-grade an open-cut 40 feet long shows a face of from 12 to 15 feet high in the solid rock. On the north end of this cut it is well mineralized for a width of 7 or 8 feet; the next 20 feet in the centre is barren andesite country-rock, and the remaining 7 or 8 feet on the south end is pyritized quartz showing some galena.

About 40 feet above this another cut was put in from the creek-bank, exposing 8 feet of heavily pyritized quartz carrying a little galena and showing scales of native silver on the seams. It is claimed that 32 oz. in silver to the ton was obtained across 7½ feet here.

The last work consisted of an open-cut and tunnel about 25 feet above the railway-grade. The open-cut is about 30 feet long, reaching the ore exposed in the lower of the cuts mentioned above. From this point a tunnel was driven along the south wall of the vein for 33 feet on a bearing of S. 75° E. (mag.), where it turns 15° to an east bearing for a further distance of 39 feet to the face. At a point 18 feet back from the face a crosscut was driven 7 feet into the vein, showing a milling-grade ore of pyritized quartz with a sprinkling of galena. The owner claims to have obtained high silver values in samples from this crosscut. The work, at any rate, proves the continuity of the vein for 70 feet.

From the mouth of the tunnel a crosscut tunnel was driven on a bearing of N. 45° E. for 72 feet; thence north for another 27 feet. A few spots of ore show in the back of the crosscut for a little way from the portal; beyond this is nothing. The property is now in good shape for informative development-work.

There are three claims and a fraction in this group—*Silver Horde Nos. 1, 2, and 3*, and *Silver Horde Fraction*. The claims adjoin the *Wolf* on the north and are owned by A. Davidson and Al. Miner. Some open-cutting has been done, exposing a vein from 15 to 20 feet in width in a fine-grained andesite.

Low values in silver are obtained from the lower cuts, but I understand that better values are found at higher elevations.

This group consists of the *Climax* and *Climax No. 2* mineral claims, owned by Olier Besner, of Prince Rupert. They are situated on the north side of Trout creek and adjoin the *Silver Horde* and *Moose* groups. The vein, also in the andesite silver-belt, has been exposed on the surface by a series of trenches down through the heavy overburden and open-cutting across the vein. This work discloses a fractured zone in the

andesite country-rock, of from 30 to 50 feet in width, filled with seams and veins of quartz and calcite sparingly mineralized with pyrite and, in places, galena.

As more elevation is gained the vein-filling becomes more quartzose and mineralization increases. The top cut at 2,350 feet elevation, 75 feet long, has exposed a quartz vein about 20 feet in width well mineralized with pyrite and galena, but the values are low on the surface. Some further work was done here this year, but I did not get up to examine it. There is no doubt that this is the extension of the *Moose* vein, which is opened up just above this. The vein is worth drifting on.

Moose Group.—This property was described and a sketch of the workings shown in the 1921 Report; consequently I will omit it here as no work was done in 1922.

Last Chance Group. There are four claims in this group, owned by Archie McPhail and Pat Morley namely—*Last Chance Nos. 1, 2, 3, and 4.* The claims lie east of and adjoining the *Moose* group and are about three-quarters of a mile up Trout creek from the main Kitsault River trail, from which there is a branch trail serving the

Climax, Moose, and this property. The showing is an exposure of ore along the side-hill for a distance of 300 feet, composed of a quartz barite-calcite gangue mineralized with pyrite, chalcopryite, galena, a little sphalerite, and some argentite.

Shots have been put in here and there over the surface; a sample taken from these places gave 61 oz. in silver to the ton. An open-cut along the face of the exposed ore shows high-grade galena and argentite. About 100 feet above the base of the exposed portion the hill breaks back on a flat bench. Pits and open-cuts here show the vein for 20 feet back from the edge of the bluff.

The showing was diamond-drilled in 1919 from the foot of the bluff. Horizontal holes proved the width of the vein and values to be very satisfactory. Down holes, however, failed to locate the vein and the work was discontinued. Since this the owners have done a lot of work in stripping and open-cutting, thus tracing the vein for over 1,000 feet, and in places finding ore assaying up to 390 oz. in silver to the ton.

The owners decided to run a crosscut tunnel lower down the hill, obtaining a depth of about 140 feet on the vein. It will require about 200 feet of tunnel, of which about 60 feet had been driven when I examined the property. I think the property has a good chance of developing a large tonnage of at least milling-grade ore.

This group has three claims in it—*Central, Homeguard,* and *Traveller*—owned **Central Group.** by Wm. McFarlane and Dan Kennedy, of Alice Arm. The claims are located on the east side of the Kitsault river, across the river from the 14-Mile post on the Dolly Varden Railway. There is a camp on the east side of the river, which is crossed by a cable. The first showing is at an elevation of 1,000 feet, or about 350 feet above the railway on the opposite side of the river. Here an open-cut along the side-hill crosses a vein 20 feet wide, filled with a breccia of greenstone country-rock cemented with calcite. The calcite is heavily mineralized with pyrite and chalcopryite. Across 12 feet 6 inches of the face of the exposure assayed as follows: 4 feet 6 inches in width, \$2.40 in gold and 6 oz. in silver to the ton, and 3.9 per cent. copper; 8 feet in width, 60 cents in gold and 2.4 oz. in silver to the ton, and 3.5 per cent. copper. I judge the 12 feet 6 inches of ore will concentrate from 5 to 8 into 1. Other similar showings are found up the hill.

The property was bonded by the Granby Consolidated Mining, Smelting, and Power Company, Limited, and diamond-drilling done. It was found that in each case the showings consisted of isolated boulders, or masses of the vein broken away and embedded in the slide-rock. A tunnel was then started by the owners at an elevation of 1,275 feet and has been driven over 150 feet. The first 20 feet went through a boulder of ore; the next 100 feet went through coarse slide-rock of country-rock, encountering no more boulders of ore; the balance of the tunnel is in solid andesitic country-rock, but the vein has not been found. The portions of the vein found in the slide certainly indicate a strong vein carrying good commercial values and well worth a considerable expenditure to locate.

This group consists of two Crown-granted claims—*Red Bluff* and *Devil's Club* **Red Bluff Group.**—owned by J. McPhee, of Butedale, Customs officer. The claims are situated on Red Bluff mountain, about 5 miles from Alice Arm, on the west side of the North-east fork of the Kitsault river, and reached by a brushed-out trail branching from the main trail up the fork, at about 500 feet elevation, opposite a small creek from the north. From an

elevation of about 2,000 feet up, the hill is cut by several deep gulches. Rock is broken down from the sides and collected in big slides at the bottom, exposing a big oxide-covered area on the side-hill that can be seen for miles, and gives the name to the mountain.

The rock formation in this vicinity is a pyritized light grey feldspathic rock in great masses, alternating with bands of argillite and intruded by many dykes. Two tunnels have been driven in this formation, one at 2,300 feet and another at 2,900 feet elevation, neither showing any concentration of mineral, although along the oxidized seams there is some chalcopyrite in the upper tunnel.

Solid chalcopyrite float has been found on the property and specks of silver sulphides and bornite have been noted in the more siliceous seams in the rock carrying disseminated pyrite. I think the ground well worth close prospecting for enriched fissures within the pyritized rock-masses, and along its contacts with the argillites and dykes.

The Silver Bar Mining and Development Company, Limited, was incorporated April 18th, 1922, with a capitalization of \$1,000,000 in 1,000,000 shares. Its registered office is in Vancouver. The holdings of the company consist of eight mineral claims, known as the *Silver Bar* group—namely, *Silver Bar*, *Silver Bar No. 2*, *No. 3*, *No. 4*, *No. 5*, *No. 6*, *No. 7*, and *No. 8*. They were owned by A. McGuire, of Alice Arm, and situated up the North-east fork of the Kitsault river. The company, however, did not get the property under way this year.

Horseshoe, Orega, and Shamrock Mineral Claims.—These claims were staked this year by E. Ness. They are situated on the North-east fork of the Kitsault, or probably a better description would be, on the Copper Creek slope of McGrath mountain. Some very fine specimens of chalcocite were brought in from the claims, and Ness reports 18 inches of ore on the surface, assaying 29 per cent. copper and 4 oz. in silver to the ton.

ILLIANCE RIVER SECTION.

This section now has one of the best pack-horse trails in the Province, from tide-water for 16 miles, following up the Illiance river.

This property was reported on in 1918. It consists of four claims—*Standard*, *Standard Group*. *Standard No. 1*, *Standard No. 2*, and *Standard No. 3*—situated on the south side of McGrath mountain and owned by Miles Donald, of Alice Arm, and partners. There is a fair foot-trail, although steep, branching from the main Illiance River trail to this and other properties higher on McGrath mountain.

The predominating rock formation of McGrath mountain is argillite. At 2,800 feet elevation an open-cut has been made along the side-hill, exposing a face of quartz for a width of over 60 feet. The main mass of quartz is well spattered with zinc-blende, while the balance contains bunches and bands up to 2 inches thick of solid zinc-blende, making the whole of a concentrating ratio of about 6 into 1.

No other mineral but zinc-sulphide was noted; consequently it would make an ideal ore for concentration. Similar quartz has been found in several places farther up the hill, but no work has been done to prove the continuity of the vein. It looks as if the open-cut was across the vein at right angles to the strike, or possibly a little diagonally, and if such is the case it is, without any exaggeration, the largest showing of zinc ore I have seen. A sample of heavy zinc-blende, taken to get the silver content, assayed 48 per cent. zinc and 0.6 oz. in silver to the ton. It is therefore a practically pure zinc ore.

This year 50 feet of tunnel was driven under the west side of the open-cut to obtain some depth on the quartz. At the time of my examination the tunnel had not encountered the quartz, and it looked as if a crosscut to the right might be necessary.

Some surface work was also done down the hill, proving the continuity of the vein in that direction. Operating conditions are ideal. There is plenty of timber, a splendid opportunity to open up the vein with tunnels, and possible transportation by tram-line to tide-water.

I am not sure of the claims in this group, but I think they are the *Supreme*, *Ingraham's Claims*. *Supreme No. 1*, and *Supreme No. 2*, owned by Ingraham, Morley, McPhee, and Saunders. At any rate, the showings examined are on the old Illiance River trail, about 200 yards below Copper creek, where Ingraham was camped. A short crosscut tunnel had been driven into a wide porphyritic dyke, striking N. 60° E. and about paralleling the river at this point. This work shows quartz and calcite seams running in

all directions in the country-rock. These, and especially the quartz veins, are fairly well mineralized with galena, and, in addition, there are patches of fine-grained galena occurring anywhere in the dyke.

A sample of the galena, taken to get the silver values, assayed a trace in gold and 11 oz. in silver to the ton, and 28 per cent. lead. Some work is warranted to find out whether the galena bunches and the quartz veins carrying galena occur with sufficient frequency to make the whole a milling-grade ore.

PORTLAND CANAL MINING DIVISION.

This Division includes the country north of Pearce island, in Portland inlet, on the east side of Portland canal (the west side is Alaska), to the summit of the range and north to Mount Brown. North of this point it takes in the upper part of the drainage-basin of the Nass river.

The northern portion, although over the Bear and Salmon river divides and on the Nass slope, is included, because it is at present more accessible by way of Stewart, where the Government Recording Office is located, and therefore much more convenient for recording, etc.

The town of Stewart, at the head of Portland canal, is the distributing centre for the Division. It is the most northerly seaport in the Province, and is therefore the natural outlet for an immense Interior country. Stewart has a weekly service by the Canadian National steamships from Vancouver and Prince Rupert; also has Government telegraph-office and radio service from Hyder, Alaska, 2 miles from Stewart, at the mouth of the Salmon river.

From Stewart one can go in any direction. Motor-cars go 8 miles up to Bitter creek. There is a good wagon-road up the Bear river 14 miles, with branch horse-trails up the main tributary creeks, and the main road continued as a first-class horse-trail up the Bear river, over the divide to Meziadin lake, a distance of 40 miles from Stewart. Any point down the canal can be reached by launch; to Maple Bay is a little over 30 miles; to Georgia river about 15 miles, with a Government trail up the river for about 5 miles; to Marmot river is 4 miles, with a good trail up to the heads of both forks. There is also a good motor-road from Stewart to the *Premier* mine. The first 2 miles is in British Columbia and connects with the Salmon River road at Hyder, Alaska, whence 13 miles of the road is in Alaska. The last 3 miles lie in British Columbia. A branch road from this is under construction by the British Columbia Government to the upper valley of the Salmon river. Very serviceable horse-trails have been built from the *Premier* road, one up to the divide on the Long Lake side, and another over the divide to the Nass slope, following up the Missouri ridge. The Division is therefore very accessible in all parts of the more prospected areas.

Another section that should be opened up is the Unuk River basin. All old reports indicate that there is a good prospecting country east of the granite about 20 miles from tide-water. A road was partially constructed fifteen or twenty years ago, but of course the bridges are now all out and a great part of the road overgrown. However, it would not be an expensive trail to build through, putting in wagon-road bridges. The first 20 miles from tide-water is through the Alaska strip and 2 or 3 miles farther on the Eastern Contact Mineral Belt is entered, which is therefore in British Columbia.

It seems to me that, under the circumstances, it is the Province of British Columbia which should take the initiative in connection with the opening-up of this section. An investment of \$25,000 might lead to as profitable returns to the Province as did a similar amount spent on the Salmon river to the same mineral-belt up the Salmon valley.

The policy of the Mines Department in assisting individual prospectors or small operators in getting started, with trails to their claims, on the recommendation of the Resident Mining Engineer, is working out to great advantage throughout the whole district.

I have this year experimented in this Division, with the commendation of the Mines Department, in building cheap "exploration trails" into unprospected mineral areas. Twenty-five miles of such trail was slashed out, down timber cut out, and foot-bridges thrown across the creeks, starting from the Bear-Nass trail north, up Surprise creek, and along the east slope of the range, at a total cost of \$2,025.

It was built by five prospectors, who, unfortunately, were late in getting started, on account of work being done on the Bear-Nass trail before pack-horses could be taken in to the starting-point, and consequently they had very little time to spend in prospecting as they went along. However, this makes accessible a big mineralized area which heretofore was practically impossible

to get to, and can now be advanced a few miles each year, making available for prospecting and development one of the greatest potential mineral-belts in the Province.

The writer made a trip through from Stewart to Alice Arm early in the year to gain some information regarding mineral and trail possibilities south of the Bear River pass. Altogether a distance of about 110 miles was covered, taking twelve days. A direct trail from the Bear-Nass trail, which goes to Meziadin lake south, along the east slope of the range, to connect with a branch of Kitsault trail up the Clearwater, would be between 35 and 40 miles. An elevation of between 2,500 and 3,000 feet was kept to avoid the impassable, dense growth of willows along the lower slopes. The disadvantage of this for a trail route would be in having to get down to an elevation of about 1,600 feet to cross the rivers, of which there are six in that distance, and then climb up on the opposite side. If a trail were built along the base of the hills at, say, 1,500 feet elevation, branch trails from 4 to 6 miles long would have to be built up each of the rivers heading in the range to get up to prospecting-ground.

The predominating rock formation is argillite, McConnell's Nass River formation, and presumably the extension north of Hanson's Kitsault River formation, overlying the Bear River greenstones. Along the eastern border of the granodiorite of the Coast range a belt of greenstones is exposed where not overlain by the glacier, which covers the crest along the full length of the range and dips down in the ravines and basins on the eastern slope.

The belt can be seen at the heads of all the rivers. Along its contact with the Nass argillites, the greenstone, being more or less impregnated with iron pyrites, can be easily distinguished by its reddish appearance. The copper-belt of the Kitsault valley may be the southern continuation of the pyritized belt.

Above the argillites, along the belt of greenstones, altered greenstones and altered argillites is the only favourable prospecting-ground. The most feasible and advantageous route to open up this belt for exploration is from Alice Arm by the extension north of the Clearwater trail. It is about 8 miles from where the Clearwater trail branches from the Kitsault trail to the South fork of White river, which flows into the Nass river.

The only property on the eastern slope on which any work has been done is the *Del Norte* at the head of Porter creek, the second creek south of Bear River pass.

A very thorough treatise on the "Geology and Ore Deposits of Salmon River District, British Columbia," by S. J. Schofield and G. Hanson, has recently been issued by the Geological Survey of Canada as Memoir 132. Accompanying the report is a very comprehensive geological map of that area. This report and map will be invaluable to examining engineers, prospectors, and operators.

Mining throughout the Division has been very active, and taking the Government office statistics, which is the best indicator, it will be noted that the number of free miners' certificates issued, number of claims recorded, and number of assessments done are far in excess of any of the past few years.

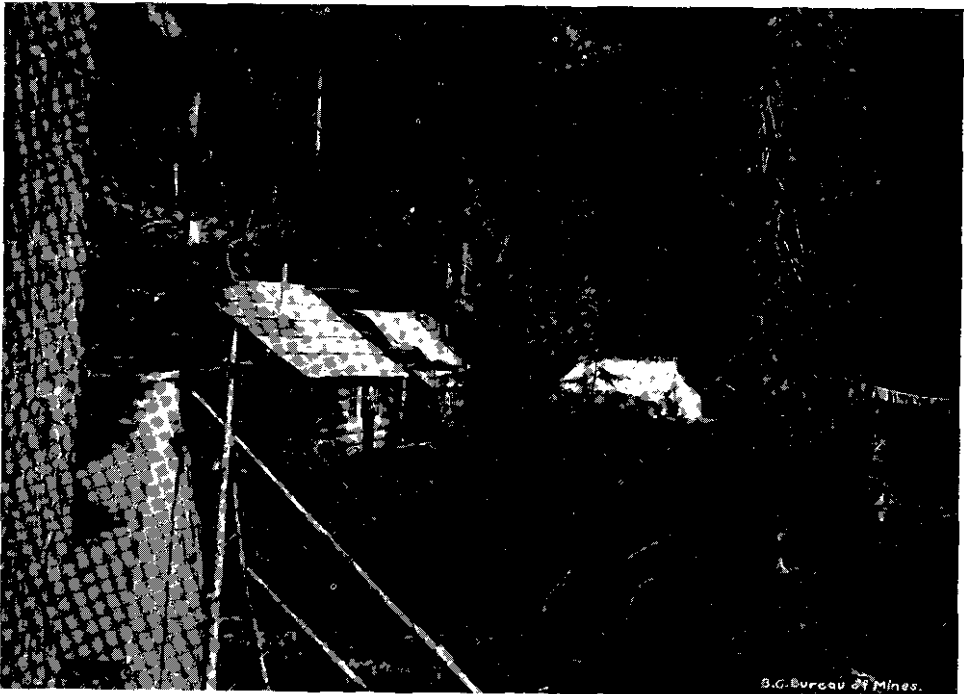
There were, of course, in this Division more prospectors in the field than in other parts of the district. While the number of claims staked indicate a great deal of prospecting in outlying areas, there has been a noticeable increase in the amount of prospecting and development work done on ground that has been staked for years. Altogether, in this Division alone, 619 claims were represented by assessment-work, which means a necessary expenditure of \$61,900 in actual work by individual claim-owners alone. Add to this the expenditures in development by individuals and companies, such as on the *Big Missouri* and *American*, the Indian Mines, the B.C. Silver, the *Silverado*, the *Prince John*, the *Mobile*, the *Outsider*, the *Dunwell*, and many smaller operators, and the aggregate outlay in exploration and development will probably be well over \$200,000 for the year. This will increase as the different properties develop and larger operations are undertaken.

This Division has this year the greatest output of any Division of the Province. The remarkable record of the Premier Gold Mining Company of paying \$2,750,000 dividends in one year on a capitalization of \$5,000,000, and a total to the end of 1922 of \$3,150,000, cannot help but lead to the extensive exploration of other showings in the same rock formation and under similar conditions for ore-deposits.

A very significant feature is the bonding of three copper properties in this Division by the Granby Consolidated, of Anyox—the *Outsider* at Maple Bay, the *Sunshine* group on Glacier creek, and the *George* copper-mines on Bear river. The successful development of the *George*



Big Missouri Workings, Portland Canal M.D.



Indian Mine Camp, Portland Canal M.D.

property would be of special importance to the Stewart country, as it would mean the operation of the Portland Canal Short Line Railway and its extension to Bear River pass, where the property is situated, thus putting a further distance of 6 miles along the Bear river on the railway and bringing all that country beyond the Bear River divide within range of transportation.

The Government dock at Stewart has been enlarged, but is still inadequate for the amount of freight and ore being handled.

PORTLAND CANAL (PROPER) SECTION.

This section consists of the country bordering Portland canal on the east, from its mouth just north of Pearce island to its head at Stewart, and is a portion of the Portland Canal Mining Division, with which it should not be confused.

Outsider Group. This group, consisting of eight claims, was briefly described in last year's report. The property was bonded this year by the Granby Consolidated and contracts let in the fall for raising and drifting, which will keep a crew of men employed throughout the winter. There is a small water-power development plant on the property, but this will be replaced in the spring by a plant suitable for production, and ore will be shipped to the smelter at Anyox early in the season. The ore is a pyritized quartz, carrying an average of possibly 2 per cent. copper, and will be utilized as a flux.

Maple Bay Groups.—There are several groups here, owned by the original stakers, W. Noble, of Stewart, and associates. About twenty-two claims constitute the holdings, which are amongst the oldest stakings in this Division. The showings were described in last year's report, page 59.

I have not examined this ground, but it is described as lying at the head of **Gloria Group.** Bull Dog creek, up the Georgia river. A specially limited company, called the Gloria Mining Company, Limited, was incorporated in November, with a capitalization of \$250,000, divided into 2,500 shares of \$100 par value. The registered office is in Vancouver.

This company at one time owned eight claims known as the *Guggenheim* group. **Georgia River Mining Co.** At present all surplus claims have been dropped and the company's holdings now consist of two claims. They are situated on the west bank of Georgia river, about 9 miles from its mouth, which is 17 miles down Portland canal from Stewart. About 5 miles of trail was built by the Government up the river from the canal. The workings are at an elevation of 3,450 feet.

A considerable amount of work had been done on this property previous to the last two years. The main working is a driftage of over 400 feet, known as the "Bullion tunnel," following a quartz vein from 4 to 12 inches wide, contained in an argillite country-rock. In this work the vein was encountered at 55 feet from the portal, and the ore was drifted on for a distance of 135 feet, varying from 4 to 12 inches in width of pyritized quartz, carrying gold values, and in places showing free gold. The ore-shoot was further proven by a raise of 35 feet through to the surface, in which some very high-grade gold ore was found. A little farther along a winze has been sunk 45 feet. The winze was started on about 10 inches of good ore, which was followed down for 22 feet, the quartz dipping out of the winze to the west at this point. A small stringer coming in from the east side was then followed down to 35 feet, where the winze was turned west, picked up the main quartz vein, which was about 24 inches wide here, and a further 7 feet was sunk on it. The vein at the bottom of the winze is a little over 2 feet wide, about half quartz and the balance pyrrhotite, the heavier sulphide assaying 2.28 oz. in gold and 3.7 oz. in silver to the ton. A grab sample of the dump, representing a more or less sorted ore from the workings on the vein, assayed \$47 in gold to the ton.

A crosscut at the face of the tunnel was driven west, toward the big vein, a distance of 35 feet. Neither the cut nor the last 200 feet in the tunnel show any values. To the west of the tunnel a big vein of quartz has been exposed on the surface by open-cuts. It outcrops at intervals for a distance of from 1,200 to 1,500 feet and varies in width from 10 to 20 feet. Its strike is N. 50° W. (mag.) and the small vein about N. 30° W. They should have intersected in the Bullion tunnel, but it was not apparent. However, a little crosscutting should pick up the big vein, on which a depth of 300 feet could be obtained with a little drifting.

There are a number of small rich veins, more or less paralleling each other, on the property, which would prove valuable "sweeteners" if a tonnage of milling-grade ore could be developed in the big vein. I think this property and vicinity worth some investigation.

Swamp Point.—The lime-quarries operated here for several years by the Granby Consolidated have been closed down.

MARMOT RIVER SECTION.

(See contour and mining property map of Salmon, Bear, and Marmot rivers accompanying this report.) This section takes in the area drained by the North and South forks of the Marmot river, which empties into the south side of Portland canal about 4 miles below Stewart, from which point it is reached by boat.

There is a fine pack-trail from the beach to the forks of the river about $2\frac{1}{2}$ miles, where there is a good cabin. The trail branches, following each fork of the river, on the South fork up to the foot of the glacier, a distance of 3 miles, and on the North fork up along the glacier for about 3 miles. The elevation at the foot of the South Fork glacier is 1,375 feet. The trail up the North fork has been rebuilt and has now a good grade up to an elevation of 4,000 feet. This area is therefore one of the most accessible in the Division. The mountains are very precipitous and at certain times of the winter there is danger from snowslides above the forks.

The Coast Range granites extend about 3 miles up from tide-water, or about to the forks; beyond this on the North fork and on the north side of the South fork, except for a narrow strip, is in the contact-zone. There are a number of small high-grade showings in this area and it looks as if several would develop into small profitable shippers. It would be a good leasing country. The majority of the claim-owners have been actively prospecting and developing them all summer, and, from reports, I think this section is very promising. A trail is needed from the upper side of the South Fork glacier to serve the claims located up Magee pass and on the mountain north of the pass. A serviceable trail could be put in for approximately \$500.

When the tonnage of shipping-ore justifies it, a good sleigh-road can without difficulty be built from the beach to the foot of the main glacier, a distance of 6 miles. North Fork ores could also then be brought down to the forks and hauled to the beach.

This group is owned by H. C. Magee, of Stewart, and Vancouver associates.

Patricia Group. and includes five mineral claims—*Patricia*, *Silver Link*, *Pat*, *Iron Mask*, and *Monarch*—situated about 4 miles from tide-water on the north side of the main or South branch of the river. It lies west of and adjoining the *Montana* group. There is a good pack-horse trail from the beach to the camp. At an elevation of 1,600 feet, or about 500 feet above the camp, a tunnel has been driven 80 feet in solid granite, following a small quartz-filled fissure from 6 to 12 inches wide. The quartz is mineralized with galena and pyrite, in places *solid sulphides*, in which the chief value is gold, the galena carrying small silver values. The best-grade ore is pyritized quartz, ranging up to \$90 all values, of which \$80 is in gold. The present face of the tunnel shows only the slip with a thin seam of barren quartz. Further work will be done in advancing the tunnel. The edge of the granite is about 500 feet north of this point, and it would seem reasonable to expect that the vein and mineralization would be continuous and probably improve in size and values as the contact is approached. The ore from this vein could probably be mined in a small way at a profit.

A cabin was built this year on the top of the bluff at an elevation of 2,600 feet, to be used while exploring the showings on the higher ground north of the granite-contact. The present trail is very steep, but by carefully cruising out a route and using short switch-backs a horse-trail could be put in from the main trail to the upper camp. The main geological feature of the higher ground is a *light-grey dyke*, about 30 feet wide, at an elevation of 3,200 to 4,200 feet, striking N. 65° E. (mag.) and dipping 61° N.W. into the hill. I judge this to be about paralleling the granite-contact, which is probably several hundred feet south of it. Some prospecting has been done along both walls of the dyke by open-cutting.

In McKechnie creek, at 3,200 feet elevation, a few shots have been put in on the lower or foot-wall side of the dyke, exposing a mineralization at this point for a width of 20 feet or more. The rock appears to be an altered greenstone, in which are small veinlets of quartz running in all directions, the whole well mineralized with pyrite, with which is associated some *chalcopyrite*. The average value would evidently be low. At a point 200 feet farther east, and probably 50 feet greater elevation, an open-cut has been put in, crossing 12 feet of well-pyritized quartz showing traces of copper and galena. The bottom of the cut looks fairly well and values

of \$4 a ton have been obtained from average samples. This width of 12 feet lies about 20 feet away from the dyke, but the extension of the cut will probably prove the mineralization up to it.

Farther east a belt of softer, broken-up material has been eroded, forming a deep, wide gulch, "Black canyon," cutting across the dyke down the steep mountain-side. There are several outcrops of mineralizations on the north side of the dyke in this canyon. On the west side of it an open-cut discloses a mineralized width of about 6 feet, in which there are three or four small veins of high-grade silver ore cutting across the mineralization and about 60° away from the strike of the dyke. The ground here is badly broken up and heavily oxidized. This showing is worth getting a little depth on to prove the high-grade veins. Across the canyon another open-cut shows a width of 10 to 12 feet of low-grade pyritized quartz.

Summarizing, it would appear from the number, extent, and mineralization of the croppings along both sides of the dyke, that some drifting along the dyke might encounter profitable ore-shoots. At any rate, it is very promising prospecting-ground.

There are seven claims in this group—*Montana, New Republic, Arizona, Montana Group. Comstock, Peach No. 1, Horseshoe, and Peach No. 2*—owned by G. W. Bruggy, of Alice Arm, and H. C. Magee, of Stewart. The claims lie along the north side of the South fork, above the toe of the glacier, and the croppings are at an elevation of 2,350 feet, or about 1,000 feet above the river. The general formation is granodiorite, but its eastern limit cannot be very far north.

The showing on this group consists of a rather flatly lying quartz vein up to 6 feet in width, filling a fissure in the granite. The quartz is mineralized in short lenses with galena and zinc-blende, with which is associated grey-copper carrying high silver values. The vein strikes N. 40° E. and dips at 25° north-west into the hill.

A crosscut tunnel has been driven from the face of the mountain, 60 feet, to the vein whose outcrop is about 20 feet above the mouth of the tunnel and traceable from 1,000 feet or more. Two drifts have been run on the vein from the tunnel on 10 feet south-west and another over 50 feet north-east, and a winze sunk on the vein for 30 feet. Several tons of ore assaying 400 oz. in silver was shipped from this work in the early days. The ore was sorted and sacked at the tunnel and let down on a wire to the valley below and from there rawhided to the beach. The tunnel is reached from the river by climbing straight up the bed of a small creek, if one manages to dodge all the pebbles and boulders coming down from thousands of feet above. A safe switch-back trail could be put in without difficulty and would be a valuable asset to the property.

On the *Horseshoe* claim there are several exposures on the east end of the mountain above the glacier, but only a small amount of work has been done here. The ground on this group north of the granite should be well worth close prospecting. Altogether it is a promising property.

This group, owned by Geo. Bunn, has three claims in it—*Engineer No. 1, Engineer Group. Engineer No. 2, and a fraction (name unknown)*. They are situated just above the east end of the Marmot glacier, about 7 miles from tide-water. Some further work was done this year by the owner (*see last year's Report*), who reports results very satisfactory.

Washington Group.—(*See last year's Report.*) The owner, R. E. Lundvall, was continuing work in the tunnel all summer, as well as surface prospecting.

Prince George Group.—(*See last year's Report.*) Assessment-work was done for the owners by R. E. Lundvall.

This group is owned by Clay Porter and George Mehlfield, of Hyder, Alaska, and two associates, J. McCallum and Lee Levine, the two latter each owning half a claim. There are eight claims in the group—*Prickly Heat, Gem of the Mountain, Lucille, Never Sweat, Perseverance, Slide, Sunday, and Nettie L.*—situated about 4 miles up the North fork of the Marmot river, on the west side of the glacier, and about 1,000 feet above it at 4,000 feet elevation. The Government trail has been extended along the east side of the glacier to a point nearly opposite the claim. Ore can be sledged across the glacier and packed to the beach or to the forks and taken from there to the beach on sleds or rawhide in winter.

The work on the property consists of a tunnel at an elevation of 4,000 feet. The first 80 feet follows an oxidized vein in which are small kidneys of galena carrying high-grade silver values. The first 40 feet of this tunnel had to be timbered. This encounters the main vein at that point, which was then drifted on to the right. The vein strikes N. 60° E. (mag.) and dips 45° into

the hill. It consists of siliceous material about 2 feet wide in andesitic schist, in which were about 6 inches of high-grade ore, assaying up to 2,000 oz. in silver to the ton in picked samples. I am informed that this drift was continued this year, distance unknown, through a soft vein-filling, necessitating timbering into a shoot of fine ore. I regret that I was unable to get to the property this year.

North Fork Basin Group.—Owned by Wm. Fraser and associates. No high-grade ore was shipped this year, though the trail has been put in good shape.

BEAR RIVER SECTION.

This section includes the Bear River valley and all its tributary streams from tide-water at Stewart to Meziadin lake in the Nass valley. The section suffered from a mining boom during 1910-11, lay dormant for the next six or seven years, and has since been fighting its way back to recognition as a mineralized area with great possibilities. It takes a long time for a district to recover from a closed season on "wild-catters" and an irresponsible newspaper advertising a "mountain of gold."

Last year one property, the *Silverado*, was operating on Bear river, and at the end of 1921 there were five that were continuing work through the winter—namely, *Dunwell*, *Prince John*, *Mobile*, *Mimico*, and *Sunshine*. The bonding of the *George* group on Bear river and the *Sunshine* group on Glacier by the Granby Consolidated Company may have a far-reaching effect toward the revival of interest in this section.

It so happens that the break in the Coast range occupied by Portland canal and its two big tributary valleys, the Salmon and Bear rivers, throws a portion of the Eastern Contact Belt, of about 20 miles in length, on to Pacific waters. There are about 60 miles of this same belt, lying north of the break on the interior or eastern slope of the range, which are only accessible by way of the Bear River valley. It was toward opening up this area that the Mines Department built 25 miles of "exploration trails" north from the Bear River pass this year. The extension of this trail to the north-west along the eastern slope will gradually bear towards the granite-contact.

The Portland Canal Short Line Railway, built by Sir Donald Mann in 1910-11, extends from Stewart to the *Red Cliff* mine, 14 miles up the Bear River valley. There is also a fair wagon-road covering the same distance, but there are several places where it is practically useless as a road, and which should be rebuilt at as early a date as possible to ensure transportation to the upper valley. From the end of the railway and wagon-road a first-class pack-trail was built in the early days through to the Groundhog coalfields. This trail was put in good repair this year as far as Meziadin lake. It was realized when the railway was constructed that this valley, with its low divide at the head of Bear river, is the logical outlet to tide-water for all the interior part of the Province lying east of the Alaska strip, and no doubt will some day be utilized for that purpose.

For geological data the reader is referred to Memoir No. 32, by R. G. McConnell, published by and obtainable from the Geological Survey, Ottawa.

This group, staked and owned by John Haahti and J. W. Stewart, of Stewart, **Silverado Group.** comprises the following claims: *Silverado Nos. 1, 2, and 3*, *Silver Bell No. 4*, and *Rainier Bluff Fraction*. They are situated on the east side of the mouth of the Bear river, just south of the glacier opposite the town of Stewart, at an elevation of about 4,000 feet. The property was acquired by J. J. Coughlan, of Vancouver, in August, 1920, and work commenced on it the following month. An aerial tramway was put in from the tunnel part way down the hill and camps established near the workings.

The showings consist of a flat vein ranging from 6 to 18 inches, outcropping along the bluff for 200 feet, in a grey andesitic country-rock. The vein gangue is quartz uniformly well mineralized with grey-copper and pyrite, the former predominating, and averaging better than 125 oz. in silver to the ton. The pure grey-copper assays up to 1,000 oz. to the ton. The tunnel was in about 30 feet when the property was bonded. The company worked the property up to June of this year, when it was closed down and held until the expiration of the option on December 1st, when it reverted to the owners.

After the installation of the tramway, the erection of camps, and other outside work completed, mining-work was started on the extension of the tunnel in January of this year. From then until June 100 feet of driving had been done, the vein pinching to a few inches in

the face. This was a feeble attempt at developing a property and is just another case of "too much overhead expense."

I am informed that the property has been again bonded to Seattle interests and a contract let for 100 feet of drivage in the tunnel. Later information is that the vein is now about 2 feet wide in the face and well mineralized with grey-copper.

There are five claims in the group—the *Automobile Nos. 1 and 2, Alice, Leah, Mobile Group,* and *Maybe*—situated just south of the old Portland Canal Mining Company's ground, at an elevation of about 3,700 feet. The property was bonded in October of this year by Montreal interests, and a company called the Mobile Mines, Limited, incorporated for 700,000 shares at \$1 par value, registered office at Stewart. R. L. Clothier is managing director and in charge of operations at the mine.

Since the organization of the company the old trail to the Portland Canal mine was put in repair and extended about a mile to the Mobile workings. Camps were constructed and underground development started about the first of December. About 40 feet had been driven up to the end of the year, following the vein, which, so far, is replaced by oxidized material. Several cuts above the tunnel on the surface show an oxidized width of 6 feet, in which are ribs of quartz carrying high values in silver, as argentite and ruby-silver.

The country-rock is argillite of McConnell's Bitter Creek formation. The vein is a bedded one, in most part conforming with the strike and dip of the bedded-planes of the country-rock, but in places follows a cross-shear to a different plane, or possibly the original plane faulted. An average composite sample from several surface cuts of from 4 to 10 inches of ore assayed 314 oz. in silver to the ton.

If the ore exposed in the cuts on the surface makes into shoots underground, this should make a profitable little property with careful management.

This group originally consisted of the *Bayview No. 1* and *Bayview No. 2* **Bayview Group.** mineral claims, owned by Geo. Cameron and W. A. Cameron, of Stewart. Two years ago the Bayview Syndicate acquired the property, added ten or eleven more claims to their holdings, had a trail built from the Bear River bridge to the camp, did a little unimportant development-work, and then quit. The only creditable work done was the trail cruised and built by Geo. Cameron over a very difficult piece of country. I am not sure just what claims are now included in the group.

The rock formation from the Bear river to the camp-site, at an elevation of 3,400 feet, is the granodiorite of the Coast range, which here takes a bend westward to the Alaska-British Columbia boundary-line. North of this is a belt of metamorphosed sedimentary rocks. The showings on the claims are two quartz veins, one on the contact of the granite and sedimentaries, and the other vein, several hundred feet north, occupying a shear-zone in the altered sedimentaries.

The contact-vein, which is the smaller, strikes N. 30° E. and dips N. 65° W., apparently away from the granite. It crops in a few places for a distance of 300 to 400 feet and has been broken into with a few 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, and galena, with some grey-copper carrying high silver values. Though little work has been done on this vein, its surface appearance does not look encouraging, the ore apparently occurring in small short lenses. A crosscut tunnel at an elevation of 3,700 feet was driven 100 feet to get under one of the surface showings at a depth of about 80 feet. No mineralization was found in the tunnel; no drifting was done on the contact.

The upper vein is the important showing on the property and here should have been the 100 feet of development-work expended on the lower vein. From what can be seen on the surface, I judge it to be a shear-zone in the schistose country-rock, in which are long lenticular bodies of quartz, with sulphides of iron, lead, and zinc mixed with country-rock. The mineralization in places along the surface shows a foot of galena with grey-copper, which, when picked into, assayed up to 300 oz. in silver to the ton, accompanied, as well, by mixed sulphides carrying good values in silver. The vein lies 600 or 700 feet westerly from the small vein and could best be attacked by a crosscut tunnel from a bench about 200 feet below the croppings, which are at 4,500 feet elevation. I would suggest extensive surface exploration along the vein to ascertain the most promising showing to crosscut to from below. No appreciable depth can be obtained along the outcrops except by sinking. The strike of this vein is N. 30° W. and therefore converges with the granite-contact, going south.

Altogether this is a property on which it is worth doing some exploratory work. It is well located for mining, well timbered on the lower claims, with available water-power, and, in the event of developing into a shipper, could be equipped with an aerial tramway to tide-water at Stewart.

**Prince John
Group.**

This property is owned by James Nesbitt and Andy Archie, of Stewart, and is now under bond to C. A. MacKenzie, of Victoria. The group comprises nine claims—*Prince John No. 1* to *Prince John No. 9*, inclusive—and is situated on the west side of Bear river, about 5 miles from Stewart. Work on the property was delayed somewhat by trail conditions. However, a grant from the Mines Department constructed a trail to the foot of the hill below the claims.

A lower crosscut tunnel was started late in the fall, and at the end of the year had been driven about 200 feet toward getting under the ore-body exposed in the upper crosscut tunnel. (See 1920 Report.) It is reported that a small ledge was cut in this work, about 4 feet wide, assaying about \$8 in gold, silver, and copper values. This is rather encouraging.

The main ore-body should be cut early in the spring. This work is of great local interest, for the property is so favourably situated for a shipping-mine that it would be of great benefit to all, and it is to be hoped that the results will bear out expectations.

**Red Bluff
Group.**

This group is situated north of and adjoining the *Prince John* group and is owned by Nesbitt, Archie & Irwin. At present the property is also under bond to C. A. MacKenzie. Some work was done on these claims after my trip in the fall. Mr. MacKenzie reports that the findings through this work were very satisfactory and he is very optimistic of the property's further development.

M.C. Group.

There are three mineral claims in this group instead of six, as stated in error in last year's report. I regret that this occurred, for I should have looked up the records myself instead of accepting information from others. The three claims are *M.C. No. 1*, *M.C. No. 2*, and *Briton*, of which C. A. MacKenzie is the recorded owner. Circumstances appear to be against my seeing this property. However, the following is taken from Mr. MacKenzie's report to his associates:—

The *M.C.* and *M.C. No. 1* are located on the top of Bear River mountain, the western part of the property descending the slope on the Salmon River side towards the *Premier* mine and on the eastern side covering the slope for some distance on the Bear River side. The *Briton* lies lower again on the eastern slope. The vein-matter, crossing the property and carrying values, is highly silicified and cuts into the mountain from east to west, with a dip of about 60° to the south.

On the southern part of the *M.C. No. 1* a strong quartz vein has been opened, cutting through, from east to west, the greenstone or quartz porphyry. This carries copper-glance, bornite, and malachite, with assays high in value. On the northern end of the *M.C. No. 1* a lens of ore has been struck which in its character seems similar to that of the *Premier* on the Salmon river. The ore is sulphides of gold, silver, lead, and zinc, carrying good values. The vein is strong and has been opened up to some 20 feet in depth and 40 feet in length, where it is over 3 feet wide in ore. This is on the Salmon River side overlooking the *Premier*, from where test-pits show that the vein crosses the crown of the mountain and down the east slope for 450 feet to a point 109 feet lower than the opening on the Salmon River side.

Mr. MacKenzie draws attention to the cross-fractures and their possibilities for ore where intersecting the east-west veins, and altogether has a very interesting report.

Aztec Group.

There are four claims in this group—*Tillamook* and *Wallaby*, owned by Geo. 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 Bitter creek, and extend from the river to the top of the mountain. The country-rock is greenstone, McConnell's Bear River formation.

There are two veins—the "iron vein" and the "copper vein." The former 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 a little chalcopyrite. An average sample across the vein assayed \$4.80 in gold and 0.8 oz. in silver to the ton, and 1.37 per cent. copper. There are 3 or 4 inches on the hanging-wall of a better grade of copper, assaying \$5.20 in gold and 1.4 oz. in silver to the ton, and 2.7 per cent. copper. The vein has been cut farther down the hill and shows the same heavy pyritic content.

The copper vein crops higher up the mountain, 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. There are several outcrops, from 2,600 to 3,850 feet elevation, showing the vein to vary from 2 to 12 feet in width, and contain, in places, 2 feet of 13-per-cent. copper ore. No drifting has been done on the vein, but, judging from the exposures made on the surface, I think the vein warrants some underground exploration.

With the railway in operation, the situation of the property is such that a comparatively low-grade ore could be shipped to the Granby Company at a profit.

(See Reports, 1919 and 1921.) This group is situated up Goose creek, on the Bear River slope of the mountain, and consists of six claims owned by Sam and Jack Fitzgerald, of Stewart. There are two or three veins on this property

which have had considerable work done on them in the way of open-cuts, short tunnels, and surface strippings. The work has exposed some very promising showings of ore of medium values, contained in an andesitic rock formation. I believe a contract was let for the extension of the tunnel 100 feet this winter, but no information is available as to the results of this work. I would recommend the property for a careful examination.

There are four claims in this group—*Mountain Boy*, *American Girl*, *Northern Belle*, and *Hard Money*—situated on the west side of American creek, about 5 miles from the end of the railway and wagon-road at the *Red Cliff*. The

property is Crown-granted and is owned by John Conway, of Anyox, and associates. The following description of the property was given in the 1919 Minister of Mines' Report, since when no work has been done.

The general rock formation is a reddish-coloured, medium-grained, sometimes porphyritic rock, probably a red andesite. The hills on both sides of the valley are high and very abrupt, resulting in talus-banks on both sides along the base of the cliffs to a height of from 800 to 1,200 feet above the valley.

The tunnel is at 2,000 feet elevation, just above the edge of the slide-rock and 1,200 feet above the camp, which is located on a small wooded "island" in the middle of the valley, which is here over half a mile wide. There is a switch-back trail, now overgrown with willows, from the camp to the tunnel.

The vein is well defined on the surface, from 16 to 18 feet wide, and consists of quartz and calcite, heavily mineralized with sphalerite, with which is associated a little galena. It occupies a shear or fractured zone in the andesitic country-rock.

At the portal of the tunnel (see sketch) the strike of the ore is S. 50° W. (mag.) and dips from 50° to 60° to the south. The tunnel has a bearing of S. 80° W. for the first 45 feet and consequently runs out of the vein into the hanging-wall about 30 feet in from the portal. It was then turned back again and enters the vein about 60 feet beyond, or 90 feet from the portal. At this point a crosscut 28 feet long was run through the ore.

A peculiar feature is shown in the tunnel, where numerous intrusives cut the vein and formation, leaving open crevices running in all directions, which, however, do not appear to interfere with the continuity or contents of the vein in any way. At a point 27 feet in the tunnel a winze was sunk 25 or 30 feet in ore. There was no water in it, but the ladders were unsafe and I did not explore it, and I did not have time to do any sampling. The vein is certainly big, well defined, and well mineralized. An immense tonnage could be developed if the ore was found to be of milling grade.

This group is situated about 1,000 feet above Bear river, on its eastern slope, between Glacier and Bitter creeks. The four claims comprising the group are *Mayflower*, *Kitty*, *Trade Dollar*, and *Blaine*, owned by H. P. Gibson, of Stewart. A few tons of ore assaying \$60 a ton in gold values was shipped

some years ago. This ore was obtained from a small vein of brecciated quartz and argillite lying in the Bitter Creek formation and showing that these veins contain good gold values. Higher up the hill some work has been done in stripping and open-cutting on three or four similar veins, a crosscut tunnel has been driven 20 feet, and a drift of 6 feet driven on the vein, as yet not finding important values. There is a fair surface showing in a 4-foot vein of quartz and argillite about 40 feet beyond the face of the drift. Because of the heavy overburden, drifting on the vein seems the best possible means of exploration.

This company was incorporated in April, 1922, and is a specially limited Dunwell Mines, reorganization of the Nass River Lands, Limited, incorporated in April, 1913.

Ltd. The capitalization of the Dunwell Mines, Limited, is 350,000 shares of \$1 each par value, and its registered office is at Victoria. The group consists of *Dunwell, Dunwell No. 2, Dunwell No. 3, and Dunwell No. 4* mineral claims, situated about 2 miles up the west side of Glacier creek from the Bear River road, the trail branching off from the road just north of Glacier Creek bridge. The original owners were J. W. Stewart and associates.

I found that a very considerable amount of well-advised work had been done on this property since my examination last year. This consists of a comfortable camp, suitable for eight to twelve men; a good stable; a first-class winter trail to the camp from the Bear River road, a distance of about 2 miles; and two tunnels, the upper one about 145 feet in length and the lower one recently started and now in about 25 feet, at the mouth of which a good blacksmith-shop has been built. Everything is therefore in good shape to carry on the work outlined throughout the winter.

The general rock formation is argillite, termed by McConnell the "Bitter Creek formation." The vein of brecciated quartz and country-rock fills a well-defined fissure in this formation, striking S. 75° E. into the hill and dipping flatly at from 40° to 45° to the south. It has been well exposed on the surface for a distance of about 300 feet by ground-slucing and three open-cuts have been put in at intervals along the thus exposed vein. The upper of these cuts shows the vein to be about 6 feet in width, of which 4 feet on the foot-wall consists chiefly of quartz heavily mineralized with pyrite, galena, and zinc-blende; the remaining 2 feet on the hanging-wall contains a larger proportion of argillite and is also well mineralized. The strike of the vein in this open-cut is S. 20° E. and would therefore appear to be a cross-fissure meeting the main vein, but I think it is only a bend in the vein exaggerated by the contour of the surface at this point and the flat dip of the vein.

The main work done this summer is a tunnel driven about 145 feet along the vein, obtaining a depth of about 50 feet on the dip of the vein at the face of the tunnel. On account of the shallow ground above, the tunnel has been timbered for a considerable distance from the collar and the vein does not show until about 50 feet in. At this point a small mineralized vein, striking approximately N. 20° W., meets, and probably crosses, the main fissure and evidently is the cause of a short shoot of high-grade ore in the main vein for about 15 feet. This high-grade shoot gradually pinched down until it disappeared. Beyond this, for a distance of about 35 feet, there are stringers and bunches of ore in a vein width of from 4 to 6 feet, the whole making a low-grade ore. From that to the face of the tunnel there is little mineralization. The vein as exposed in the tunnel conforms very closely with surface conditions, and it is evident that this work has not yet reached the ore showing in the upper cut on the surface. It is estimated that it will require about 25 feet further work to accomplish this, and I would strongly advise that this be done at once, as it may have an important bearing on subsequent work.

The enriched ore-shoot where the small north-south vein meets the main vein is a very significant and encouraging feature, as it is known that farther west, there is a series of at least three strong, well-defined, north-south veins on the property. •It is very reasonable to expect that where they meet or cross the main *Dunwell* vein there will be found more important ore-bodies.

Another tunnel has been recently started and driven about 25 feet, which will give an additional vertical depth of about 150 feet below the upper tunnel. The vein has already been encountered in this tunnel, but does not carry appreciable values at this point. A good blacksmith-shop has been built at the mouth of the tunnel and I understand that this work will be pushed all winter. Though no surveys have been made, it seems possible that this tunnel may encounter the most easterly of the series of north-south veins mentioned above. If not, I think it very important that the *Dunwell* vein be traced down the hill by means of open-cuts a sufficient distance to be certain that a tunnel started from that point will intersect at least one of the important north-south veins. This, in my opinion, is the quickest and surest way of proving the worth of the property. If a profitable ore-body can be so exposed, the property can then be best exploited by the continuation of the deeper tunnel on one of the north-south veins.

Lakeview This group consists of four mineral claims—*Lakeview Nos. 1, 2, and 3* and *Silver Bell Fraction*—owned by James McKay and Charles Bihean, of Stewart.

Group. The claims are situated on the north bank of Glacier creek, about 2½ miles by good horse-trail from the Bear River wagon-road. There is a good camp suitable for eight to ten men on the property close to the workings at an elevation of 2,100 feet.

This is one of the old locations in this section and considerable work has been done, the owners having shipped several tons of high-grade silver ore in the past few years.

The first work on the claims was an open-cut across the full width of the vein, obtaining a depth of about 12 feet and showing it to be at this point 9 feet in width. The vein is quartz lying in the argillite country-rock, the hanging-wall consisting of a light grey dyke about 4 feet wide; the footwall is of country-rock.

The quartz gangue is heavily pyritized, especially on the hanging-wall, for a width of 5 feet, the remaining 4 feet on the foot-wall showing less mineralization. The whole would concentrate about 7 or 8 into 1. The vein strikes about east and west and dips to the south 50°, and can be traced on the surface for several hundred feet.

From the surface crosscut a drift was run west for 28 feet, following a small vein of high-grade silver ore, which was sorted and made up the shipments set out. A crosscut tunnel was then started at a point 100 feet vertically lower than the surface exposure, and driven 250 feet without encountering the vein, which should have been cut in the tunnel if its strike and dip as indicated on the surface had persisted. Later a crosscut was driven west from a point 200 feet in the tunnel and at 50 feet picked up the vein, which is as strong and carries about the same mineralization as on the surface. Drifting and raising on the vein, however, proved the values to be very low and disappointing, and no further work was done from this level.

Some work was done on a small high-grade quartz vein showing on the surface north of and paralleling the big vein. A few tons of ore had been mined and shipped from this vein. A 10-foot open-cut was made along this vein and continued as a tunnel for 25 feet, and later a shaft sunk 57 feet on the vein from the open-cut, where some fine ore had been found. The values proved very satisfactory for a depth of 25 to 30 feet, below which they gradually diminished and became very erratic. No work was done on the property this year and the above is about its condition at present.

Fair average values and patches assaying high in gold values were obtained from the big vein on the surface. This, with the fact that good values were found to a depth of 30 feet on the north vein, might warrant the further exploration of both veins, depending, of course, on the terms on which the property can be acquired.

This property is situated on the North fork of Glacier creek, about 4 miles from the Bear River wagon-road at Glacier Creek bridge. There are four claims in the group—*Ruth*, *Francis*, *Copper King*, and *Little Johnny*—owned by James Nesbitt and Andy Archie, of Stewart. There is a small cabin at the workings at 3,440 feet elevation, to which there is a good trail from the wagon-road, the extension of the *Dunwell-Lakeview* trail.

On the *Ruth* claim a tunnel has been driven 60 feet, the first 30 feet following the hanging-wall of the vein, following a small seam of ore on a bearing of N. 40° E.; the balance of the drivage to the face following the foot-wall on a bearing of N. 10° E. The country-rock is argillite and the vein a pyritized breccia of quartz and slate.

At 30 feet in the tunnel, where the turn to the left is made, there is a face 6 feet wide of solid antimonial lead on the right, an average chipped sample of which assayed 40 cents in gold and 31.6 oz. in silver to the ton; lead, 15 per cent.; zinc, 18 per cent.; antimony, 8.3 per cent. No drifting has been done on this to prove its extent.

About 200 feet south and 60 feet vertically lower another tunnel has been driven 25 feet, presumably on the same vein, showing a width of 6 feet of mixed quartz and slate, showing a little pyrite and galena. A small open-cut has been put in on a cross-vein, striking N. 60° W., about 25 feet south of the mouth of the long tunnel. It exposes 4 feet in width of typical quartz and slate carrying low values. About 15 feet east of the main tunnel a parallel vein of quartz and slate outcrops in the bed of the creek. Nothing has been done on it.

On the *Copper King* claim a 40-foot tunnel has been run toward getting under a quartz-calcite vein mineralized with chalcopyrite. I did not see this, but some good samples were shown from it.

Some work should be done on the antimonial lead to find out whether it is worth while, or only a bulge in the vein along the hanging-wall.

This group, consisting of two claims—*Sunshine* and *Sunshine No. 1*, and possibly another claim—has been bonded to the Granby Consolidated Company by the owners, Fred Young and Godfrey Anderson, of Stewart. The property

was described in 1919 Minister of Mines' Report. A contract was let for driving a crosscut tunnel below the cabin, and which would therefore obtain considerable depth on the vein under the open-cut, where 3 feet of fine chalcopryite ore was exposed. It is reported that a 3-foot vein of good ore was crossed in this tunnel, and that the main vein has been encountered and proved very satisfactory. Work is being continued in drifting on these showings.

This group of three claims—*L. and L. Nos. 1 and 2* and *Marion Fraction*—is **L. and L. Group.** situated on the North fork of the middle fork of Glacier creek, just across the glacier from the *Sunshine* group. It is impossible to cross the glacier, and is therefore reached by an entirely different trail starting from above the Portland Canal Mining Company's concentrator. The claims were owned by the late Jack Lockwood, and now under the administration of the executor, John Hovland, of Hyder, Alaska. This property is, in part, the old *Katherine* claim, from which a ton of ore was sorted and shipped in 1913. The assay returns of this gave 273.5 oz. in silver to the ton, 22.1 per cent. lead, 11.5 per cent. zinc, 21.5 per cent. silica, and 11.4 per cent. iron.

There has been a lot of work done on the claims in stripping, open-cutting, and a tunnel driven to obtain depth below the open-cuts. The vein so exposed consists of quartz heavily mineralized with zinc-blende and arsenical iron in about equal proportions, with an additional small percentage of galena and grey-copper, the latter no doubt carrying the high silver values. The vein is contained in a mass of augite porphyrite about $1\frac{1}{2}$ by 2 miles in area.

From the portal of the tunnel the surface is free of overburden for 100 feet or more and the vein can be traced without difficulty for that length. The first 30 feet shows some ore and is probably that followed in from the portal of the tunnel; the next 60 or 70 feet shows no ore on the surface, and a corresponding barren distance is found in the tunnel. From this point up the hill are four open-cuts along the vein. The lowest one exposes 10 feet along the vein, showing it to be from 12 to 18 inches wide, of good-grade ore. The next cut, 25 feet vertically higher, exposes 40 feet along the vein, which is from 12 to 24 inches wide at the lower end, increasing to 5 or 6 feet at the upper end of the cut, where a cross-vein joins the main vein at a small angle. At this point it is about 100 feet vertically above the tunnel-level. The next cut, about 250 feet on the surface from the portal of the tunnel, exposes a mineralization of about 8 feet in width, of which 3 feet is good-looking ore and the rest slightly mineralized, silicified country-rock.

The top cut, about 25 feet vertically above the last, shows the vein to be 5 feet wide, of which 2 feet is solid sulphides. This is about 300 feet from the tunnel portal and approximately 150 feet vertically higher. There is therefore about 200 feet of what is evidently a continuous ore-shoot exposed on the surface. In the tunnel there is a narrow shoot of ore for 40 feet in length, and from there to the face, 85 feet, no ore is showing, though small veins of slightly mineralized quartz are now appearing.

Allowing a small rake of the ore-shoot into the hill, and therefore away from the tunnel, as indicated by the small ore-shoot at the mouth, the length of the tunnel, 125 feet, is just about sufficient to reach the ore. Conditions in the faces are indicative of the proximity of the ore-shoot and is just at the point where in a few feet farther there is a good chance of opening up a profitable body of ore. Assuming, from surface indications, that the ore-shoot is 150 feet in length, an average of 125 feet above the tunnel of stoping-ground, and a foot of ore in width, would yield about 1,500 tons of ore, which at, say, \$100 a ton would run into substantial figures.

On account of the zinc itself, and which also carries grey-copper, the sorting of the ore might prove a serious drawback. However, it is worth investigation. Transportation would consist of 5 miles of horse-packing to the wagon-road and a 5-mile haul from there to the dock at Stewart. I understand that very reasonable terms are offered for lease or purchase.

These claims are owned by W. W. Rush, of Stewart, and are situated on the South fork of the middle fork of Glacier creek, about a mile from the forks of the trail to the *Ben Bolt* and about $4\frac{1}{2}$ miles from the wagon-road at the Portland Canal concentrator. They are old locations and some few tons of high-grade ore was shipped from them in the early days of the camp. They lie in the augite-porphyrity area. The main working is a tunnel driven over 100 feet under a shoot exposed by a 30-foot open-cut on the surface, and from which high-grade ore was shipped. The vein is a siliceous rock, striking N. 30° E., and stands perpendicularly. There is a band of siderite on each wall containing what mineralization there is of antimony, zinc sulphide, and occasionally

a little grey-copper. No ore of importance has been found in the tunnel. On the *Columbia*, on the opposite slope across the creek, the same vein and conditions are found.

These claims are owned by W. W. Rush and partner, Arthur Boggs, and are two of the oldest locations in this district. They are situated high up on the ridge at an elevation of 4,000 to 4,500 feet on the south side of the South fork of Glacier creek. The general rock formation is volcanic, probably lying within the southern rim of the augite-porphry mass. My description of the showings contained in 1919 Report is as follows: There are on the claims several veins of a light-grey siliceous rock, with a general strike of from N. 5° E. (mag.) to N. 20° E. (mag.), throughout which are small veinlets of stibnite, sphalerite, and tetrahedrite, while along the wall is generally from 4 to 12 inches of siderite and quartz carrying high-grade silver values in grey-copper, some galena, and considerable zinc.

What has the appearance of being the main shear-zone strikes N. 20° E. and dips about 50° to the north-west. This vein is up to 6 feet in width, with a streak of high-grade ore in it of from 4 to 12 inches wide, the balance with veinlets of sulphides throughout it, but probably not of milling grade.

The main vein has been open-cut in several places and a great deal of stripping and trenching has been done, showing in one place, for a length of fifty feet, ore that can be sorted to a shipping grade. The high-grade ore seems to lie in numerous small kidneys or lenses in the vein-filling rather than in a continuous shoot. Some further depth can be obtained under this showing, but any considerable depth would necessitate a long tunnel or sinking. There are also at least two almost parallel veins striking about N. 30° E. uphill, and therefore converging toward the main vein, and also dipping slightly toward it. One of these "spur veins" looks promising where stripped for 30 or 40 feet. Under this a tunnel has been run 10 feet along the hanging-wall, gaining a depth of about 30 feet. The high-grade ore, from 4 to 12 inches wide, is on the foot-wall and has been left standing until such time as transportation has been provided, when it can be easily mined. This vein can also be opened up on the opposite side of the gulch where its cropping can be seen. This tunnel has now been extended by Mr. Rush to a length of 40 feet, with the high grade of about a foot wide persisting all the way. With transportation, in the shape of a good pack-trail that could be used for rawhiding in the winter, this property should become a profitable small producer.

This group is comprised of four claims—*Mimico*, *Mimico No. 2*, *Riveteer*, and

Mimico Group. *Second Relief*—owned by H. O. McClymont, of Stewart, and A. Aldridge.

The claims are situated on the South fork of Glacier, about 1½ miles up the *Ben Bolt* trail from the Portland Canal concentrator. The cabin, built this fall, is just beside the trail. An open-cut across the trail, about 20 feet long, exposes a vein of quartz of from 4 to 12 inches in width, lying in argillite country-rock. In places the vein is solid sulphides of iron, lead, and zinc a foot wide. The owner informed me that the best galena assays \$190 in silver and lead, of which the silver values are about \$100. The vein strikes S. 20° W. into the hill and dips 60° W.

At a vertical depth of 35 feet below the surface exposure a tunnel had been driven 70 feet at the time of my examination and a crosscut driven to the right for 12 feet. Unless the vein takes a greater dip below the surface the tunnel and crosscut should have struck the vein. I am informed that later work in the continuation of the crosscut encountered the vein, and that it looked so encouraging that the cabin was built and Mr. McClymont is continuing the work all winter. It is a fine little showing of shipping-grade ore and should be made to show a good profit if operated in a small way, eliminating overhead expenses.

This group is comprised of seven claims—*Rufus*, *Rufus No. 1* to *No. 6*,

Rufus Group. inclusive—owned by Ben Erickson and associates. The claims are situated south of Erickson creek, on the north slope of Bear river, about 4 miles from the end of the wagon-road and railway at the *Red Cliff* mine. The main Bear-Nass trail is across the river from the foot of the hill on which the claims are located. From the river camp up to the tent camp on the claims is a climb of about 2,600 feet over a foot-trail of the *Vetron-Comet* type.

The general rock formation is the greenstone of McConnell's Bear River formation. Contained in this are wide zones of altered and silicified country-rock having a general north-westerly trend. These are more or less mineralized with disseminated grains of pyrite and

showing, where broken into, traces of chalcopyrite. They crop through to the surface in the prominent bluffs, which have become weathered and oxidized and show up prominently from the valley below. There are apparently three such bands, one just south of the glacier filling the upper part of Erickson creek, and two others about 1,000 feet west.

Practically no work has been done on them, except a few shots here and there on the more prominent outcrops. These show, as stated, a considerable pyritization of the quartzose gangue and traces of chalcopyrite. Any work such as a prospector could do would be inadequate on such showings. Extensive drifting and crosscutting is required, or probably diamond-drilling, to prove whether the average values would constitute commercial ore or not, under present conditions of transportation, etc.

West of the red bluffs bordering the glacier there is a well-defined fissure from 4 to 6 feet wide, striking N. 40° W. into the hill and dipping about 60° S.W. The vein-filling is a breccia of greenstone and a jaspery-looking rock, cemented with calcite and quartz and mineralized with varying amounts of pyrite and chalcopyrite, with streaks of galena along the walls. The continuity and mineralization of this vein would justify its exploration if the larger zones were proven valuable.

Farther west, between this vein and the west oxidized zone, a flat vein has been exposed on the surface by the sloughing-off of the overlying greenstone. An area of approximately 200 by 50 feet has been thus uncovered, showing the vein to be tilted uphill at an angle of about 30°. The vein is quartz and feldspar, well mineralized with zinc-blende and galena, with some chalcopyrite and grey-copper, and varies in width from a few inches up to 2 feet. The ore showing grey-copper assays well in silver and an average sample would probably show a fair grade of ore. The exposed area of this vein might pay to mine, sort, and ship, but underground mining on it would not be profitable.

Everything considered, I think the property worth an expenditure of a few thousand dollars to prove the large zones; should they not develop favourably the small veins are of no importance.

There are four claims in this group—*Vetron*, *Vetron No. 1*, *Vetron No. 2*, **Vetron Group.** and *Vetron No. 3*—owned by Ben Erickson and William Forrest. The claims are situated on the north slope of Bear river, about 6 miles from the end of the wagon-road and railway at the *Red Cliff*, from which there is a first-class pack-horse trail, the main Bear-Nass trail. From the foot of the hill to the *Comet* group, at an elevation of 3,375 feet, which is used for both the *Comet* and *Vetron* properties, there is a prospectors' "perpendicular" trail.

The general rock formation of this vicinity is the Bear River formation, of greenstone, agglomerates, breccia, etc. The showing on the claims is a 2-foot vein of quartz, striking N. 60° E. and dipping steeply into the hill. At 3,000 feet elevation a number of open-cuts have been put in on the vein along the steep side-hill for 3,000 feet, showing it to be well mineralized with pyrite, chalcopyrite, with a little magnetite and specular hæmatite.

The vein could be opened up by crosscut tunnels from the steep side-hill, which would gain about a foot in depth on the vein for every foot driven. Several felsitic dykes striking into the hill cut the vein at nearly right angles, but apparently are post-mineral, as they seem to have no effect on the mineralization or continuity of the vein. No depth has been obtained on the vein, the assessment-work being confined so far to surface cuts. It is a promising showing and well situated for operating.

This group consists of two claims—*Comet No. 1* and *Comet No. 2*—lying higher up the mountain and west of the *Vetron* claims. They are owned by Ben Erickson, of Stewart, and associates. The showing on the claims is a vein up to 40 feet in width, lying in greenstone country-rock and traceable on the surface for several hundred feet, the highest outcrop being 4,750 feet elevation. The vein gangue consists of quartz and calcite, well mineralized with arsenopyrite and, in places, considerable galena, in which are gold and silver values. Assays of \$32 in gold to the ton have been obtained from the arsenical iron. The strike of the vein is about N. 20° E. diagonally up the hill and its dip almost perpendicular.

Very little work has been done other than tracing the vein on the surface by means of small trenches and sinking a shaft about 14 feet deep on the side-hill. The vein has been exposed in the shaft for a width of 10 feet, which evidently is not its full size, as it has a well-defined width of 40 feet just above this. There should be no difficulty in tracing this vein down the hill to a

more advantageous point from which to drift on it. It impressed me as a very likely chance to develop a big body of milling-ore.

Should the railway ever be continued up the valley this property would be well worth extensive exploration, and might contain ore that would stand shipping under present conditions.

Another vein, known as the "Blue vein," has been found several hundred feet to the west. It is from 6 to 18 inches wide and carries up to \$100 in silver values. Its situation, overlooking the glacier, is not very favourable for operation.

This property, owned by J. McNeil, of Stewart, and J. J. Connors, was under bond to Seattle interests a year ago, when considerable development-work was done. (*See* 1920 Report.) Two crosscut tunnels were started to obtain depth under the outcrops of two veins, one up the hill at 3,850 feet, 400 feet above the camp, and the other at the camp-level. The upper vein carries galena and the lower one copper.

Owing to financial difficulties the work could not be continued by the bondholders and the property reverted to the owners. Their work this year was confined to the continuation of the lower crosscut tunnel. The ore evidently has not been struck, as nothing has been reported to that effect.

Some claims were staked this year just west of Bear River divide on the old *Lucky Frenchman* ground. Some fine high-grade silver ore was found, as float, in prospecting by the stakers. Several groups have also been located on Beaver creek, on the Nass slope of Bear River pass.

This group, composed of six mineral claims—*Delnorte No. 1 to No. 6*, inclusive—is owned by J. Green and H. Picklin, of Hyder, Alaska. The claims are situated on the east slope of the mountain range between the Bear and Nass River valleys, at the head of Porter creek. (*See* contour map of Salmon and Bear River sections accompanying this report, on which the property is marked "Porter.")

Another group of eight claims, called the *Delnorte Extension*, has been staked adjoining this—two on the north end, four on the south end, and two on the east side (down the creek) of the *Delnorte* groups.

There is a wide zone, up to several hundred feet in places, which occurs along the contact of the Bear River formation with the Nass River argillites. This belt is reddened by the surface oxidation of the iron pyrites, and can be seen at the heads of all the creeks heading in the glacier and flowing east into the Nass river.

The *Delnorte* group is staked along the western border of the Nass argillites, which are silicified and fissured for a width of 40 to 50 feet. In this belt are small veins of quartz paralleling the contact on a strike of N. 70° W. (mag.) and dipping N. 70° E. About the only work that has been done is a short tunnel, now caved in, driven some years ago. Above this tunnel and along the foot-wall of the zone is a foot or two of banded quartz and argillites, the quartz mineralized with pyrite, galena, stibnite, and zinc-blende, from which high values have been obtained. The owners claim to have found values all the way across the zone, and it is very probable that the quartz stringers carry values. However, I could not take the time to sample the whole zone, as I was on my way through to Alice Arm.

Situated as it is, there is not enough high grade opened up yet to amount to anything, and the balance of the zone would require a thorough sampling and testing before justifying any development.

This property, situated 6 miles up Bear river from the end of the wagon-road and railway at the *Red Cliff* mine, has been worked every year for a number of years by the owners, W. B. George and associates. Previous reports cover all the showings and work that has been done to date. The property is now under bond to the Granby Consolidated Company and some extensive exploratory work will very likely be undertaken next spring. The development of the showings on these claims into a producing mine would mean the extension of the railway, and would give a much-needed impetus to mining exploration and development throughout the Bear River valley and bring the Nass slope of the range within reach of transportation.

SALMON RIVER SECTION.

This takes in a small area of the Eastern Contact Belt up the Salmon River valley, from the Alaska-British Columbia boundary-line north to the divide between the Nass and Salmon valleys. It is about 3 miles wide at the lower end and about 6 miles at the upper, by about 13 miles long; approximately 60 square miles.

The section is served by a wagon-road from tide-water at Stewart and Hyder, Alaska, to the *Premier* mine, about 15 miles. Crossing the boundary-line at 13-Mile, where there is a Canadian Customs office, a branch road from the *Premier* road is being built by the Provincial Government to the upper Salmon valley. It is completed for about 2 miles and built as a sleigh-road another 5 miles to Silver lake. The development of the Indian Mines will necessitate another branch road, crossing Cascade creek below 13-Mile and following up the *Missouri* Ridge, on the west side of Cascade creek. At present there is a good pack-horse trail along the west side of the creek and through to the *Forty-nine* property. From the *Forty-nine* the trail was extended this year by the Mines Department through to Tide lake on the Nass River slope. A trail branching from the *Missouri* trail at the Indian Mines trail, passing over the low ridge at Indian lake, and following along the east bank of Salmon River glacier and below No Name lake, is badly needed by a number of groups of claims.

The fact that the *Premier* mine of the Premier Gold Mining Company has produced in the last four years approximately 170,000 oz. gold and 5,650,000 oz. silver, or about \$8,000,000, of which the greater portion is this year's output, has brought this area prominently before the whole mining world. As a result, this year has had the greatest amount of development ever done in this section. The results have more than fulfilled expectations. The ore-bodies of the *Premier* mine have been proven by diamond-drilling to greater depth, showing the values and extent of the ore-bodies to be very gratifying. The Indian Mines, Limited, has had about 1,000 feet of development work done on it, on three levels, in drifting, raising, and crosscutting, exposing a big tonnage of good-grade milling-ore, as well as an appreciable tonnage of shipping grade. The British Columbia Silver Mines, Limited, has also done about 1,000 feet of underground work, mainly in driving a crosscut tunnel, toward cutting the extension north-east of the *Premier* quartz porphyries. This objective was reached early in 1923, the tunnel crossing through about 25 feet of mineralized ground, no doubt the extension of one of the *Premier* fissures, and stated by the manager to carry satisfactory values. Though the ore-body has not been explored to any extent at the time of writing this, there is every reason for believing that the strike is important, and that the property can now be developed into a big enterprise.

The summer's development on the *Big Missouri* ground gave sufficient encouragement for the payment of the second instalment on the purchase price, and work will, I understand, proceed as soon as conditions permit.

The interesting of Toronto and Montreal capital in the development of the Indian Mines and *Mobile*, of English capital in the operations of the British Columbia Silver Mines, Limited, and British Columbia capital in the exploration of the *Big Missouri* are significant facts and may bring far-reaching results. There is no doubt that next year's operations will greatly exceed this year's and will go a long way towards putting these mines in the shipping class.

The detailed report of the "Geology and Ore Deposits of Salmon River District, British Columbia," by S. J. Schofield and G. Hanson, has been issued by the Geological Survey, Canada, in Memoir 132. The following is excerpted from this report:—

"The geological conditions which surround the *Premier* extend hundreds of miles north and south, along the eastern flank of the Coast Range batholith, and it is most probable that other properties similar to the *Premier* will be discovered in this large unprospected area. *Keno Hill* in the Yukon, the *Engineer* mine of Atlin, and the *Dolly Varden* mine of Alice arm are other properties in this great belt of mineralization. The occurrence of such high-grade ore as occurs in the *Premier* mine proves conclusively that there are ore-bodies in British Columbia that can be made to pay from the outcrop.

"The ore-deposits fall into three main types: (a) A low-grade, complex, siliceous type, with values in the base metals, copper, lead, and zinc (*Province*, *Big Missouri*, *Hercules*, *Forty-nine*, etc.); (b) a silver-gold type, rich in silver and gold minerals, including native silver, tetrahedrite, pyrrargyrite, freibergite, argentite (*Premier*, *Silver Tip*, certain ore-bodies in *Forty-nine*, *Big Missouri*, and *Mineral Hill*); (c) a pyrite siliceous type, with high gold values (an ore-body in the *Premier*)."

"Most of the ore-bodies are associated with the quartz-porphyry sills at their intrusive contact with the tuffs of the Bear River formation. On the geological map (No. 1829) the sills are not separated from the tuffs, so that most of the area mapped as being underlain by the Bear River formation may be considered worthy of attention.

"The most favourable geological conditions for the occurrence of ore in Salmon River area appear to be found at the following places: At the contact of the quartz porphyry with the tuffs; in certain beds of tuff and tufaceous conglomerate; in the quartz-porphyry sills.

"The slates, although mineralized in some cases, do not appear favourable for the deposition of commercial ore-bodies. The native silver is considered to be of secondary origin."

Several properties on the Alaska side, in the Fish Creek basin, are said to be developing very favourably.

Premier. The Premier Gold Mining Company, Limited, was incorporated in February, 1919, with a capitalization of \$5,000,000, divided into 5,000,000 shares and is a reorganization of the old Salmon Bear River Mining Company, Limited.

In the fall of 1919 the American Smelting and Refining Company acquired the controlling interest in the company from Messrs. Trites, Wood, Wilson, and Neill, under whose operation the property had been brought into prominence. The company has since purchased considerable adjoining mining property, as shown on a group map accompanying this report.

Up to the end of 1921 the mine had produced over 45,000 oz. gold and nearly 1,400,000 oz. silver. This year's output of 123,527 oz. gold and 4,261,368 oz. silver is therefore about three times its total former production. This was made possible by the completion of the tramway early in January, 1922, and its continuous service throughout the year, handling an average of 200 tons a day during the full year. Lately it has been run up to a capacity of 300 tons a day, working three shifts. There is therefore a probability of increased shipments in 1923.

The tonnage mined this year is a little over 102,000 tons, of which 70,000 tons were shipped directly to the smelters, the lower grade going to Anyox and the higher to Tacoma. The balance of 32,000 tons was milled, producing 4,137 tons of concentrates, a ratio of about 7 into 1.

This year the company disbursed in dividends \$2,750,000, which, with \$400,000 for 1921, totals \$3,150,000 in dividends to date, or 63 per cent. on the capital stock. This is the most remarkable returns made by a mining property in Canada.

For geological data relating to the *Premier* mine the reader is referred to Memoir 132, published by the Geological Survey of Canada, Ottawa.

It has been proven by later development and stoping that the ore-bodies are contained in the tuffs as well as in the quartz porphyries. Diamond-drilling has located extensive ore-bodies at considerable depth below the No. 4 level, giving conclusive reasons for estimating the life of the mine at more than a couple of years.

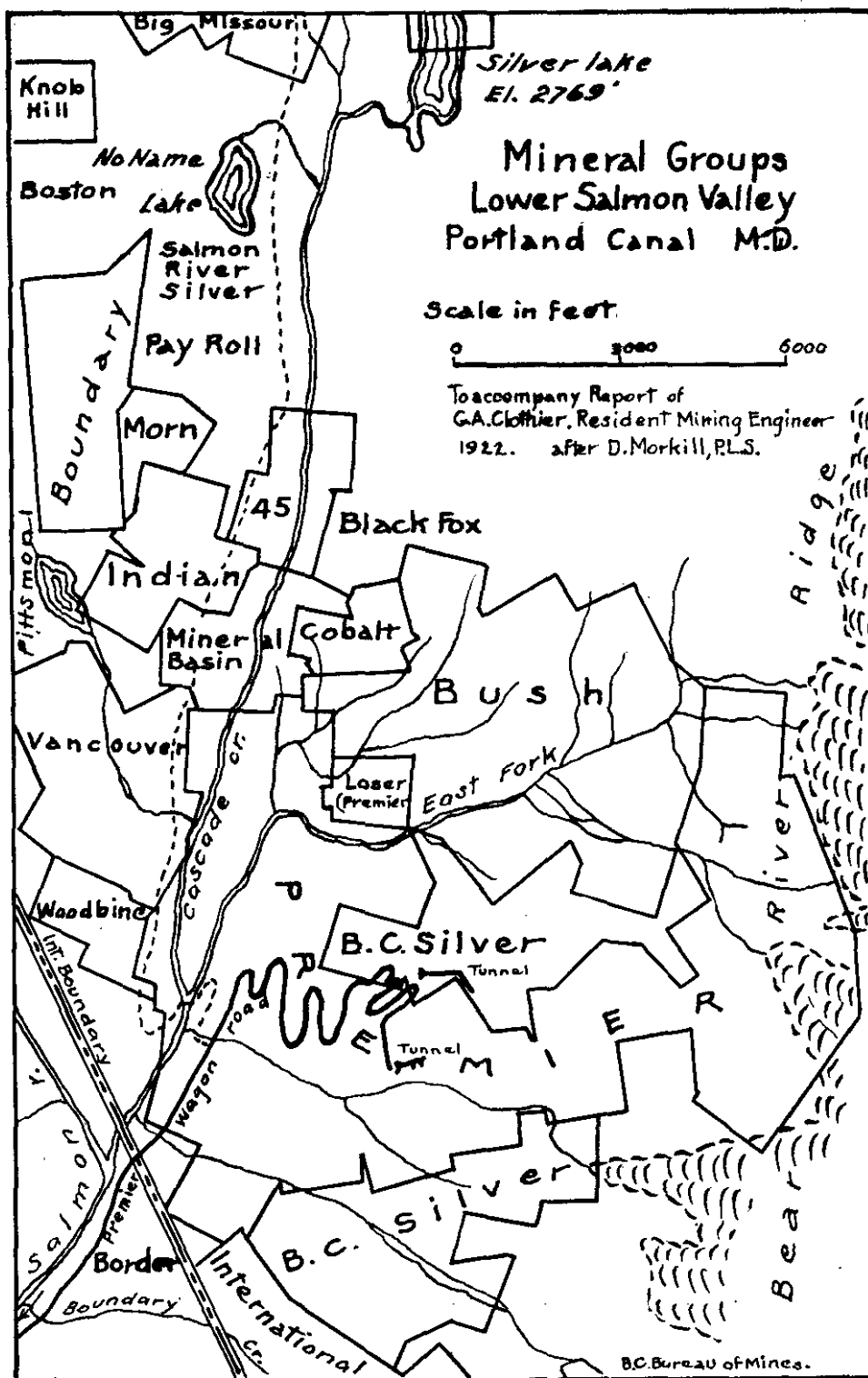
There has been considerable expansion this year, both in mining operations and in the amount of construction-work accomplished. In the mine some 5,000 feet of development drifts and raises were driven on all levels. The ore has been followed on No. 4 level and stopes opened in it, using the usual shrinkage system of mining. A new vertical 4-compartment raise, 420 feet long, connecting No. 4 and No. 2 levels in the vicinity of the ore-bodies, is nearing completion and will greatly simplify the movement of ore from the upper levels to the tram and mill. A 3-ton storage-battery locomotive has been secured and will replace all hand-tramming on No. 4 level.

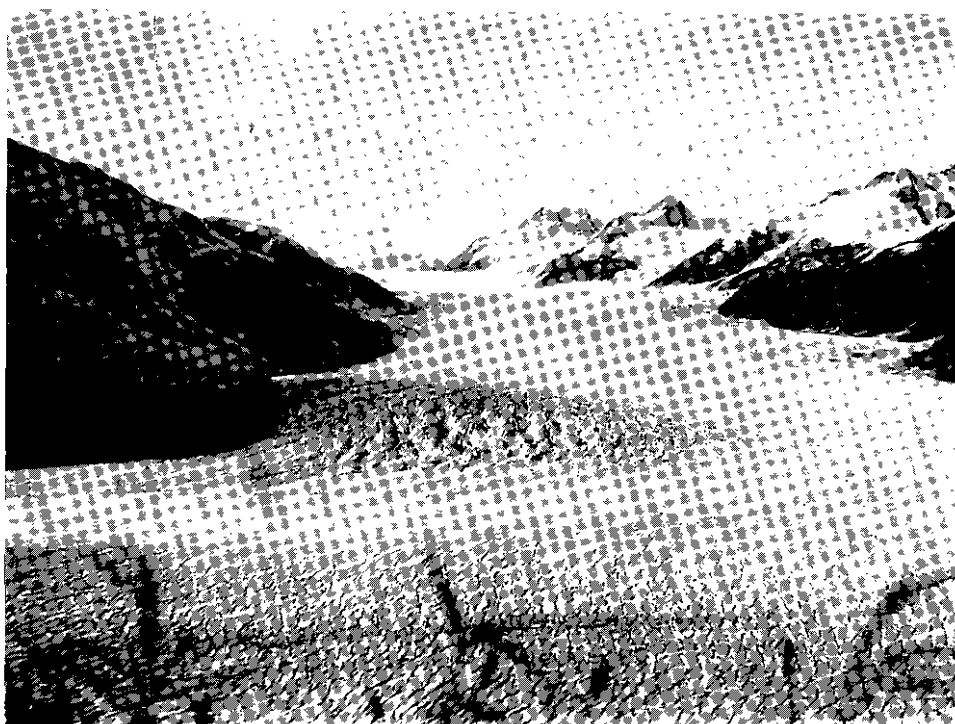
Diamond-drilling was used even more than last year, and some 12,000 feet was drilled in outlining ore-bodies, etc., and in one instance such a hole is being used for ventilation.

No radical changes have been made in the mill, but a primary breaker unit with an 18- by 30-inch jaw-crusher and appropriate bins, conveyors, etc., have been installed and will be placed in operation early in 1923.

The tramway is now being run with three shifts each day and is giving satisfactory service, latterly handling 300 tons daily for extended periods. The loading facilities at the dock have been improved by the substitution of a boom conveyor for the removable type formerly used. This conveyor handles up to 150 tons an hour and can load ships at any stage of tide, and can be raised clear of the dock when not in use.

No. 2 power-house, situated on Cascade creek, was completed early in the year. This plant takes its water-supply from the two forks of Cascade creek. The water is directed by two concrete dams and is then sent by flume or 30-inch continuous wood-stave pipe to a 40-inch riveted steel pipe. This pipe, which is reduced to 36 inches diameter at the plant, delivers the water under a head of 150 feet to a specially designed Pelton wheel having three runners and two nozzles to each runner. The wheel is directly connected to a 400-k.v.a. generator, producing alternating current at 2,300 volts. An interesting feature of this plant is that it is





Salmon Glacier (Opposite 49 Mine), Portland Canal M.D.



Salmon-Nass Divide, Portland Canal M.D.

controlled from the old No. 1 power-house, wherein power is generated by a 6-foot Pelton wheel under a head of 1,400 feet. No. 1 power-house is equipped with a 450-k.w. generator, which, like No. 2 power-house, produces alternating current at 2,300 volts, which is synchronized with that generated in No. 2 power-house and sent over the lines to the plant.

As the supply of water decreases rapidly in the winter months, it is necessary to have auxiliary power, and four 150-horse-power semi-Diesel engines are in use for this purpose. In order to economically handle the oil which is needed in considerable quantity for these engines, a tank has been constructed at the Stewart dock having a capacity of 200,000 gallons. This tank is so situated that the oil flows by gravity into specially designed carriers on the tram, and is thus taken to the mine to be delivered by gravity or pumping to the respective engines.

Several more or less pretentious buildings have been completed, including a roomy warehouse near the head of the tram, melting-house, assay office, oil-house, carpenter and drill-repair shop, and a covered steel rack. An up-to-date bunk-house is nearing completion, which will be steam-heated and have all modern conveniences for the men. Steam plants have been installed both at No. 1 and No. 4 camps for heating all mine buildings and bunk-houses. Nine cottages, with running water, lights, etc., have been built to accommodate married employees.

The property is certainly making a wonderful record under the very efficient management of Dale L. Pitt and the assistant manager, Bert F. Smith. Harry Jackson is auditor and Hector MacDonald is mine superintendent.

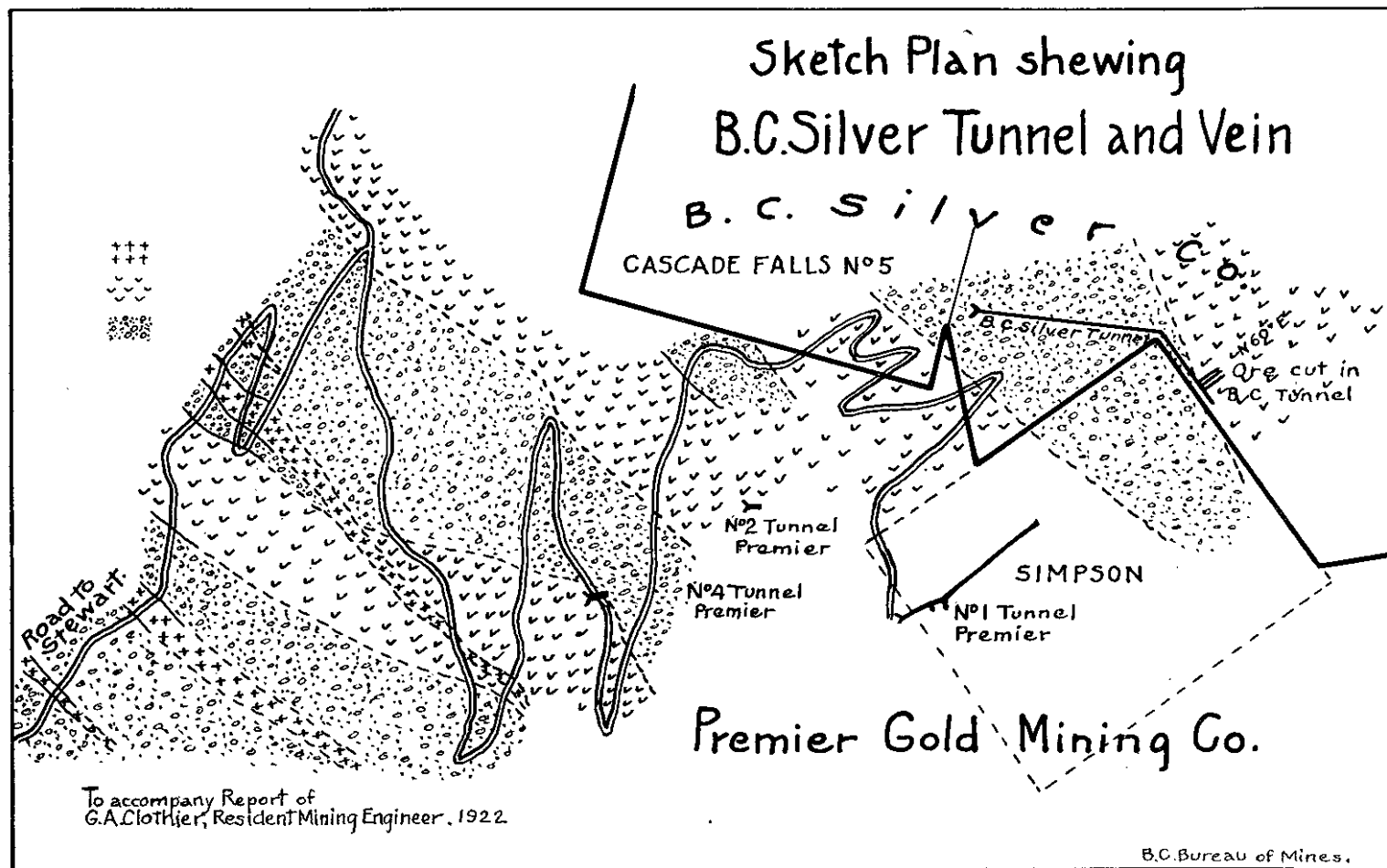
(See group map.) This group is composed of eight claims—*International Cabin, Group, Lucky Daly, Grubstake, Grub, and Boundary*—owned by Pat Daly and associates. The showing is a pyritized quartzose vein, in which are small veinlets of pure quartz, lying in the Bear River formation. A few open-cuts show the vein to be from 8 to 10 feet wide. A crosscut tunnel was started two or three years ago and driven about 100 feet toward the vein, which it should cut at about 160 feet depth. It will take about 300 feet of a tunnel to intersect the vein. Nothing has been done on the property since 1919.

B.C. Silver Mines, Ltd. This company, organized in October, 1919, with a capitalization of \$1,500,000, divided into 1,500,000 shares, has a group of eight claims, situated between the *International* group and the Premier Gold Mining Company's holdings, as well as a group of eleven claims north of the *Premier* ground, between that and the Bush Mines, Limited, holdings on the north. Nothing of any account has been done on the "South" group.

On the "North" group some diamond-drilling was done in 1920-21, with indifferent results. This year a tunnel was started on the *Oakville Fraction* (see sketch) and run almost due east for 776 feet to the corner of the *Simpson* claim of the *Premier* holdings. It was then turned to the right and paralleled the north-east line of the *Simpson* claim for 274 feet, the total drivage of 1,050 feet being in the volcanic tuffs. The first several hundred feet was run through glacial wash and loose ground, requiring timbering. At a distance of 1,050 feet from the portal of the tunnel the contact of the tuff with the quartz porphyries was entered. This proved to be fairly well mineralized for a width of 25 feet, the values gradually diminishing in the next 15 feet until the straight quartz porphyry was found. This is without doubt the continuation of one of the important ore-bearing fissures in the *Premier* ground just south-west of this. At the time of writing little is known of the ore-deposits, since it has only been crosscut. The manager, C. A. Banks, stated that, as far as values were concerned, he was perfectly satisfied with them.

Increased power is being installed and an aggressive plan of development will be carried on. The company's ground extends over 3,000 feet north-east of the point where the ore was cut, and as greater depth will rapidly be gained in drifting on the vein, tonnage can be quickly developed above the present level. It seems very probable, therefore, that at no distant date a large-capacity concentrator will be warranted and this property become one of the big shipping-mines of the Province.

The Selukwe Gold Mining and Finance Company, of London, England, owns 60 per cent. of the capital stock of the British Columbia Silver Mines, Limited, and is prepared financially to see the property through to the producing stage. The mining engineer and manager, C. A. Banks, is to be commended on his work and perseverance in bringing this property to its present very promising position. Mr. Banks has been very ably assisted in the development-work by his superintendent, C. B. North, formerly with the *Dolly Varden* at Alice arm.



There are six claims in the company's holdings—*Leslie, Leslie M., Leslie No. 2, Bush Mines, Ltd. Leslie No. 5, Leslie No. 6, and Mahood*—situated north of and adjoining the "North" group of the British Columbia Silver Mines, Limited. The company is capitalized for \$1,000,000, divided into 1,000,000 shares. Considerable work was done in 1919 on the claims, good camps were put up, and three tunnels driven. The results were not very encouraging and very little has been done since.

This group of three claims—*Spider, Spider No. 2, and Spider No. 3*—situated at the north-east end of Long lake, are held by the original stakers, Bill Hamilton and Charlie Larson. The property was under bond during 1919–20 to the Algonquin Development Company, a Belgian syndicate, which did a great deal of work under the supervision of W. A. Maloche. Owing to financial difficulties, operations were discontinued and the bond relinquished, the property reverting to the original owners.

Surface showings indicate four or five quartz veins in an intrusive mass of augite porphyry. The "North" or No. 1 vein is the largest and oldest fissure and probably of lower grade than the balance of the veins. It strikes S. 55° E. up the hill and dips about 65° N.E.

Later shearing action formed a series of smaller, roughly parallel, high-grade veins converging toward the main quartz vein. A tunnel was driven 700 feet, following one of these smaller veins, encountering several lenses of good-grade milling-ore in that distance. The mineralization is galena, zinc-blende, some chalcopyrite, with silver sulphides and some native silver showing in the seams. Some surface work was done on a vein south of this, where high-grade ore assaying up to 300 oz. in silver to the ton was exposed. Should the big quartz vein carry a milling grade of ore the cross-veins would be important "sweeteners." Good camps were built and a compressor installed, but at present everything is in a state of dilapidation.

This company is a reorganization of the Mahood Mines, Limited, which was incorporated in March, 1920, with a capitalization of \$1,000,000. The present American Mining and Milling company is capitalized for \$1,500,000, divided into 1,500,000 shares. The Co., Ltd. British Columbia holdings of the company consist of the *Betty* group, the *Sunrise* group, the *Daly-Sullivan* group, and the *Lois-Edith* group. The *Betty* group consists of six claims—*Betty Nos. 1 to 6*, inclusive, situated about 4 miles north of the *Spider* group on the east side of Divide lake. A small cabin was built this year at 3,500 feet elevation that will accommodate three or four men. Three men were working during the summer.

The work done on the property consists of one main open-cut to the vein, two or three pits along its strike, and a short tunnel. The main cut extends in from the surface, a distance of 40 feet, to the vein, which it strikes at right angles to the cut, at S. 45° E., and at this point appears to dip 70° W. The face of the cut gives a depth of about 15 feet on the vein, showing it to lie in a schistose belt formed on the contact of the volcanic rock above, with banded argillite on the lower side. The schist-belt is from 1 to 4 feet wide, in which are lenses of quartzose rock next to the argillite, mineralized with pyrite, galena, zinc-blende, and chalcopyrite, in which are occasional patches of silver sulphides. Samples taken where the silver sulphides show have assayed up to 400 oz. in silver to the ton. The quartzose vein in the face of the cut is about 6 inches wide. Three or four pits sunk farther north along the strike of the contact show the schists, but no mineralization. South of the big cut a short tunnel 12 to 15 feet long, driven along the contact, exposed a slightly mineralized, brecciated vein a foot or two in width. About 400 feet farther south, at 3,930 feet elevation, a slightly inclined shaft had been driven about 25 feet on what must be a cross-vein of quartz, since it lies wholly in the greenstone and strikes S. 75° E. Examination of the material on the dump shows the quartz to be very sparsely mineralized, and with a trace of silver sulphides showing occasionally.

The exposure of the argillite in the big cut shows its bedding-planes to strike S. 65° E. and dips 63° N.E. toward the contact. Small lenticular bunches of ore, showing silver sulphides and specks of silver on the seams, occur on the bedding-planes of the argillites, but are too infrequent to be important. Similar seams of ore are seen in a tunnel just started below the big cut. This tunnel will have to be driven 200 feet to the contact, gaining a depth of 125 feet below the big cut. Drifts along the contact from the level of the lower tunnel started this year may discover commercial ore-bodies, though the surface exposures are not as remarkable as one would be led to believe from a perusal of the prospectus of the company.

This was the only group of the company's holdings on which any work was being done at the end of September, and therefore the only one examined by me. I understand that no shipments of ore have been made from the company's property on the Alaskan side.

Silver Hill Group.—This group consists of eleven claims situated on the eastern slope of Dilworth mountain. They are owned by the Silver Crest Mines, Limited. The property was reported on in 1920 Minister of Mines' Report, since which time the company has been inactive.

Silver Tip Group.—The Silver Tip Mining Syndicate, Limited, was organized in 1920, and did considerable work on the property that year, under the supervision of P. W. Racey. Nothing has since been done, and the reader is therefore referred to the Report of that year.

Sunset Group.—This group of two claims, adjoining the *Silver Tip* and *Unicorn* groups, and lying on the south slope of Dilworth mountain, has had very little work done on it. The Salmon River Silver Mines, Limited, was incorporated for \$50,000 and acquired this group of claims.

The *Motherlode* group, consisting of six claims, is situated on the west side of Salmon glacier. Early in 1920 the Salmon River Mother Lode Mining Company, Limited, was organized with \$100,000 capitalization, but no work of any account was done on the property.

The *Yellowstone*, *Forty-nine*, and *Hercules* groups, lying north of the *Big Missouri* and east of the Salmon glacier, have been inactive for the past two or three years. I understand that a deal is pending on the *Yellowstone* group. The reader is referred to 1919-20 Reports for reviews of these properties.

This group, comprised of four claims—*Unity*, *Unicorn*, *Unicorn No. 2*, and

Unicorn Group. *Unicorn No. 3*—is owned by John Hovland, of Hyder, Alaska. It lies east of the upper claims of the *Big Missouri* group and was bonded this year by Messrs. Trites and Wilson at the time they took the bond on the *Big Missouri* group. The summer's work consisted of extensive surface prospecting by way of numerous trenches and open-cuts. Arrangements have been made for the continuation of the bond and further work will be done next season.

(See previous Reports.) This group, consisting of sixteen full claims and four

Big Missouri Group. fractions, all Crown-granted, lies along the ridge east of Salmon glacier for a length of 2 miles. This property has been the subject of more geological

discussions and less actual work for the extent of its surface showings than any property in the country. Everything has been proven geologically, and it now remains to prove practically the underground intricacies of the ore-bodies having such very promising outcrops. A good start was made in the right direction this year by Messrs. Trites and Wilson, who acquired the property on a bond. Under the supervision of H. Howson, the old camps were rebuilt and a crew of from fifteen to twenty men employed during the summer months.

The work consisted of a systematic exploration of the outcrops by deep open-cuts and trenches, which not only exposed considerable high-grade ore, but gave important information and insight into the strike, dip, and trend of the ore-shoots. With this information gained, a vertical shaft was sunk to a depth of 90 feet, first encountering rich ore at a depth of about 40 feet. The shaft was down 50 feet at the time of my examination, and although the ore was still showing in one corner in the bottom, it appeared to be dipping away from the shaft. I am informed that the ore came in again lower and continued to the bottom. The work was closed down for the winter, but was sufficiently encouraging to justify the making of the second payment on the property a short time ago. Work will be resumed as early in the spring as conditions will permit.

The company's holdings consist of seven claims, constituting the *Mineral Hill* group, which adjoins the *Lama*, *E Pluribus Unum*, and *Golden Crown* claims of the *Big Missouri* group on the east. A great deal of surface and under-

Mineral Hill Mines, Ltd. ground exploratory work was done in 1918-19. (See Reports.) Since then nothing has been done on the property, awaiting the results of development on the adjoining *E Pluribus Unum* claim, where conditions are identical.

There are several promising-looking groups south of the *Big Missouri* group, but only yearly assessment is done on them. These include the *Payroll* group, owned by Bill Murphy; the *Boundary* group of four claims, owned by Dan McIntominery, of Anyox, and now under bond to the Indian Mines, Limited; the *Morning* claim, owned by John Hovland, of Hyder, Alaska, and also under bond to the Indian Mines, Limited; the *Glacier* group of eight claims, lying east of Salmon glacier and owned by F. Jancowski and H. Scovil, of Stewart; the *Pittsmont* group

of five claims, south of and adjoining the Indian Mines claims and owned by M. R. Jamieson, of Hyder, Alaska, and associates; and the *Vancouver* group, owned by H. McGuire and associates, of Stewart, and which, together with the *Woodbine* and *Kitchener* claims, owned by Dave O'Leary, have been recently bonded to New York interests by Mr. McGuire.

(See sketch of workings.) This company was incorporated in 1911 with a capitalization of \$1,000,000, divided into 1,000,000 shares. The registered office is at Prince Rupert. Its holdings consist of four Crown-granted claims

Indian Mines, Ltd. — *Portland No. 1, Portland No. 2, Fritz, and Big Dick.* Since resuming operations in April of this year the two fractions, *O'Brien* and *Morn*, adjoining on the north, have been secured under bond, and recently the *Boundary* group of four claims, adjoining on the north-west, has also been bonded. This is one of the properties worked in the early days before there was a horse-trail up Salmon river, and when supplies were taken in in winter-time by dog-team over the "little divide" from 9-Mile, crossing the Salmon river at the toe of the glacier and climbing up along the east side of the glacier to Indian lake, from which point they were packed by men to the camp at the mine.

Altogether some 500 feet of drift-tunnelling was done in two tunnels, three large open-cuts put in on the surface croppings, and a number of smaller cuts at intervals, tracing the vein to the end line of the claims, previous to the renewal of operations this year. The surface work had shown a continuous, well-mineralized quartz vein, averaging about 14 feet wide, from the mouth of the main tunnel to the end of the claims, over 1,000 feet; the third cut, called the "galena cut," exposing an exceptionally fine showing, across 14 feet of which 8 feet was solid galena ore.

The main tunnel had been driven over 400 feet, passing through two shoots of ore, and in another shoot for about 30 feet to the face. The first shoot was about 35 feet long and consisted of solid steel galena, which gradually raised to about the middle of the tunnel, and as gradually disappeared, giving the impression of an ore-body below. The second shoot, which came in about 280 feet from the portal of the tunnel, was from 4 to 8 feet wide of heavily pyritized quartz, averaging \$10 to the ton in gold, for a distance of about 30 feet, where it narrowed to about a foot of ore; this was followed for about 100 feet, when it again widened out to over 14 feet, of which 10 feet was very heavy sulphides of iron, lead, and zinc, about 4 feet on one wall being a lightly pyritized quartz. This tunnel gave 150 feet depth below the "galena cut."

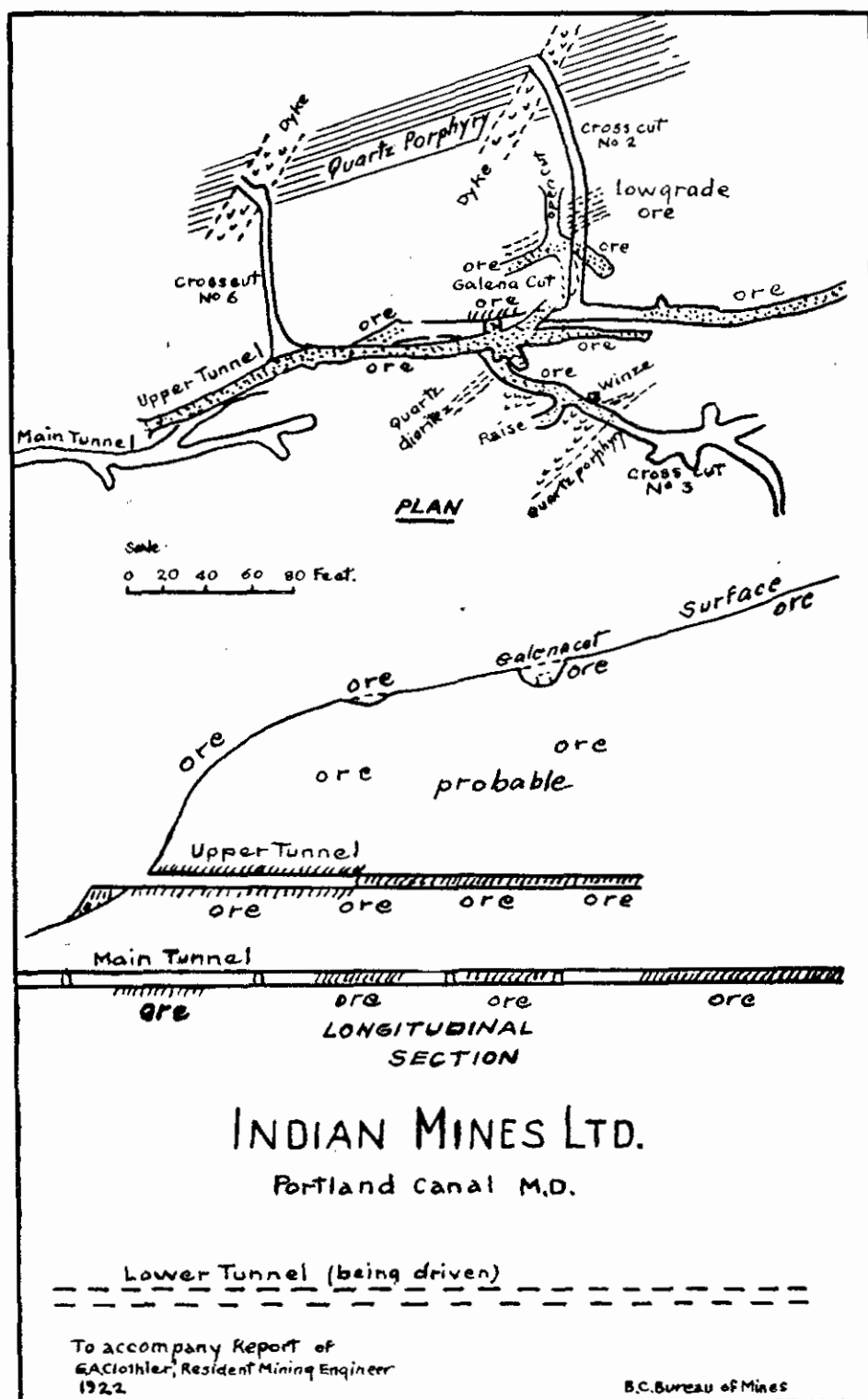
The lower tunnel, about 150 feet vertically below the main tunnel, had been driven a little over 50 feet, following a well-defined wall on which were from 2 to 4 feet of ore carrying good gold values, with practically no zinc or lead.

The work accomplished this year amounts to about 1,000 feet of drifting and crosscutting, with a little raising and sinking. The first work was in the main tunnel, where Nos. 6 and 7 crosscuts were driven on the west side, No. 8 crosscut on the east side, and the main tunnel advanced. No. 6 crosscut was driven 80 feet, finding nothing. No. 7 crosscut was driven 122 feet. At 40 feet from the main tunnel a body of quartz 18 feet wide was cut, paralleling the main fissure. The quartz is sparingly mineralized with pyrite and carries low values in gold and is well worth later exploration.

No. 8 crosscut was driven 182 feet and 135 feet of drifting and crosscutting done from it. An ore-body was struck about 40 feet from the main tunnel and proved to be over 90 feet in length, varying from 6 inches to 2 feet in width, of quartz mineralized with pyrite and a little galena and showing considerable native silver in thin flakes. The main values are in gold, running up to \$50 a ton, the whole averaging about \$40 to the ton in all values. All assays quoted are from the company's records. A raise was put up on this ore-body for 55 feet, showing it about the same as on the level. Later a winze was sunk about 20 feet, from which a few tons of ore was sorted, assaying \$90 a ton. This is a very promising cross-fissure and ore-body.

The main tunnel was driven a further distance of 48 feet in the same heavy sulphides showing in the face when work was started. These heavy sulphide ores, while carrying fair values, are of a complex character and will require some metallurgical investigation.

Since the ore-bodies disclosed in the main tunnel did not conform very closely with what was to be expected from the surface showings, it was thought advisable to drive another tunnel about 50 feet higher up. This has proven, and is proving, to be a very fortunate piece of work. This upper tunnel up to the end of the year had been driven 225 feet in ore all the way from



the portal. The vein is quartz, varying from 10 to 18 feet wide, mineralized chiefly with pyrite and galena and showing, in places, specks of native silver. The mineral contents will make it a very suitable ore for concentration, which, I should judge, would be about 8 into 1. It is of good milling grade, with a good persistent gold value, and will average about \$14 to the ton in gold, silver, and lead values. (The latest report, February 15th, 1923, stated that the tunnel was in 325 feet, with the same character and grade of ore throughout. The face of the tunnel at this date would be approximately 150 feet below the surface.) This ore-body represents a very substantial tonnage of milling-ore, with surface showings indicating its continuance.

The lower tunnel, 150 feet below the main tunnel, has been advanced 40 feet during the year in a faulted section of the vein, which was later driven through and the vein again found, well mineralized the width of the drift, with 2 feet of solid ore on the wall. A contract has been let to drive this tunnel 525 feet, which will put it under the heavy sulphide ore-body in the face of the main tunnel. A suitable compressor and equipment will be installed for this work, for the small compressor plant used in the upper tunnels has not sufficient capacity to handle all the work.

The general rock formation in which the vein occurs is quartz porphyry of the *Premier* type, intruded by many dykes, as shown by the accompanying sketch. The vein lies in a shear-zone in the porphyry, following, for a distance at least, one of the intruding dykes. The ore is of primary origin and, as such may be expected to maintain its values to the depth of the ore-bodies. With the main ore-bodies of primary ore of milling grade as a sure basis on which to figure operations and the probabilities of enriched shoots in them, where the richer cross-veins join them, and the appreciable tonnage of high-grade ore in the cross-fissures themselves as demonstrated in No. 8 crosscut, it looks as if at least an excellent grade of concentrating-ore can be depended upon. If the driving of the lower tunnel develops a proportionate tonnage of milling-ore to that exposed in the upper tunnel it will make a big mine.

G. D. B. Turner, of New York, a mining engineer and operator of widely recognized ability and experience, undertook the financing and management of the property early in the year. After a careful consideration of conditions in the vicinity of the mine and examination of the tunnels, together with such open-cuts as could be cleared of snow, he then succeeded in interesting Toronto and Montreal capital, and work was started early in May with R. L. Clothier as superintendent in charge, to whose energy and efficiency is due the economical development of the mine.

This group is comprised of seven mineral claims—*Munro*, *Munro Nos. 1, 2*, and *Munro Group. 3*, *Big Chief No. 1*, *Big Chief No. 2*, and *Big Chief No. 3*—and is situated on the west side of Salmon glacier, opposite the *Big Missouri*. The claims are owned by J. E. Munro, Pat McBride, and Alex. McDonald, of Stewart. The owners were working on the property all summer and report that they have driven 25 and 20 feet respectively on two veins. Each vein shows up to a foot of high-grade galena-grey-copper ore, carrying high values in silver, as well as some gold. They expect to ship ore next season.

I regret that I had not the time to see the properties on the west side of the glacier this year.

This group is situated on the west side of Salmon glacier, just south of the west fork of the glacier. The following mineral claims, owned by E. H. Bartholf and associates, constitute the group: *Mountain Girl*, *Mineral Zone*, *Silver Extension Fraction*, *Silver Cord Fraction*, *Bar Silver*, *Silver Bar*, and *Silver Thrift No. 2*. Work was carried on all summer under the direction of Mr. Bartholf and twenty-eight sacks of ore was sent out as a trial shipment to the smelter. These claims along the west bank of the glacier lie in Hanson's "belt of dykes." The showings are small quartz veins, heavily mineralized with galena and grey-copper, carrying high values in silver.

UNUK RIVER SECTION.

This section I have designated to take in all the drainage-basin of the Unuk river east of the Alaska-British Columbia boundary-line. The Unuk empties into the head of Burroughs bay.

The mineral area is reached by poling and lining a boat up the river, as early in the spring as possible, unless one is an expert boatman. The granite contact is about 24 miles from the mouth of the river, beyond which is undoubtedly a good prospecting country. The mineral-belt is the extension north of the belt through from Kitsumgallum lake, Alice arm, and Stewart.

I have been advised by several parties of their intention of prospecting in that field next season.

STIKINE AND LIARD MINING DIVISIONS.

These two Divisions are entirely dependent on the Stikine river for communication and transportation. A river-boat leaves Wrangell, the day after the call of the C.P.R. steamer, for Telegraph Creek, from which there is a pack-trail 75 miles to Dease lake; thence waterways for hundreds of miles in a practically unknown country.

Investigation was made this summer of the extent of possible placer-dredging and hydraulic-ing-ground along the Stikine and its tributary streams, with special reference to the Clearwater river, by Frank Breeze. His report in effect is that the immense terraces or benches of river-gravel flanking the Stikine and Clearwater rivers, indicating the different levels of the river-bed from time to time, undoubtedly carry gold, since they were worked in places in early days by old methods, but they would require extensive exploration by drilling to prove their commercial value.

DEASE LAKE SECTION.

H. W. Dodd, the Gold Commissioner at Telegraph Creek, who is thoroughly conversant with everything pertaining to the Division, reports that considerable more placer-development was done this year than for many seasons.

The output for the year amounted to 320 oz., as follows: Thibert Creek hydraulic, 155 oz.; Mosquito creek, 20 oz.; Dease creek, 40 oz.; McDame creek, 20 oz.; lower Liard (base), 40 oz.; Tahltan river, 30 oz.; and Clearwater river, 15 oz.

Thirteen placer leases were applied for during the year, of which nine were granted and four pending.

On Thibert creek George Adams had eight men employed from May 15th to September 15th, his clean-up amounting to 320 oz. This work, while disappointing in the gold yield for the amount of gravel handled, has given very valuable information, and Mr. Adams is more than ever convinced that, with sufficient water to handle the heavy gravel-banks, he has a very profitable undertaking. Water would have to be obtained from Thibert creek, necessitating a considerable distance of large-diameter pipe. On account of lack of transportation from the head of navigation at Telegraph Creek the cost of taking such a pipe-line in is prohibitive. He is therefore figuring on putting in a sawmill and cutting out the staves for a continuous wood-stave pipe. If this can be done operations will be continued.

On Deloire creek, a tributary of Thibert creek, Quinn, Ball, and Finn Bros. have this season nearly completed a 900-foot bed-rock flume on three leases formerly held by the Mitchell Bros. When this is finished the higher pay-gravel can be worked and their prospects are very encouraging.

On Dease creek Bryan, Hankin, and Johnson have been whip-sawing lumber for flumes. At the mouth of the creek, F. W. Craig and associates, of Seattle, have taken up four leases. Their intention is to test the ground by drilling, and for this purpose an Empire drill and boiler were taken in. Owing to the lateness of the season the boiler was left at the head of Dease lake, but operations will be resumed in the spring.

On McDame creek Amos Godfrey and Dan Campbell were prospecting the *Princess May* lease, and on Mosquito creek George Adsit took out about 20 oz.

ATLIN MINING DIVISION.

ATLIN SECTION.

There has been a slight increase in the placer-output during this year, the total yield being approximately \$145,000, against \$138,500 last year, according to returns furnished at the end of the year by J. Williams, Acting Gold Commissioner.

J. A. Fraser, the lately retired Gold Commissioner, has very kindly furnished me with the following review of the season's work, as I was unable to get up north this year.

On Ruby creek the output has been about \$58,000, taken out by the Placer Gold Mines Company. Above the company's ground considerable development-work has been done by individual operators sinking through the basalt-flow to the old creek-bed beneath. No returns have been received from any of this work yet, but it is expected that next season's work will begin to bear results.

On Spruce creek a total of approximately \$38,000 was cleaned up by the different operators. Mr. Fraser says: "Ground which has been held since the inception of the camp until recently was relocated very soon after abandonment by former holders, by good miners and old-timers

on the creek, who are doing real development-work and are expecting good results. This applies to a portion of the *Discovery* claim and from there up-stream for some distance, and I have no doubt there will be renewed activity on that creek."

On Otter creek the Mines d'Otter Creek took out \$20,000, which has been the most satisfactory season yet. This company has done an unbelievable amount of dead-work in getting to bed-rock, and it is hoped that the reward will be ample.

On Pine creek a number of men were operating, the total output amounting to about \$15,000. On Boulder creek the yield is reported about \$6,000. Other creeks are lumped at \$8,000.

(See 1921 Report under heading *Big Canyon* and *Ruffner* groups, page 78.)

Atlin Silver-Lead Mines. This property (see accompanying map) consists of the following fifteen mineral claims: *Cherokee, Ptarmigan, Tom, Apache, Silver Wedge, Barber, Mountain Hoboe, Commanchee, Cranberry, Portal, Nellie, Frontal Fraction, Cabin Fraction, Duck Pond, and Fourth of July*. They are situated on Vaughan mountain, about 10 miles up Fourth of July creek from Atlin lake and 14 miles by wagon-road from Atlin. The first 6 miles of wagon-road along Atlin lake is a fair road, but the remaining 8 miles up Fourth of July creek is at best only a temporary road. If the property develops into a shipper a wagon-road will have to be built on the west side of the creek, where there is an even grade and good side-hill for road-building. J. M. Ruffner, of Atlin, is manager of the property. A full report was made on the property last year and therefore need not be repeated here. I did not get up north this season and am therefore taking the manager's report for this year's development-work, assays, etc., written December 1st, 1922.

The open-cut at 2 C on the accompanying map, on the *Cherokee* claim, was extended and deepened a further 8 feet, making its total depth 14 feet. From this work were taken over 10 tons of ore, of mixed sulphides, carbonates, and sulphates. This was shipped to the Selby smelter, which settled for it on a basis of 95 cents in gold and 83 oz. in silver to the ton, and 45 per cent. lead, or \$102 a ton, silver at 64½ cents an ounce and lead at 5.33 cents a pound. The total cost of mining, handling, hauling, freight, treatment, and deductions was approximately \$75 a ton. Samples of the solid sulphides in this shipment assayed over 200 oz. in silver to the ton.

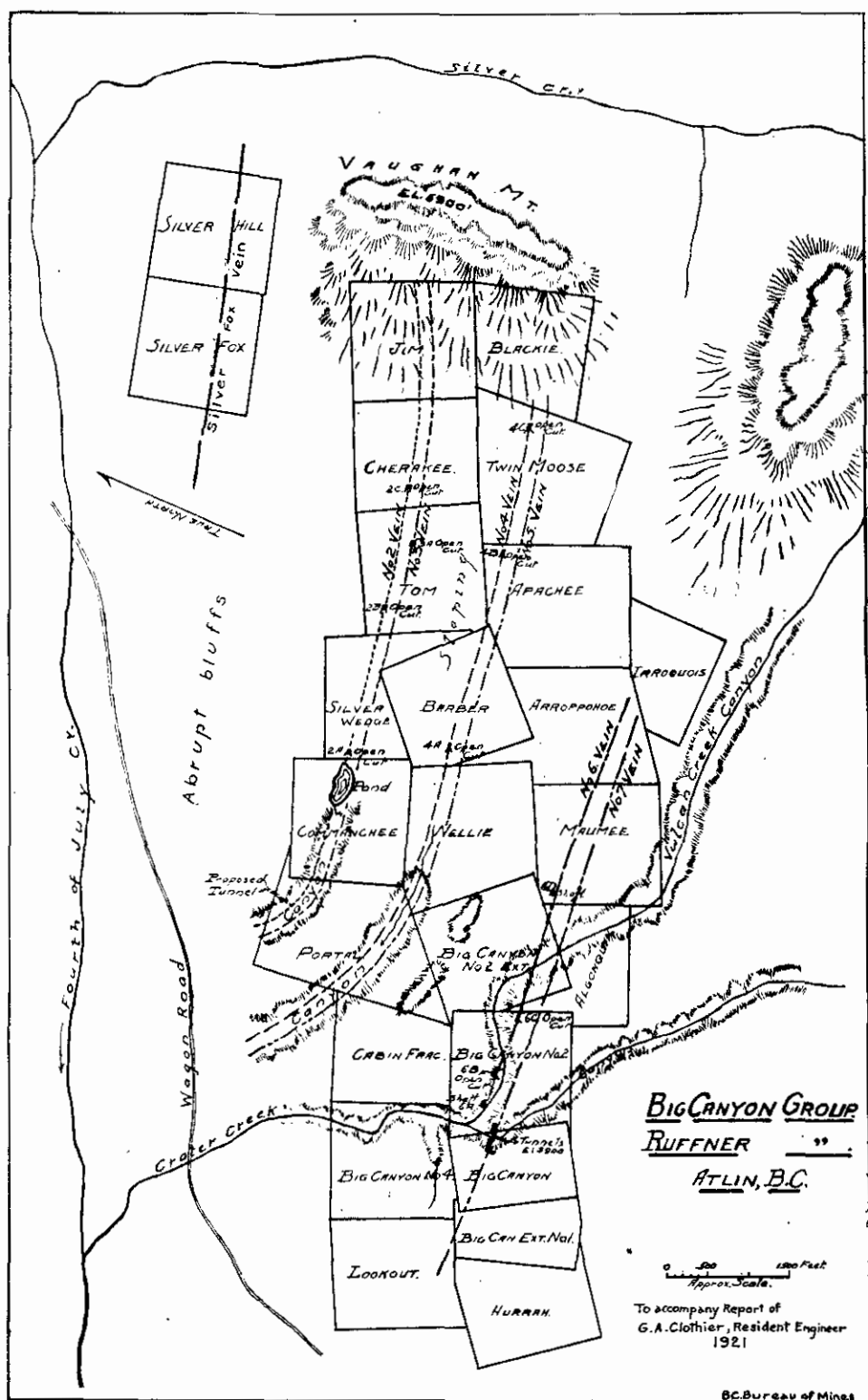
The encouraging feature of this work was the increase in the proportion of solid sulphides as depth was gained, giving every reason to expect that when the surface oxidation is penetrated there will be extensive bodies of ore that can be shipped at a good profit. The results of the sinking were so gratifying that a contract was let to sink another 50 feet. A later report from Mr. Ruffner, December 20th, 1922, states that from a point 14 feet, which was the bottom of the shaft when the contract was let, to a point 26 feet deep, the vein was very much oxidized. At 26 feet the sulphides began to show again, and at 28 feet depth there was 2 feet of solid galena on the hanging-wall and some coming on the foot-wall of the shaft. Here there is considerable chalcopryrite associated with the galena. A sample showing considerable copper assayed \$1.60 in gold and 41.68 oz. in silver to the ton, and 3.84 per cent. copper. A sample of the solid galena from here assayed \$4.40 in gold and 113.02 oz. in silver to the ton, and 65.2 per cent. lead.

On the surface the open-cut at which this shaft is being sunk showed the vein to be at least 14 feet wide, mineralized throughout this width with seams of galena. Should the present showing of 2 feet of solid galena at 28 feet in the shaft hold to further considerable depth, and the mineralization in the balance of the vein continue, the whole would make a good concentrating-ore. The vein will be crosscut and drifted on when the 50-foot sinking contract is finished. Altogether it is a very promising showing at this point.

On No. 4 vein, at the point 4 A on the map at the bottom of the *Barber* claim, there was last year an open-cut and tunnel totalling about 40 feet in length. At the portal of the tunnel there were about 8 feet of soft oxides, but at the face of the tunnel some sulphides were appearing.

This tunnel was continued this year for 30 feet, making a total of 70 feet, going a depth in that distance of about 30 feet below the surface, and a crosscut run toward the foot-wall, exposing a portion of the vein 12 feet wide. It still shows intense oxidation, though small ribs of sulphides are appearing. About 3 tons of ore was sorted from this work, giving smelter returns of \$2.28 in gold and 81.0 oz. in silver to the ton, and 31 per cent. lead.

The width of oxidized material, over 12 feet, would certainly lead one to believe that at depth there is a wide, heavily mineralized vein. The high silver content of the galena and the



low silver content of the carbonates would also suggest a zone of secondary enrichment at the bottom of the oxidized material.

I was very favourably impressed with the different showings on the property last year, and the additional work as reviewed here confirms this impression more than ever. I will be very interested in seeing this property again next season.

(See Geological Survey of Canada, Memoir 37, by D. D. Cairnes and Minister of Mines' Reports, 1904, 1918.) This property has been in litigation since the death, in 1918, of its former owner, Captain James Alexander. The suit was carried to the Privy Council, and decision rendered this year in favour of Captain Alexander's heirs, the Smith interests. The mine was taken under option for examination by L. H. and N. A. Timmins, of Montreal, in June of this year and an examination made by their engineers. No information is available as to the results of the investigation. Nothing further seems to have been done. The operation of this property would have a very beneficial mining effect on the whole Atlin country, and it therefore is hoped that work will be resumed.

RAINY HOLLOW SECTION.

(See 1921 Report, page 75.)

The only property under development in this section is the *Maid of Erin* group. This property is 56 miles from Haines, Alaska, a port of call for American boats, but not C.P.R. steamships, which go through to Skagway, about 15 miles farther at the head of the canal.

A good motor-truck road is being built by the Alaska Road Commission through Alaska, from Haines to the boundary at Pleasant camp, a distance of 44 miles; the remaining 12 miles is in British Columbia.

The property is under bond to Robert Wiley, of Portland, Oregon, who has developed it for the past two years. Further work was done this year up to the middle of August, when it was closed down on account of some flaw in the titles.

There was 47 tons shipped this year and about 1,000 sacks ready to send out, pending road improvements. The Alaska Commission has spent approximately \$100,000 on the road and will complete it through to the boundary-line. The Provincial Government should then improve the remaining 12 miles into a first-class truck-road. This would not be expensive, as there is a fair road now, but it requires permanent improvements.

There is a well-mineralized area in the vicinity of the *Maid of Erin*, which transportation would help develop.

I take this opportunity of thanking the prospectors and mining operators throughout the district for their courtesy and assistance.

CASSIAR DISTRICT.

ATLIN MINING DIVISION.

REPORT BY J. WILLIAMS, ACTING GOLD COMMISSIONER.

I have the honour to submit office statistics of the Atlin Mining Division of Cassiar District for the year ending December 31st, 1922.

OFFICE STATISTICS—ATLIN MINING DIVISION.

Free miners' certificates issued (individual)	149
Free miners' certificates issued (company)	1
Free miners' certificates issued (special)	1

Revenue.

Free miners' certificates	\$ 758 00
Mining receipts, general	8,006 35 /
Receipts from all other sources	13,611 83 /
Total	\$22,376 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, 1922.

There has been a slight improvement in the general outlook over last season, not so much in the amount of gold recovered as in development-work done.

During the season thirteen placer leases have been applied for, nine of which have been granted, with four pending.

On Thibert creek George Adams had eight men employed from May 15th to September 15th, prospecting the Dease Syndicate leases; it is the intention of Mr. Adams to place a larger plant on this property, and he has left for the Coast to make arrangements accordingly.

On Deloire creek Quinn, Ball, and the Finn Bros. have been busy all season constructing 900 feet of bed-rock flume on three leases which they have taken up, formerly the old Mitchell ground; their prospects were encouraging and it will require about another month's work before the higher pay-gravel will be reached.

On Dease creek Bryan, Hankin & Johnson have been whip-sawing lumber for flumes.

At the mouth of Dease creek F. W. Craig and associates, of Seattle, have taken up four leases with the intention of drilling the ground. An Empire drill was procured and a boiler brought in, but owing to the lateness of the season the boiler was left at the head of Dease lake; they will, however, have everything in shape to commence operations the coming season.

On McDame creek Amos Godfrey and Dan Campbell have been prospecting the *Princess May* lease.

Mineral Claims.—No development has taken place during the year.

As the report of the Resident Mining Engineer covers all developments during the season, I have nothing more to add.

OFFICE STATISTICS—LIARD AND STIKINE MINING DIVISIONS.

Revenue.

Free miners' certificates	\$ 382 75
Mining receipts	1,399 50
Other sources	3,776 00
Total	\$5,558 25

SKEENA DISTRICT.

SKEENA AND BELLA COOLA MINING DIVISIONS.

REPORT BY J. H. McMULLIN, GOLD COMMISSIONER.

I beg to enclose herewith a statement showing the office statistics for the year 1922 for the Skeena and Bella Coola Mining Divisions.

The report of the Resident Mining Engineer covers the mining developments for the year.

OFFICE STATISTICS—SKEENA AND BELLA COOLA MINING DIVISIONS.

Free miners' certificates issued	403
Special free miners' certificates issued	2
Mining receipts issued	173
Mineral claims recorded	88
Certificates of work issued	145
Filings	15
Certificates of improvements granted	6

Revenue.

Free miners' certificates	\$1,758 00
Mining receipts	1,283 05
Total	\$3,041 05

NASS RIVER MINING DIVISION.

REPORT BY JOHN CONWAY, ACTING MINING RECORDER, ANYOX.

I have the honour to forward you herewith the office statistics of the Nass River Mining Division for the year 1922.

The report of the Resident Mining Engineer fully covers the year's operations and I have nothing to add to his report.

OFFICE STATISTICS—NASS RIVER MINING DIVISION.

Free miners' certificates (individual)	213
Free miners' certificates (company)	1
Mineral claims recorded	151
Certificates of work issued	435
Bills of sale, etc., recorded	54
Filings	15
Certificates of improvements recorded	12

Revenue.

Free miners' certificates	\$1,139 00
Mining receipts, general	2,657 30
Total	\$3,796 30

PORTLAND CANAL MINING DIVISION.

REPORT BY J. P. SCARLETT, ACTING MINING RECORDER.

I have the honour to submit herewith office statistics of the Portland Canal Mining Division for the year ending December 31st, 1922.

The report of the Resident Mining Engineer deals fully with the mining activities in this Division during the past year.

OFFICE STATISTICS—PORTLAND CANAL MINING DIVISION.

Free miners' certificates (individual)	335
Free miners' certificates (company)	5
Free miners' certificates (special)	2
Mineral claims recorded	458
Certificates of work issued	619
Bills of sale, etc., recorded	193
Certificates of improvement recorded	18
Filings	61
Abandonments	1

Revenue.

Free miners' certificates	\$2,045 25
Mining receipts, general	6,875 20
Other sources	833 00
Total	\$9,753 45

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, 1922.

No developed mine has been in operation during 1922, but many of the individual prospector owners have been steadily developing their properties and accumulating ore for future shipment: At Copper island, A. Heino; at Jedway, A. J. Wilds, W. Campbell, J. H. Hunter, and G. Vanderdasson; at Lockeport, J. Dunn, Jesse Collier, Nels Persen, and C. J. Bensen; at Louise island, Alex. Rogers, Duncan Fraser, and C. J. Benson; at Kootenay harbour, on the *Blue Mule* group, Nels Larsen and partners have been sticking ardently and long to uncovering so good a prospect that none have had time to come in and report, but it is known that the showings are good.

The *South Easter* and Gold Harbour properties have been dormant during the past year, but may resume operations at any time.

Black sands on the north and east coasts of Graham island: Six placer leases only are at present in good standing; little work beyond that necessary to hold them has been done during 1922.

OFFICE STATISTICS—QUEEN CHARLOTTE MINING DIVISION.

Free miners' certificates issued	52
Mining claims recorded (quartz)	10
Mining claims recorded (placer)	1
Certificates of work issued	68
Records	7
Filings	4

Revenue.

Free miners' certificates	\$ 250 25
Mining receipts	509 50
Trade licences	180 00
Firearm licences	102 50
General receipts (P.C.F.)	15 00
General receipts (fur royalty)	5 00
Marriage licences	15 00
Liquor permits	15 00
Total	\$1,092 25

NORTH-EASTERN DISTRICT (No. 2).

REPORT OF JOHN D. GALLOWAY, RESIDENT MINING ENGINEER.

GENERAL REMARKS.

The North-eastern Mineral Survey District consists of Omineca, Cariboo, Quesnel, and Peace River Mining Divisions, and occupies a large portion of Northern British Columbia, having an area of nearly 100,000 square miles. The northern, western, and southern boundaries of this district are the arbitrary boundary-lines of the Mining Divisions, but these, where practicable, always follow the watersheds of the country. The eastern boundary is the British Columbia-Alberta boundary-line. The western boundary is roughly 100 miles from the Coast, while the northern and southern boundaries are about 200 miles from the respective Provincial boundaries.

For descriptive purposes in this report the district is reviewed under the main headings of the Mining Divisions, subdivided into sections as follows:—

Omineca Division—Skeena section; Hazelton section; Telkwa section; Fraser Lake section; Manson section.

Cariboo Division—Barkerville section; Fort George section.

Quesnel Division—Quesnel River section; Quesnel Lake section; Horsefly section; Keithley section.

Peace River Division.

A general description of the geographic, geologic, and topographic features of the district was given in the Annual Report of the Minister of Mines for 1917. In the following table is given a list of the more important reports on this district, in addition to which numerous references can be found in the Summary Reports of the Geological Survey and the Annual Reports of the British Columbia Department of Mines:—

Name of Author.	Publication.	Year.	Page.
Dr. Geo. Dawson	Geological Survey of Canada	1875	233
"	"	1876	17
"	"	1879	Pt. B
"	"	1888	73R
Amos Bowman	"	1887-8	Pt. C
R. G. McConnell	"	1894	50
W. Fleet Robertson	Minister of Mines' Report	1905	89
"	"	1906	101
"	"	1908	66
"	"	1911	95
"	"	1912	65
W. W. Leach	Geological Survey of Canada, Summary Report	1906	35
"	"	1907	19
"	Telkwa River and Vicinity, Geological Survey	1907	..
"	Geological Survey of Canada, Summary Report	1908	41
"	"	1909	61
"	"	1910	91
G. S. Malloch	"	1911	92
R. G. McConnell	"	1912	55
G. S. Malloch	"	1912	69
"	"	1912	103
C. F. J. Galloway	Minister of Mines' Report	1912	118
W. M. Brewer	"	1914	101
John D. Galloway	"	1914	176
J. D. MacKenzie	Geological Survey of Canada, Summary Report	1915	62
Chas. Cammell	"	1915	70
John D. Galloway	Minister of Mines' Report	1916	134
"	"	1917	86
"	"	1918	107
B. R. MacKay	Summary Report, Part B, Geological Survey	1918	39
J. J. O'Neill	Memoir 110, Geological Survey	1919	..
B. R. MacKay	Summary Report, Part B, Geological Survey	1919	36
John D. Galloway	Minister of Mines' Report	1919	96
J. C. Gwillim	Oil Survey, Peace River Dist., Depart. of Lands	1920	..
John D. Galloway	Minister of Mines' Report	1920	79
John A. Dresser and Edward Spieker	Oil Surveys, Peace River Dis., Depart. of Lands	1920	..
R. W. Brock	Summary Report, 1920, Part A, Geological Survey	1920	81
John D. Galloway	Minister of Mines' Report	1921	89
W. A. Johnston	Summary Report, Part A, Geological Survey	1921	59

SUMMARY OF MINING ACTIVITY.

The year 1922 has been an encouraging one for mining activity throughout the North-eastern District, and it would seem that the depression of the past two years has been definitely passed. The lode-mineral production from the district in recent years has been very small and even this year but little ore has been shipped. The development-work done this year, however, gives substantial promise of a largely increased output in the future.

Properties on Hudson Bay mountain were actively developed during the year and most encouraging results were obtained in the operations on Dome mountain, in the Babine range. Properties in other sections of the Babine range were further developed with satisfactory results. It is becoming more and more evident that the Babine range is an important mineralized zone and as yet it has only been slightly prospected.

The copper properties on Rocher Déboulé mountain remained inactive all year; the *Rocher Déboulé* mine has been closed for some years. This mine has in the past produced a considerable tonnage of good-grade copper ore, but apparently will not be reopened until there is an improvement in the copper market. The *Silver Standard* mine near Hazelton was reopened in January and operations were continued for about three months, when it was again closed.

The coalfields of the North-eastern District have not as yet made much production, although there is now a fair market for such coal. A small tonnage of coal was again mined from the *Betty* mine near Telkwa. Diamond-drilling of the Copper River Coal Company's property was carried out during the season, and the results were satisfactory.

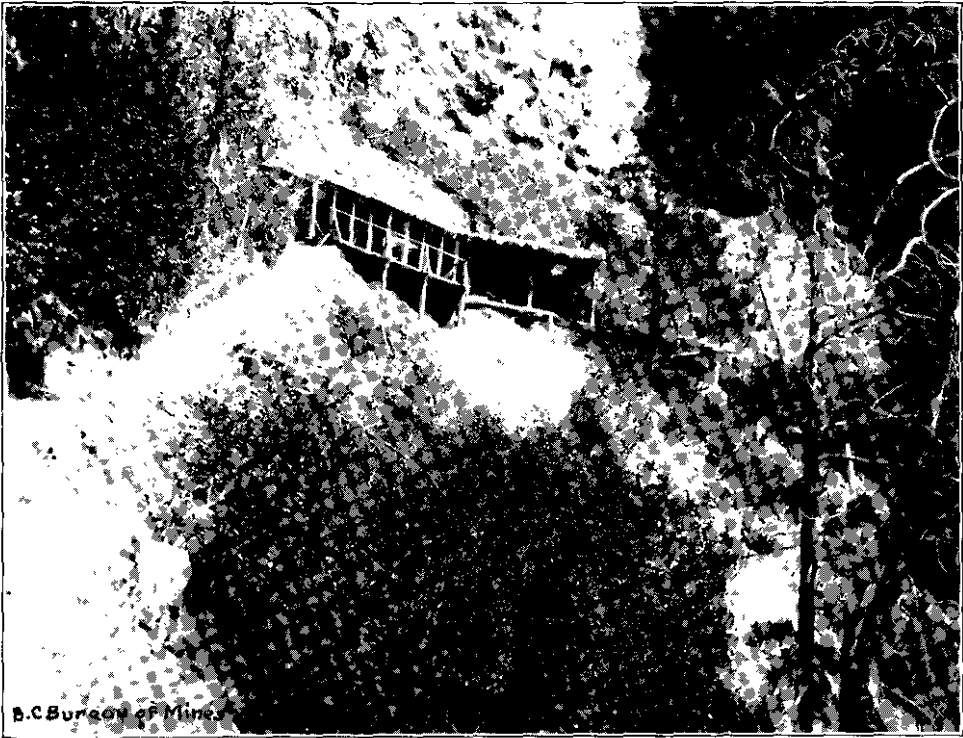
A very marked revival in placer-mining has been evident in the Cariboo and Quesnel Divisions. The important discovery of Cedar Creek camp (discovered in late fall of 1921) has aroused considerable interest and during the summer there was a great influx of prospectors. Much misinformation was published in the daily press about the Cedar Creek discovery, and as a result many persons rushed into the country who knew nothing about prospecting or mining. Most of this type soon left the district again and spread pessimistic stories that the Cedar Creek discovery was a fake. The truth is that a strike of very rich placer-ground was made at Cedar creek, and that the work done this summer has exposed richer ground than the discovery, and that the deposit of auriferous gravel is likely to have a considerable areal extent. Gold to the amount of approximately \$125,500 has been taken out this year, mainly by means of rockers, so it is quite evident that the discovery is one of some importance. The placer-deposit at this point is somewhat unusual, as it differs in many ways from the old workings of the Cariboo, and therefore should be of great value as an indicator for this section of the country and should stimulate renewed prospecting.

Much Keystone-drilling of placer-gravels has been carried out in the Cariboo during the year, with satisfactory results in some places. On the result of such testing will depend the future of the older and formerly worked parts of the Cariboo. It is probable that many areas of low-grade gravels will pay to work if properly handled. Placer-mining of this nature calls first of all for thorough testing of the ground to determine values and physical conditions; and, secondly, for sufficient capital so that the property can be properly equipped. Besides the operating companies, there are at the present time in the Cariboo District a number of companies engaged in prospecting or equipping properties for such large-scale placer-mining, and there is still much ground left that at least warrants preliminary testing to see if it will not pay to work by dredging or other methods.

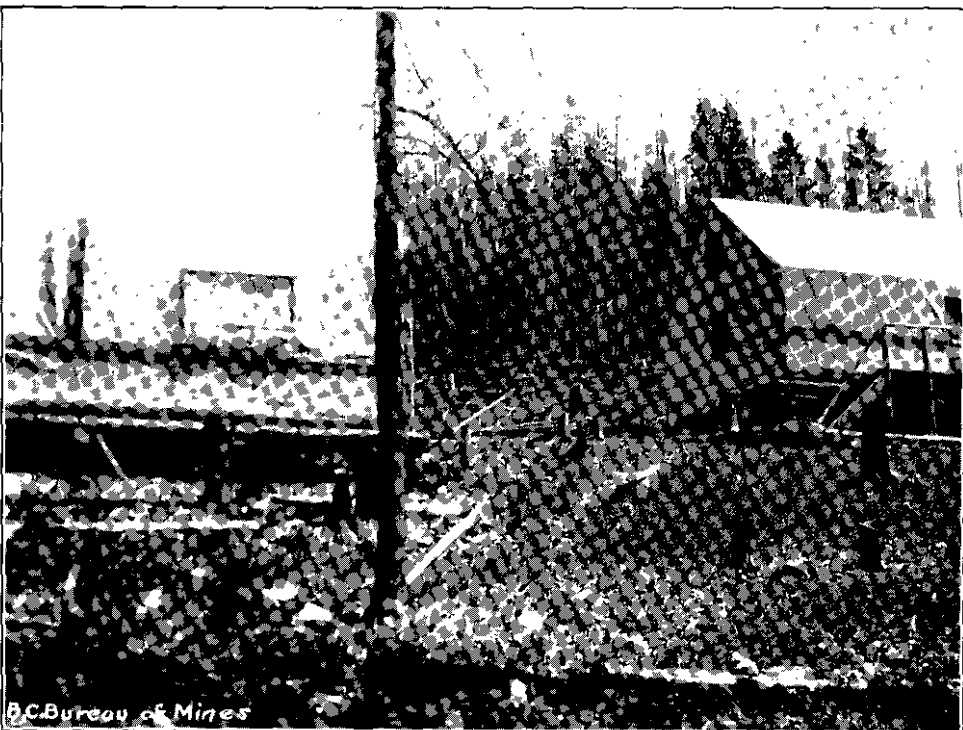
The hydraulic mines of the Cariboo had a poor year, due entirely to an insufficiency of water-supply, caused by an unusually dry season. Rains late in the fall enabled some fall clean-ups to be made, but the gold production from hydraulic mining was much less than would have been the case under normal water conditions. Notwithstanding this, the placer-gold production of the Cariboo District was more than twice that of 1921. The total production of placer gold for the North-eastern District for the year 1922 was \$197,800.

In the 1921 Annual Report, a portion of the report headed "Prospecting Possibilities" gave an outline of the North-eastern District with regard to the opportunities for prospecting. It is not necessary to repeat this in this report, but it should be emphasized that there are many parts of the district that offer considerable possibilities to the prospector.

The Babine range has been examined at several points in past years and evidences of widespread mineralization occur. The developments of the past year have shown the probability of some of the discoveries becoming important mines. There is still, however, much of the



Henderson Mine, Hudson Bay Mountain, Omineca M.D.



Henderson Mine Camp, Omineca M.D.

Babine range which has not been gone over carefully and it is recommended as a promising section for the prospector.

OMINECA DIVISION.

SKEENA SECTION.

Usk.

In the vicinity of Usk development operations and prospecting were continued throughout the year, but no ore shipments were made. Some local excitement was created in the fall of the year by the reported discovery of rich placer-ground on Kleanza (Gold) creek, but apparently the ground was not as rich as reported.

The town of Usk has depended largely on the lumbering business, but for some time past the three sawmills near the town have been closed down. With the improvement in the lumber market, the big mill of the Kleanza Company was started, and it is expected that it will be kept in continuous operation. Besides its sawmilling and lumber business, the Kleanza Company is also a mining company and is engaged in developing certain mineral properties.

This company owns the *Cordillera* property, situated about a mile from Usk and **Kitsalas Moun-** a short distance from the Grand Trunk Pacific Railway. Development of the **tain Copper Co.** property has been carried out intermittently for the past five years. The main vein was developed by an incline shaft and then a crosscut tunnel was run to cut this vein at a depth of 150 feet below the surface. The vein was found, but unfortunately it contained little or no values, consisting almost entirely of white quartz. Attention was then turned to developing what is known as the "blind-vein," which was exposed in the crosscut tunnel, but was not known to crop on the surface. This vein was drifted on and a winze sunk on it, 30 feet deep. Much trouble was experienced with water, so a lower crosscut tunnel was started which would cut the vein at a further depth of 80 feet below the top of the winze. This tunnel was completed this summer, having been driven 400 feet to where the vein was struck, the distance being almost exactly as had been calculated. Where cut, this vein has a width of from 10 to 12 feet and carries some well-mineralized bands. The gangue is quartz and the mineralization is with bornite, chalcocite, and free gold. It is considered that from 4 to 5 feet of the vein is sufficiently mineralized to constitute milling-ore.

This property has been previously described in several Annual Reports. It is equipped with a small mill consisting of a Gibson grinder and Wilfley table with incidental machinery. Work is to be carried on all winter with a small crew of men and will consist of drifting on the vein. It is hoped that a sufficient tonnage of milling-ore will be developed by spring to start the mill. All mining is done by hand as no power plant has yet been erected.

The properties owned by this company have been described in previous years. **Kleanza Co.** Some further surface work was done during the summer, but not as much as in former years. A careful examination of the properties of the company was made during the summer by D. C. MacKay, a mining engineer from South Dakota, who advised a continuation of the work of surface development.

Kleanza Creek.

The usual annual assessment-work was done on a number of groups of claims at the head of Kleanza creek. The showings (which have been described in previous Annual Reports) consist of sheared and sheeted zones containing irregular deposits of chalcocite, bornite, and chalcopyrite. In places there are small bands of high-grade copper sulphides, but the showings as a whole must be considered as large deposits of low-grade ore. The depression in the copper market has made it rather difficult to interest any one in the development of such properties, but undoubtedly the showings warrant more extensive development. Further work was done during the year on the piece of new trail from Usk to the head of Kleanza creek.

From time to time, in past years, Kleanza creek has been prospected and worked for placer gold. The most important attempt was that of the Cassiar Hydraulic Company, which is described in the 1914 Annual Report. This company only operated a short time and then closed down owing to lack of funds.

Kleanza creek is a rapid mountain stream rising in the Kleanza range and, flowing westerly, joins the Skeena river near the town of Usk. For most of its 20 miles of length the creek flows in a narrow deep valley with the lower slopes steep and the higher ones flatter. There are many

rapids, waterfalls, and rocky canyons along the stream. Towards the mouth there are a few terraces in the valley, and it is apparent that these represent gravel-bars left stranded at successive stages of creek-deepening. The creek-valley has evidently been scoured by glacial erosion, and to a great extent the present gravels are of recent origin, together with some glacial material reworked by stream-action. The bed-rock is mainly a granitic rock and the pebbles in the gravels mostly granite and diorite.

The gold is flat, well worn, and not very coarse. There is no evidence of old Tertiary gravels or the character of gold associated with such gravels. The terraces or benches along the valley may consist of gravels where the conditions of formation caused a certain amount of concentration of the gold in the gravel. Such benches, therefore, may be found to carry sufficient gold to pay for hydraulicking.

During the summer prospecting was commenced by Joe Marcheldon and George Minchin and two claims were staked about $1\frac{1}{2}$ miles above the mouth of the creek; this is just a short distance above the old plant of the Cassiar Hydraulic Company. Two other claims have been taken up by others and a lease applied for farther up-stream by the Kleanza Company.

The place being worked by Marcheldon and Minchin is on a bench close to the creek, but about 65 feet above it. The deposit consists of 2 feet of soil and sand on top, and then 2 to 4 feet of gravel. The bed-rock apparently pitches slightly into the hill and there are some very large boulders. The method of working is with a sluice and grizzly, but is on a small scale. Not much ground has been handled and it is doubtful if wages can be made by this way of working.

Farther down-stream the owners intended to work a bench by means of a ground-sluice from a small pond. This pond collects seepage-water from the steep hillside of the valley, and it was considered that in the wet season sufficient water would be obtained for ground-sluicing. It is possible that proper testing of the benches along the creek would show sufficient values to warrant the installation of an hydraulic plant. There is plenty of water in Kleanza creek for hydraulicking and plenty of fall from the benches to the creek to get rid of tailings.

Legate Creek.

It was pointed out in last year's report that there are a number of claims at the head of Legate creek which have showings of high-grade ore, which should prove attractive for further development. The locality is easy of access and the distance from the railway, 12 miles, is not prohibitive. It is to be regretted, therefore, that another year has passed with but little activity in this section. Assessment-work and small-scale work was carried out by the owners, but development of mineral properties cannot proceed quickly by the unaided efforts of the prospector-owners. It is to be hoped that some of the scouting engineers will pay a visit to this section next year.

Fiddler Property, Dorreen.—Development of this property was carried out during the summer with a small force and is being continued. Plans are now being prepared for the erection of a small mill on the property and it is expected that this work will be carried out next year. (For a description of the property see the Annual Report for 1916.)

HAZELTON SECTION.

The *Silver Standard* mine has been described in detail in several of the Annual **Silver Standard.** Reports from 1911 to 1919; a plan of the workings was included in the 1920 Report. The mine was reopened in January and operations were continued for about three months, when it was again closed. Approximately 900 tons of ore was mined and milled during the period of operation, producing 165 tons of concentrates, containing 45 oz. gold, 20,191 oz. silver, 21,071 lb. zinc, and 30,979 lb. lead. The property is now in the position that further development is required, as most of the ore above the 250-foot tunnel has been stoped out. A low-level tunnel giving an additional 200 feet of depth was started two years ago and driven in about 1,000 feet. To strike the No. 4 vein an additional 400 feet will have to be driven and about 900 feet to strike the main vein. The future plans of the company are not known.

Nine-mile Mountain.—In the fall of the year a lease and bond on the *Sunrise* property on Nine-mile mountain was obtained by W. S. Harris and small-scale work was started. There are a number of silver-lead properties in this section which have been partially developed. Descriptions of the various workings can be found in previous Annual Reports.

Boulder Creek.

This property, consisting of four claims and owned by Macdonald & Hicks, **Sultana Group.** was described in detail in the Annual Report for 1921. It is situated at the head of the South fork of Boulder creek and is distant about 12 miles from the Grand Trunk Pacific Railway, the nearest station being Seaton. The property was re-examined this year, and as the showing is a promising one it is considered advisable to repeat the description in this report.

The claims are situated on the east side of the basin at the head of the South fork of Boulder creek. The showings are at an elevation of 5,300 feet above sea-level on a flat bench well above timber-line.

The rock formation at this point is a typical coarse-grained granodiorite, which in other places is seen to be intrusive into older volcanic measures. On the claims the only rock in evidence is the granodiorite. The surface outcrop of the ore-body is an iron-capping and is apparently of the nature of a sheared zone. This ore-body has been exposed on the surface for a distance of about 125 feet and has an apparent width of from 4 to 20 feet. Attempts to find a continuation of the ore-body to the north and in a small bluff to the south have not been successful. This may be due in part to the fact that the deposit is capped over in these places with unaltered granite and oxidized material. Furthermore, the depth attained in the surface prospecting nowhere amounts to more than a few feet. There is such a strong showing in the one place that it is highly probable that it will have some continuity in length.

The sulphides present in the ore-body are pyrite, tetrahedrite, and small amounts of galena and chalcopyrite; a few specks of molybdenite were also noted. The pyrite is present in considerable quantity and some of it may be arsenopyrite. The surface of the deposit is turned into a typical iron-capping by the oxidation of the iron sulphides, with a plentiful distribution of iron oxide scattered through decomposed granitic rock-matter. There is not any great development of quartz in the deposit, the gangue consisting mainly of somewhat altered granite.

The following table of assay results is made up from results obtained last year and this year; the first five samples being taken in 1921:—

Description.	Gold.	Silver.	Copper.
	Oz.	Oz.	Per Cent.
Across 8 feet near upper end of cut.....	0.02	29.0	1.7
Across 10 feet continuing down cut from first sample.....	0.06	59.0	5.2
Selected ore from two bands of sulphide in the cut.....	0.10	86.0	13.2
Selected ore showing grey-copper.....	0.06	112.0	16.0
Grab sample from dump from small cut 50 feet south-west of big cut.....	0.01	31.5	3.7
Across 6 feet, main cut.....	0.04	34.0	5.8
Across 9 feet, main cut, continuation down the cut from preceding sample....	0.22	60.0	0.5
Across 2 feet, small cut near large cut.....	0.12	100.0	1.0
Across 4 feet from small pit.....	0.06	40.0	5.2
Across 4 feet from cut beside pit.....	0.12	26.0	Trace.

Samples were taken from the small bluff 200 yards to the south, where some holes were dug this year in order to find the extension of the ore-body, but these did not carry any values. At this point the granodiorite is slightly oxidized and rusty with iron oxide, but no mineralization with sulphides was to be seen. The samples taken this year were in the nature of checks of the samples taken last year, and it will be noticed that the average value in the big cut remains about the same—namely, nearly 50 oz. silver to the ton. At this point the width of the ore-body is over 15 feet.

It was possible to sample the small pit and open-cut beside it more thoroughly this year than last, owing to there being no snow on the ground. There is at this point a showing of ore from 4 to 8 feet in width which will assay from 30 to 50 oz. silver to the ton.

Although not proven to any great length, this showing is a decidedly promising one and certainly warrants some development-work; it should be an attractive property for some of the scouting engineers to bring to the attention of their principals.

The situation of this property is a favourable one. The ore could be handled nicely by a short tram down to a point on Boulder creek, from which a good wagon-road on an easy grade

could be made to the railway. The length of this road would probably not exceed 10 miles. There is plenty of timber for mining purposes close to the property and on Boulder creek and its branches a certain amount of water-power is available.

This locality is one which warrants much further prospecting than it has been given. Some years ago the country lying between Rocher Déboulé and Hudson Bay mountains was roughly prospected, but much of it was never even gone over and in recent years no prospectors have been in to it. The country is mountainous, with several creeks rising in the mountains and flowing easterly to the Bulkley river, such as Porphyry, Boulder, and Gramophone creeks. The rock formations exposed are mainly sediments and volcanics of the Hazelton formation, intruded by granodiorites and porphyries. Such geologic conditions are favourable for the occurrence of mineral-bearing deposits. Prospectors are therefore advised to consider the possibilities of this section.

TELKWA SECTION.

The name "Telkwa section" is used to embrace a large area of country including Hudson Bay mountain, Telkwa river, and several camps in the Babine range. All these different mineral camps are tributary to the towns of Telkwa and Smithers, both situated on the railway-line in the Bulkley valley. Smithers is a divisional point on the railway and is the starting-point for the various properties on Hudson Bay mountain and Driftwood creek. Telkwa is situated 10 miles up the railway from Smithers (south-easterly), and a few years ago, when there were many prospectors in the hills, was an important outfitting-point. It is now the centre of an extensive agricultural district, in addition to being a distributing-point for supplies to mining operations in the Babine range and up the Telkwa river. In recent years the mining properties tributary to Telkwa have not been very active, but during the season of 1922 indications of a revival were evident. Development of any of the coalfields on the Telkwa, Morice, or Zymoetz rivers will be of importance to Telkwa, as it is the natural outlet to the railway for these fields.

Dome Mountain.

In the following report on Dome Mountain camp no attempt has been made to give detailed descriptions of the different properties, but the camp as a whole has been treated in a general way. Among the properties described are the *Gem* and *Cabin* groups, the *Forks* showing, and claims owned by Heslip, Hoops & Chisholm.

Introduction.—Dome Mountain camp is situated in the Babine range, about 23 miles east of the town of Telkwa, a station on the Grand Trunk Pacific Railway. The route to the camp is by wagon-road for 8 miles and by a good trail for the remaining 15 miles.

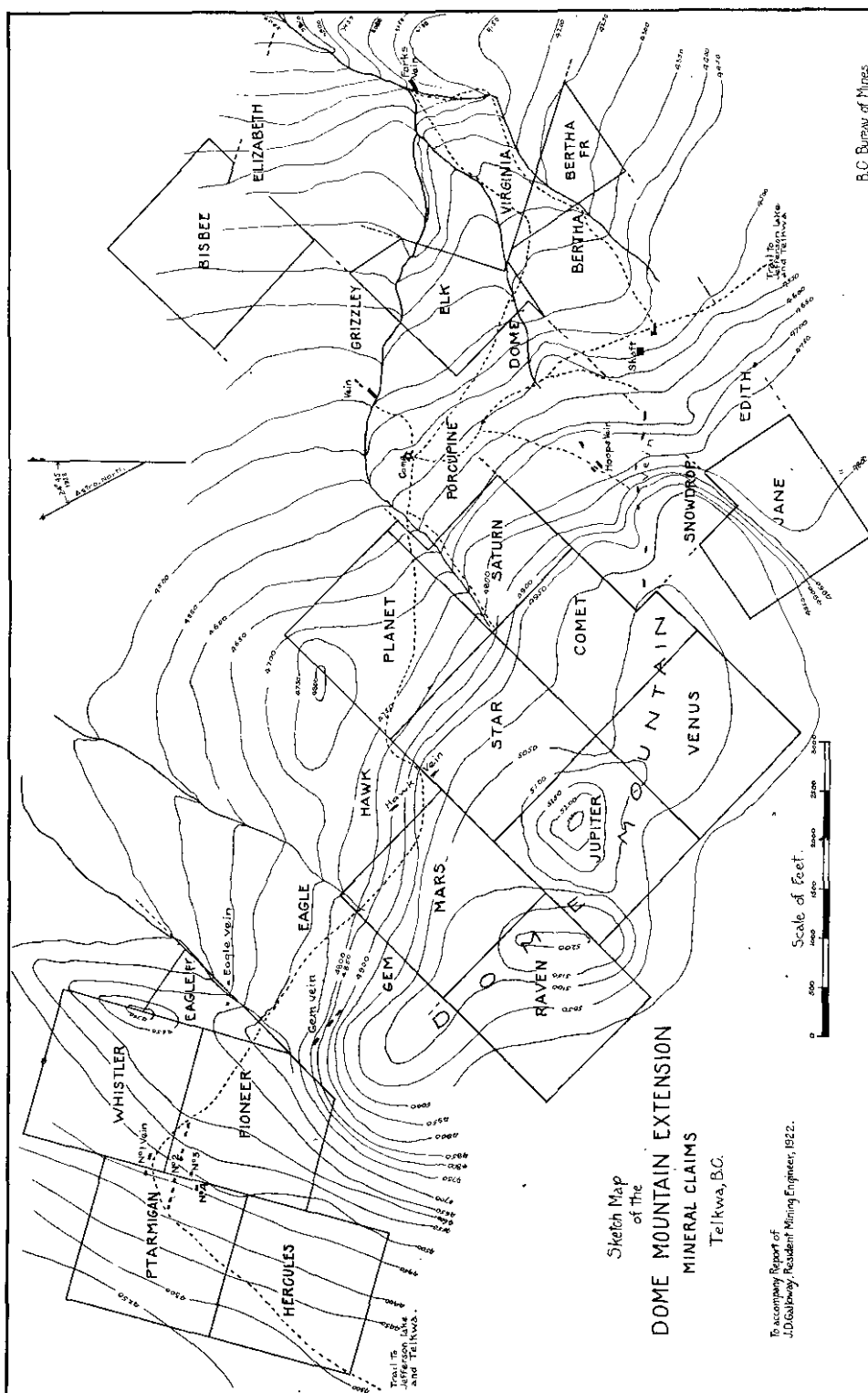
The mountain is a prominent mass, somewhat flat-topped, and is conspicuous because it is surrounded by country at considerably lower elevations. As the name indicates, the mountain is dome-shaped and a considerable area lies above timber-line, which is at an elevation of about 4,500 feet; the highest point of the mountain is 5,300 feet elevation.

Mineral claims were staked on Dome mountain at least eight years ago, and possibly before that. From twenty to thirty claims have been held in the camp, but in the aggregate very little development-work has been done. Until the summer of 1922 the work done consisted of the annual assessment-work, and in many cases the claims were allowed to lapse and were restaked.

In the winter of 1921-22 options were obtained on all the more important claims on the mountain by T. E. Jefferson. In all, Mr. Jefferson controls by option or location about twenty claims or fractional claims on the mountain.

During the summer of 1922 Mr. Jefferson commenced a systematic examination of the property. From ten to fifteen men were employed and an assayer was secured, so that samples could be determined on the ground. The work done consisted mainly of surface-stripping and crosscutting of the veins, so as to open them up for proper sampling. The assayer, A. J. Gaul, was kept busy and much useful information was obtained.

Geologic Discussion.—The rock formations of Dome mountain consist, predominantly, of volcanic rocks and by far the larger part of these are of an andesitic type. Red and green andesites are the most frequent rock types seen. In places there are some sedimentary measures interbedded and intercalated with the volcanics. The whole area has been affected by regional metamorphism, with the result that broad bands of schistose rocks occur. These schistose bands or lines of shearing are of importance, as it is in them that the quartz veins occur. The



sedimentary rocks are in many places sufficiently metamorphosed to become metamorphic rocks, as argillite, slates, etc. Much secondary calcite is developed in places throughout the rocks.

The mineral-showings of Dome mountain consist of a series of quartz veins, which belong partly to the filled-fissure type and partly to the replacement type. In width these veins vary from a few inches up to many feet. A series of small veins which have a general north-west strike are exposed on the higher parts of the mountain above timber-line. They are characterized by their continuity in length.

Two large veins occurring on the eastern slope of the mountain have a strike of roughly north-easterly or nearly at right angles to the other series. These veins have not as yet been proved for any considerable length, but it is to be expected that they would be as continuous as the veins exposed higher up on the mountain.

The gangue-filling of these veins is largely quartz, but in places there is some siderite and calcite. The metallic minerals present are pyrite, arsenopyrite, chalcopyrite, galena, and zinc-blende. The iron-sulphide minerals are the most abundant, and undoubtedly these are the important minerals, as they contain most of the gold content of the ore. The chalcopyrite and zinc-blende content is unimportant commercially, and probably would not affect adversely any treatment process for the ore. In some places the galena content becomes appreciable, and as it carries approximately an ounce of silver to the unit of lead, it is of some importance. The main value in the ore, however, is the gold content, and it is on the basis of gold ore that the camp must be considered.

All the veins do not contain all the five sulphides enumerated, and as a rule only the iron sulphides are abundant, together with small amounts of galena. Although containing several sulphides, the ore cannot be considered as an unusually complex ore, and there seems little doubt that a suitable treatment process for it could be easily devised.

The outcrops of the veins are in places oxidized, but oxidation is only a surface feature and does not as a rule continue to more than a few feet in depth. The usual oxidation minerals, such as limonite and copper carbonates, are found, but are quite unimportant.

No exact tests have been made to determine in what minerals the gold is contained, but it seems highly probable that the arsenopyrite is the most important gold-bearing sulphide, with pyrite and chalcopyrite also containing some gold. Some free gold may occur in the pure quartz, free from sulphides, but this point has not been settled.

The silver content shown in the assays comes partly from silver alloyed with the gold, partly in the iron sulphides, and, where high, from the galena content.

Description of Showings.—It will be unnecessary in this report to describe all the open-cuts and workings on the various showings on the mountain, and only the more important will be considered.

As indicated before, there are a number of small veins on the mountain; these vary in width from 6 inches to about 3 feet and are very persistent in length. They have been developed by open-cuts and shallow shafts and have been described in previous Annual Reports of the Minister of Mines. Some of these small veins are well mineralized, and on development might yield sufficiently continuous ore-shoots to pay to work.

One vein known as the *Jane* has been exposed at intervals for a length of nearly 5,000 feet. In many places it is small and nearly barren of values, but in others carries a high percentage of sulphides and good gold values. This is the vein on the Higgins property, where a short tunnel was driven on it showing it to be from 6 to 12 inches wide and carrying about an ounce of gold to the ton. At the other end it is possible that this is the vein in the Chisholm shaft, where it is larger. From this shaft 14 tons of ore was shipped which returned about \$50 a ton in gold.

There are two veins on the Heslip property which are from 6 inches to 2 feet wide and show in places high-grade ore. A large showing of ore on the Hoops property was further prospected this summer, when it was found that the vein was lying flat and was not as wide as had been supposed.

All these small veins were sampled during the summer by Mr. Jefferson, and where necessary some work was done, so that the sampling could be properly done. His results show that these small veins may yield considerable tonnages of ore that can be treated at a profit if a mill were erected to handle all ore from the camp.

The showing on the *Cabin* group is a quartz vein, striking N. 45° E., which is about 10 feet wide. It is situated a short distance from the camp and the outcrop is in the bed of a creek; the stream, running at right angles to the strike of the vein, has exposed the quartz by cutting down through the overlying surface wash.

The vein consists of massive quartz slightly mineralized with pyrite, arsenopyrite, and traces of galena. The gold values are low, from \$2 to \$5 a ton, but the vein is a very well-defined one and it seems quite possible that somewhere it will be found to contain shoots of ore carrying a higher sulphide content and a corresponding higher gold value. This vein had only been traced a short distance on the surface when the writer saw it, but work done after that exposed it 200 feet to the east of the creek and with better values.

The important showing on the mountain is that known as the *Forks*. It is so described because the outcrop of ore is in the bed of a creek immediately below the confluence of two small creeks; that is to say, the ore is at the "forks" of a creek.

This showing was developed some years ago by the then owner, Geo. Hazelton, but owing to the surface conditions little was accomplished. The surface at this point, unless where scoured by the creek, is heavily overlain by glacial clays and gravels, and it is a decidedly difficult place to do any efficient work. It is also apparent that the vein is in part capped by schistose rock, so that the attempt to find the vein up and down the creek by tunnelling has only been partially successful. Hazelton drove two short tunnels which showed evidences of the vein, but these were at places where the quartz was mixed with schist and also leached out.

Considerable work was done this summer on the actual outcrop in the creek-bed and on the sides of the creek adjacent thereto. This has resulted in showing up a remarkable body of gold ore, covering, roughly, an area of 50 by 200 feet. It is impossible to say at present just what width this vein has, as it may be faulted so as to increase the apparent width, or it may be a large shoot at an intersection, but it seems fairly certain that it has at least a width of from 20 to 30 feet. Mineralization of the quartz with sulphides is irregular, but in the aggregate the sulphides form from 5 to 10 per cent. of the mass. In places there is a considerable development of galena, but pyrite and arsenopyrite are in the greatest abundance.

A short distance down the creek from this showing a tunnel was driven this summer into the steep bank rising from the creek. It was expected that this would strike the continuation of the vein, but this was not successful. The strike of the vein, where showing, is N. 30° E., but there is considerable doubt as to whether or not this is a true strike. Apparently the tunnel went across the vein near the portal, when still in clay and slide material, before the solid formation was reached. Other attempts were made to find the vein along its strike, both up and down the creek, by digging through the surface wash to bed-rock; all these were unsuccessful.

From the experience gained by the work done by Hazelton and that done this summer, it seems useless to prospect any more for this vein on the surface. It will be necessary to prospect the vein by sinking. A suitable place for sinking would be in the small bluff lying between the two small creeks just above the forks. The vein outcrops at this point, but is more or less capped with schist. By sinking at this point no great trouble should be experienced with water, except possibly in extreme high water in the spring; a small pump would probably handle any flow of water made by this shaft.

The rock formation that this vein occurs in is a reddish andesite, which in many places is altered into a schist. The crosscut tunnel driven this summer below the showing is in argillite at the face, which indicates that the vein has been passed and there would be no use in continuing the tunnel any farther.

A tabulated list of values will be given later, but it may be said here that the ore of the *Forks* showing is surprisingly high grade. Average samples across 10 to 15 feet show from \$20 to \$30 a ton, while grab samples of the large dump usually show about \$80. It is practically impossible to get any average sample that will run less than \$10 a ton. It may safely be said that there is here a body of ore that has a width of at least 30 feet that will average at least \$20 a ton.

From the small veins on the mountain there is excellent evidence of the continuity of the quartz in this locality, and they are not only continuous as veins, but the mineralization with sulphides is also fairly continuous, although, of course, in places they are almost barren of values. The two large veins so far known on the mountain are identical in type with the small veins, and it is therefore quite reasonable to suppose that they will also prove to have considerable length.

Veins such as these are almost certain to continue to considerable depths and the only question is as to continuity of values. The ore is a primary one and as such may be expected to prove continuous, but probably it will occur in the veins in shoots, with barren spaces between.

Values.—No attempt was made by the writer to systematically sample all the workings on the mountain; time was not available for this, and in any case it was quite unnecessary, as all the results of Mr. Gaul's assaying were available. It was apparent that the sampling and assaying done by Mr. Gaul was quite thorough, and that an intelligent estimate of the various showings could be arrived at from a consideration of his results.

A number of samples were taken by the writer when examining these properties in 1918 and a few more were taken this year. The following table of assays is compiled from these, together with a number from Mr. Gaul's results:—

Description.	Authority.	Gold.	Silver.
		Oz.	Oz.
La Petite, across 10 inches.....	Galloway, 1918....	8.00	8.00
" grab sample of dump.....	" "	1.00	2.00
Heslip, across 12 inches.....	Gaul.....	1.24	2.00
Hoops, across 3 feet.....	"	1.28	5.00
Jane, across 2 feet.....	"	4.34	10.46
Cabin, across 10 feet.....	"	0.08	1.60
" selected ore.....	"	1.28	5.00
" average of dump.....	Galloway, 1922....	0.20	2.50
Forks, across 25 feet.....	Gaul.....	5.40	2.84
" across 6 feet.....	"	1.55	0.41
" across 10 feet.....	Galloway, 1922....	1.68	3.00
" grab sample of dump.....	" "	4.08	4.00
" Hazelton tunnel dump	" 1918....	1.62	4.20

The above samples are fairly representative of the ore on the mountain, although, of course, there are barren places in all the veins which will not assay as well. The evidences of value, together with the promise of continuity of the veins and mineralization, make this proposition a most desirable one to develop.

General Remarks.—The mineral properties on Dome mountain are situated within reasonable distance of transportation, as a good wagon-road can be put in to the town of Telkwa, with a distance of approximately 20 miles. If the properties develop so as to show substantial tonnages of ore, a plant to treat this ore would be erected on the ground, and the product of such plant would be either gold or a high-grade concentrate that would stand transportation, or both. The ore will not present any complex problem in treatment.

There is plenty of timber available for mining purposes, camps, etc. It is not known if there is any suitable water-power within reasonable distance that could be developed to supply power for mining and milling, but as the country is mountainous it is possible that a small power may be found. There is an abundance of water for all milling purposes.

The mountain is not rugged and inaccessible, as is often found in this part of the country. Camps could be built and mining operations carried on without any danger of snowslides, and there would be no difficulty in carrying on operations the year round.

Development of the *Cabin* and *Forks* showings will of necessity be by shaft-sinking, but this will present no unusual difficulties. Some of the small veins on the higher part of the mountain may be developed partly by tunnelling.

The important showing at the present time is the *Forks* one, and to begin with, it should be vigorously developed. If the development of it turns out as is indicated by the surface showing, a mill will be required to treat the ore. With milling facilities at hand, it will then probably be found that some of the other showings on the mountain can be profitably worked.

Driftwood Creek.

Driftwood creek is a tributary of the Bulkley river, which rises in the Babine range to the east of the town of Smithers. From the main wagon-road going up and down the Bulkley valley a branch road extends up Driftwood creek for 5 or 6 miles. From the end of the road the McCabe trail starts, which goes up to the head of one branch of Driftwood creek. Several

branch trails from the McCabe trail go to different mineral properties; one of these extends to the head of the main creek and over the Driftwood divide to Highland basin and Cronin's mine. There are a number of mineral properties situated in this part of the Babine range which are served by this system of trails radiating from Driftwood creek. (See map in 1921 Annual Report.)

The most developed property is that of the Babine Bonanza Company, better known as "Cronin's mine," which has been described several times in previous Annual Reports. No work was done on this property this year. A rough sketch-plan showing the approximate location of many of these properties was included in the Annual Report for 1921. Information about many of the properties in this section has also been given before.

The section was again visited this year and some properties examined that had not previously been reported upon and others on which new work had been done.

This area of country consists largely of a series of interbedded volcanics and sediments, which, however, have been considerably metamorphosed, with the result that schistose rocks are of frequent occurrence. This series has been intruded by a rhyolitic type of rock which varies from a true rhyolite to granodiorite. This intrusive occurs as irregular masses and dykes and it is evident that it has been the mineralizing factor in the district.

Mineralogically, there is a considerable diversity of types for relatively such a small area. The galena-zinc-blende type is predominant, but there are, in addition, deposits of high-grade copper sulphides and the chalcopyrite-pyrite type. A list of the metallic minerals found in the various showings would include: Galena, zinc-blende, grey-copper, bornite, chalcocite, stibnite, arsenopyrite, pyrite, chalcopyrite, and oxidation products therefrom. Most of these sulphides are of primary origin, but in one instance the ore carries considerable native silver and silver sulphides, which are of secondary origin, possibly by breaking-up of the grey-copper.

The various ore-bodies are of different types, including quartz-filled fissures, contact ore-bodies, replacement sheared-zone fissures, and irregular disseminated deposits. The important ore-body of the Cronin mine is a contact deposit lying between rhyolite and black schist. This ore-body is typical of several in this section and has been sufficiently developed to show its general character. To this type belong the showings on the *Victoria* and *Highland Basin* groups. As a rule, the ore is developed at or near the contact, but does not extend into the schist. The ore occurs in solid bands or disseminated through the rhyolite. The shoots of ore are irregular in occurrence, but this type of ore-body gives possibilities of large pay-shoots.

This property is situated in Highland basin, which is a basin on the Babine Lake slope, opposite the head of Driftwood creek in the Babine range. The property is distant about 20 miles from Smithers, the first 12 miles of which is by road and the remainder a good trail. Martin Cane and Tommy King are the owners. There are a number of showings on this property, but the principal one is a contact ore-body lying between slate and rhyolite. It is developed by several open-cuts and a tunnel which is in about 30 feet. This tunnel cuts several mineralized bands and there are showings of ore in the different cuts. The contact is an irregular one and the surface outcrops are broken and considerably oxidized. The general strike of the ore-zone is north-east (mag.) and it has a dip of 45° to 60° to the south-east. In places there are alternating bands of quartz, rhyolite, and schist; widths of 3 to 6 feet of milling-ore are exposed by the development. The ore consists of quartz, siderite, and rhyolite gangue containing variable amounts of galena, zinc-blende, grey-copper, pyrite, arsenopyrite, and chalcopyrite.

Narrow streaks of solid grey-copper occur in places, and also bands of mixed galena and zinc-blende. High gold values occur in places, probably associated with the copper and iron sulphides. The following are the results of assays of samples taken:—

Description.	Gold.	Silver.	Lead.	Zinc.	Copper.
	Oz.	Oz.	Per Cent.	Per Cent.	Per Cent.
Selected ore from dump.....	4.12	128.0	24.5	17.0	1.5
Selected grey-copper	1.60	1,170.0	....	....	26.0
Sample across 5 feet	0.14	78.0	5.0	....	1.5

There are several other showings on the property consisting of stringers of ore and in one place a well-defined quartz vein from 3 to 4 feet wide, which, however, is only slightly mineralized.

From one place a 4-inch band of clean galena and grey-copper was stripped off and 2½ tons of ore shipped some years ago; this gave returns of 179 oz. silver and 52 per cent. lead. This ore lay on a steeply inclined wall on a small bluff where a creek cuts through.

The first showing described is a promising one and warrants systematic development. The present owners of the property are excellent workers and have been successful by their work during the past season in showing the property to much better advantage.

This property is situated on the easterly slope of the Babine range, about **Victoria Group**, 3 miles easterly from the Driftwood Creek divide; it is owned by P. J. Higgins, of Spokane, and partners. The showings on this property belong to the contact type of ore-body, but here there are more or less well-defined veins occurring in the schist close to the rhyolite contact. A full description of the property can be found in the 1918 Annual Report. Since that time the tunnel has been driven ahead on the main showing a further distance of 50 feet, or a total length of about 180 feet.

This property is situated about a mile from the *Victoria* group and just over the divide of the East fork of Driftwood creek, up which the McCabe trail runs. It is owned by Martin Cane and Tommy King. At this point the formation consists of schist and volcanic rocks, which range in composition from rhyolite to andesite. The contact between the schist and igneous rocks is irregular and plunging, and apparently the rhyolite is intrusive into the schist.

The showing on the property consists of a small quartz vein which follows very closely the contact between the schist and the rhyolite. It is developed by a drift-tunnel 100 feet long. The vein varies in width from a few inches up to 1 foot and is well mineralized with grey-copper, which occurs usually as bands a few inches wide within the quartz gangue. Along from the portal of the tunnel there is a large open-cut showing a vein in rhyolite which probably has some connection with the tunnel vein; it may be a portion displaced by faulting.

The tunnel vein strikes N. 8° W. and dips to the west. At the face of the tunnel the vein is 8 to 10 inches wide and fairly well mineralized. The selected grey-copper carries high silver values, from 200 to 800 oz. to the ton.

This property is situated on the East fork of Driftwood creek and is reached **Shamrock Group**, by a short branch trail from the McCabe trail. The owner is J. Carson, of Smithers. There are five claims in the group—*Shamrock No. 1* to *No. 5*. The vein, which is from 1 to 3 feet in width, is a replacement fissure, occurring in red andesite. The gangue is brecciated andesite and calcite with no quartz, and the metallic minerals are bornite, covellite, and chalcocite; some native copper and red oxide occur, but in unimportant quantities. The copper minerals occur as a well-defined pay-streak on the hanging-wall from 2 to 8 inches wide. This ore is high grade, as it carries, in addition to the copper, good silver values.

The vein crops out on a sloping hillside above timber-line and is developed by some open-cuts. A sample across 2 feet of the vein, excluding the rich pay-streak, assayed: Gold, trace; silver, 3 oz.; copper, 0.9 per cent. Another sample of selected high-grade ore returned: Gold, trace; silver, 68.5 oz.; copper, 46.4 per cent.

This property is situated at the head of the East fork of Driftwood creek and **Iriquois Group**, it is reached by the McCabe trail. Formerly this group and other claims were known as the *Social* group and owned by McCabe & McPhee. Now the ownership is split up and certain claims are owned outright by McCabe and the others by McPhee. The *Social* group was described in the 1918 Annual Report. The vein described in that report as being developed by tunnels is now taken in by the *Iriquois* group, owned by P. McPhee. The other showings are mostly on ground now held by A. W. McCabe, but no further development has been done on them.

A very good season's work was done by Mr. McPhee this year, working alone. He drove a tunnel on the vein a distance of 80 feet, starting at a point 100 feet below the old McCabe tunnel. The vein is a replacement fissure, varying in width from a few inches up to 4 feet and occurring in andesite. The ore-minerals present are copper-glance, grey-copper, malachite, and azurite. The sulphides have been very considerably oxidized, with the result that copper carbonates and iron oxides are freely distributed throughout the vein and exceed in amount the sulphides present. The tunnel driven this summer has been disappointing, as, although the vein is continuous, it is completely leached out and shows little mineralization. The surface showing of mixed carbonates

and sulphides looks promising, and if the vein were found where it is not leached out it may be well mineralized.

**Silver King
Group.**

(See previous Annual Reports.) This property is situated at the head of Driftwood creek and is owned by P. J. Higgins and partners. During the summer W. Foley and E. Lee started work on the property on an agreement to do certain development for a small interest in the property. The exploration of a vein on the east side of the basin, which had not previously been developed, was started. A crosscut tunnel was being driven and at the time of visiting the property it was in 35 feet.

The vein is a replacement fissure, striking N. 50° W. and dipping to the north-east at 60°, and occurs in rhyolite. There are several bands and stringers of quartz, separated by rhyolite; one of these bands above the tunnel is about 3 feet wide and is slightly mineralized with grey-copper, galena, and chalcopryite. From 150 to 200 feet of tunnelling will be required to crosscut the vein. There is a good cabin on the property and it was expected that work would be continued all winter.

Hudson Bay Mountain.

The geological features of Hudson Bay mountain have been described by W. W. Leach in the Summary Report of the Geological Survey for 1908 and by the writer in previous Annual Reports of the Minister of Mines. It is desirable to recapitulate briefly.

Hudson Bay mountain consists dominantly of volcanic and tufaceous rocks belonging to the lower horizon of the Hazelton formation. The core of the mountain consists of an intrusive granitic rock ranging in composition from quartz porphyry to granodiorite. The volcanic rocks are mostly andesitic in composition, but diabase and rhyolite also occur. Andesite porphyrite and andesite breccia are of frequent occurrence. The Hazelton formation rocks have been more or less metamorphosed, partly owing to regional mountain-building forces and partly due to the intrusion of granodiorite in the centre of the mountain. Dykes are numerous, consisting, in part, of offshoots from the granitic core and others, which would seem to be contemporaneous with the volcanic measures. Undoubtedly the granitic intrusion and associated dykes have been responsible for the fracturing of the rocks and subsequent mineralization by being the source of the mineral-laden solutions and gases.

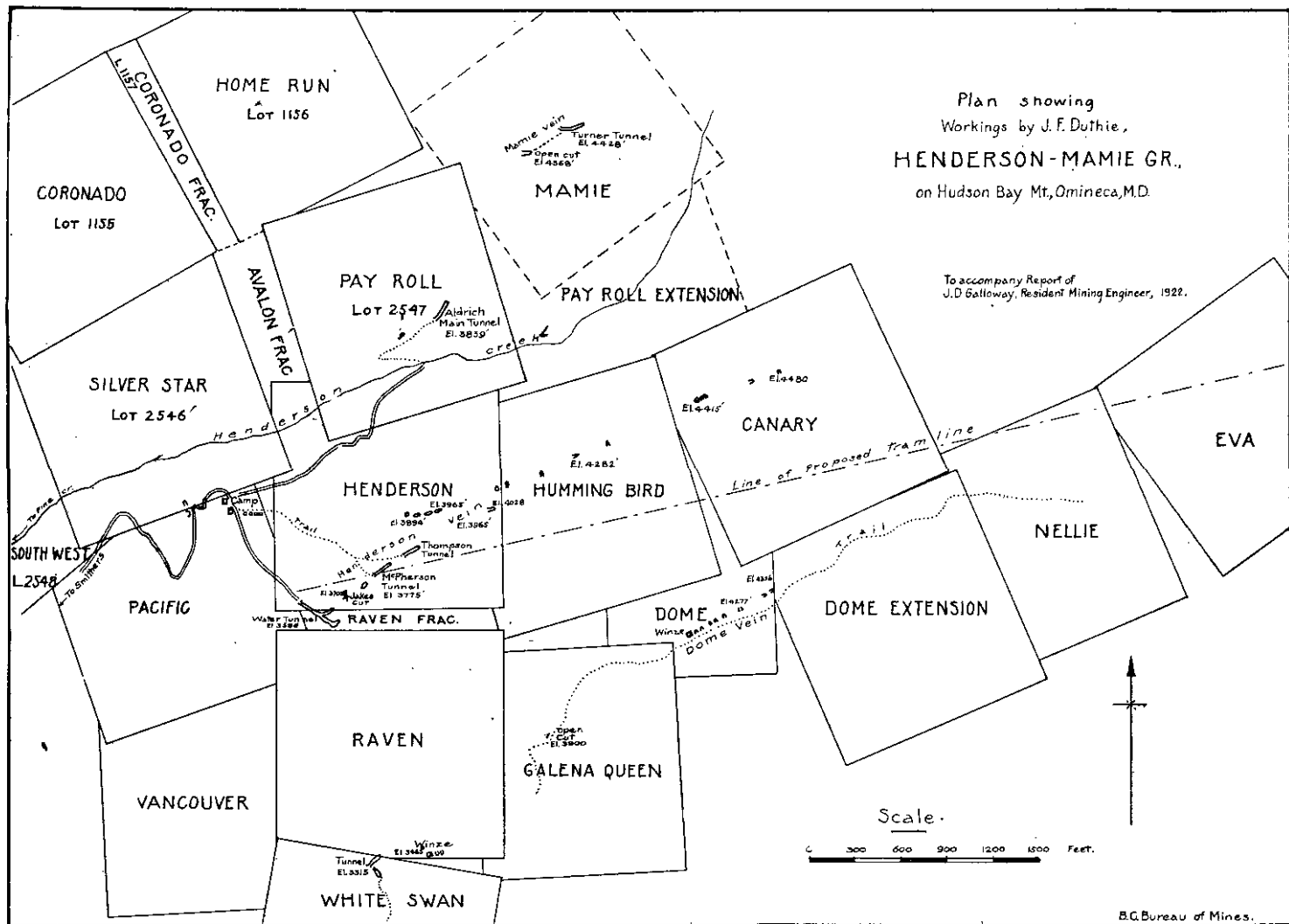
The veins on the southern slope of the mountain are mainly of the sheared- and sheeted-zone types, but in some instances have been described by Leach as mineralizations in and along the walls of dykes. In these cases the dykes must be considered as dyke-rocks belonging to the Hazelton volcanic series, and not apophyses from the granitic intrusive. As a rule, the gangue in these veins consists almost entirely of wall-rock in various degrees of silicification and alteration and but little true quartz. Calcite, siderite, and manganiferous minerals are sometimes present. The metallic minerals present are galena, zinc-blende, grey-copper, freibergite, arsenopyrite, pyrite, chalcopryite, and in one vein small amounts of ruby-silver and native silver. The surface outcrops of the veins are only slightly oxidized and in many places the sulphides occur right at the surface. The usual oxidation minerals, such as iron oxides, lead sulphate, and carbonates and copper carbonates, are found, but they are unimportant and, as a rule, only occur at or near the surface. The primary nature of the sulphides is self-evident and they should therefore continue to at least reasonable depths. The different sulphides are not found in all the veins; in some galena and zinc-blende are associated, in some arsenopyrite and zinc-blende, and in others the iron sulphides occur almost exclusively. Grey-copper (freibergite) is found in small amounts in several of the veins, but in the *Henderson* vein it occurs in considerable quantity.

It is apparent that the different minerals in these veins had not a contemporaneous deposition, but were successively precipitated. The order of deposition has not been worked out.

This group, which is owned by J. Aldrich, was secured under bond by J. R.

Mamie. Turner in 1919, acting for J. F. Duthie. Development was carried out until

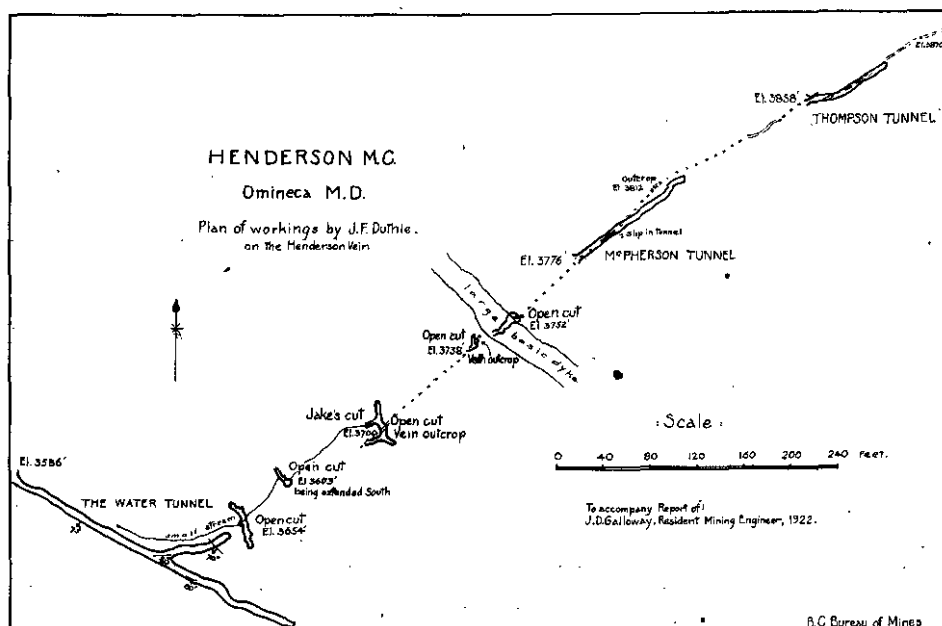
March, 1920, when owing to weather conditions the work was stopped. About the beginning of December, 1921, Mr. Turner returned to Smithers and made satisfactory arrangements with Mr. Aldrich to continue the bond on the property. Since that time work has been carried on as continuously as possible. The property is situated on the southern slope of Hudson Bay mountain at an elevation of 4,000 to 4,500 feet. The vein consists of a sheared zone, 4 to 8 feet in width, occurring in a light-coloured volcanic rock of a rhyolite type. The gangue-matter consists of wall-rock, practically unaltered; the ore-minerals disseminated through the gangue



in bunches and stringers are zinc-blende and arsenopyrite, together with a little chalcopyrite. Galena does not commonly occur in the ore, but in one place in the workings a small shoot of galena ore was uncovered. The most abundant mineral is the zinc-blende, but the most important value in the ore is gold, which is believed to be associated with the arsenopyrite. Low silver values are shown by some assays.

The development up to the time Mr. Duthie took over the property consisted of a 20-foot shaft and open-cuts and stripping, which exposed the vein for a length of some 400 feet up and down the hill. Development of the property by a drift-tunnel on the vein was commenced in 1917, but this tunnel had only been driven a few feet when the work was stopped. This tunnel was continued when the property was taken up by Mr. Duthie and driven 165 feet, in on the vein. Two winzes, 33 and 42 feet deep respectively, were sunk from this tunnel. The results of this work were to prove that the vein was continuous and well mineralized. Extensive sampling and assaying of the vein was carried out, and the conclusion arrived at by Mr. Turner, the manager, is that the vein as a whole will yield a good grade of milling-ore.

This vein outcrops up and down a gently sloping hillside, and it is impossible to get much depth by drift-tunnelling. It was therefore decided by the management to run a crosscut tunnel



to develop the vein at depth. A short distance to the east Henderson creek cuts a deep gorge into the mountain, so at this point the tunnel was started; it is 325 feet lower in elevation than the drift-tunnel. It is estimated that this crosscut will have to be driven 950 feet to cut the vein, and that this will give about 500 feet of "backs." In the early part of the summer a small water-power plant was put in on Henderson creek. This consisted of a small dam and wood-stave pipe-line, giving 90 feet head to a water-wheel, coupled to an air-compressor of 250 cubic feet a minute capacity. This plant was just erected when the water in the creek nearly dried up owing to the unusually dry season. A portable Ingersoll-Rand gasoline-driven compressor was then taken in to the property. This is a new type of machine and is a very compact outfit, mounted on wheels; it has a nominal capacity of 210 cubic feet a minute. By the end of November the tunnel was in about 200 feet. Winter conditions and the desire of the management to rush the work on the Henderson property have caused some delay in the driving of this tunnel, and the work was stopped for a time. The question of the advisability of diamond-drilling from the present face of the tunnel is also being considered. In any event, the work of proving the property will be actively carried out during 1923.

This property is situated on the south-east side of Henderson creek, not far from the Mamie crosscut tunnel portal. It was staked many years ago by Boyd & Ashman, but is now owned entirely by J. K. Ashman. It was bonded

by J. F. Duthie in July of this year. Annual assessment-work, consisting mainly of open-cutting and stripping, constituted the only development-work on the property until this year. Much of this work had been done on one vein, but this year the assessment was done on a parallel vein lying 125 feet to the south-east, which had been discovered in 1921. It was soon apparent that this vein carried much higher silver values than any of the others previously prospected.

After the property was secured by Mr. Duthie this vein was well opened up and stripped on the surface for several hundred feet by means of open-cuts, strippings, and drift-tunnels. Much high-grade ore was taken out in doing this work, and much of the material rejected from the hand-sorting is good-grade mill-feed.

The three tunnels on the property are known as the Thompson, McPherson, and Water tunnels. The first two are drift-tunnels on the vein and much good ore has been taken out in driving them. The Water tunnel was started at a point 185 feet lower in elevation than the McPherson tunnel, and is now (December) in about 350 feet. This working went in for some distance as a half crosscut, but the ore was encountered at about 300 feet, and there is now, at the face, about 16 inches of high-grade ore showing galena, zinc-blende, freibergite, and a little ruby and native silver. At the mouth of this tunnel a gasoline-driven compressor similar to the one at the *Mamie* tunnel has been put in, and the *Mamie* compressor has also been brought over for work during the winter. The tunnel is being driven ahead with two shifts. A pneumatic drill-sharpener has also been installed and a fan for ventilation, so that the property is now well equipped.

The *Henderson* vein is a fairly well-defined fracture, but in places splits up so as to give it somewhat the appearance of a sheeted zone. There is generally one main band of ore from 1 to 2 feet wide and several paralleling stringers. In places the whole working-face, 4 to 5 feet wide, is sufficiently mineralized to constitute milling-ore after the high-grade ore is sorted out. The vein occurs in volcanic rock, which varies from rhyolite to andesite. The metallic minerals present are galena, zinc-blende, freibergite, and a little chalcopryite; small amounts of ruby-silver and native silver have been noted, which are probably of secondary origin. From much assaying it is evident that the galena of this vein carries about the same silver content as is general throughout the district. The grey-copper, however, is so rich in silver as to belong to the classification of "freibergite." It is due to the occurrence of this mineral in considerable amount that the ore is so high grade. Two analyses of this mineral, as nearly pure as possible to obtain, gave the following results:—

Description.	Sample No. 1.	Sample No. 2.
	Per Cent.	Per Cent.
Sulphur.....	21.8	20.7
Antimony.....	25.0	25.5
Copper.....	19.0	18.0
Iron.....	4.0	5.0
Zinc.....	4.0	2.5
Silver.....	25.3*	26.8†
Gold.....	‡	‡
Bismuth.....	Nil.	Nil.
Arsenic.....	"	"
Tellurium.....	"	"
Specific gravity.....	5.1	5.2

* Equals 7,384 oz. to the ton. † Equals 7,925 oz. to the ton. ‡ Equals 2.1 oz. to the ton.

By the end of the year about 80 tons of ore had been taken down to the railway at Smithers. It is expected that this ore will run about 250 oz. of silver to the ton, and it will have, in addition, a considerable lead and zinc content. Owing to negotiations over freight and treatment rates none of this ore has been shipped, but it will go to a smelter early in 1923.

The central camp for the Duthie operations is situated on the *Pacific* claim, close to the *Henderson* property. A rough road was built to this camp from a point on the Hudson Bay Mountain road from Smithers. Suitable camp buildings to accommodate about forty men have been erected. A force of from twenty-five to thirty men is being kept employed on the development of the *Henderson* all winter.

The Hudson Bay Mountain road was constructed in 1914 as a sleigh-road. It runs from Smithers to the *Coronado* camp, a distance of about 13 miles, and serves a large number of claims on the southern slope of Hudson Bay mountain. Since construction this road has been improved year by year, until now it is a rough wagon-road. A further expenditure will be required on it so as to make it suitable for hauling ore by motor-truck.

This group of mineral claims adjoins the *Henderson* group to the south and **White Swan.** east and is owned by W. Hannah and George Charlton. It was bonded in the fall of the year by J. F. Duthie. No attempt has been made as yet to develop any of the showings, as the efforts of the management were concentrated on the *Mamie* and *Henderson* properties. It will apparently be necessary to develop it by means of shafts, and the early approach of winter weather made it inadvisable to start such work until next spring.

The showings on the property are similar to others on the mountain, consisting of irregularly mineralized fractured zones. Galena, zinc-blende, and iron sulphides are the important minerals present, but in one showing some grey-copper has been observed. The veins have been partially developed by the owners by shallow shafts, open-cutting, and stripping. Mr. Turner expects to commence active development of the property as soon as the snow goes in the spring.

This property, which lies about a mile to the west of the *Mamie* property, **Victory Group.** has been fully described in previous Annual Reports of the Minister of Mines. The owner, Donald Simpson, carried on further development during the summer and was endeavouring to get out a car-load of ore; so far as is known, however, no ore was shipped during the year. The main vein on the property has been partially developed by drift-tunnels and open-cuts. It is a well-defined vein and is mineralized with galena, zinc-blende, and pyrite. The showings warrant more development than has yet been done.

In a letter dated January 17th, 1923, from Mr. Simpson, the following further information was given with regard to his work: "The No. 2 tunnel is now in about 60 feet and has on the hanging-wall for the last 40 feet from 2 to 3 feet of ore which averages \$75 a ton (gross value) in gold, silver, lead, and zinc. A few feet back from the face I started a crosscut towards the foot-wall, which is all in mineralized rock for 16 feet from the hanging-wall, when I broke into a body of better-looking ore than drifted on on the hanging-wall. I am now into that body about 4 feet with no foot-wall in sight."

Mr. Simpson is a most industrious prospector and, single-handed, accomplishes a lot of work each year.

Other Properties.—Annual assessment-work and small-scale development were carried out on other properties on the mountain during the year. The success which is attending the Duthie operations should have a most stimulating effect on this section and induce the acquirement and development of other properties on Hudson Bay mountain.

COAL.

Aveling Coal Property.

(See 1921 Annual Report.) During the early part of the year coal was mined from the *Betty* seam of the Aveling property by the lessees, Gillespie & Wilson. Production was maintained as long as the coal could be hauled by sleigh to the railway at Telkwa, a distance of 7 miles; the tonnage shipped was 700 tons.

During the high-water period the temporary bridge across the Telkwa river, by which the property was reached, was washed away. During the summer some prospecting was done on the south side of the river in an attempt to find a continuation of the *Betty* seam, but without much success. The lessees then commenced work on the property of the Telkwa Collieries, situated $4\frac{1}{2}$ miles from Telkwa, on which property they had a lease in previous years and from which they had shipped coal. The main seam on this property was opened up by a new drift-tunnel higher up Mud creek, and it is believed a few cars of coal were shipped in December.

About the end of the year construction of a new bridge across the Telkwa river was commenced by the Public Works Department. When this is completed it is expected that development of the *Betty* seam will be again started.

Copper River Coal Company.

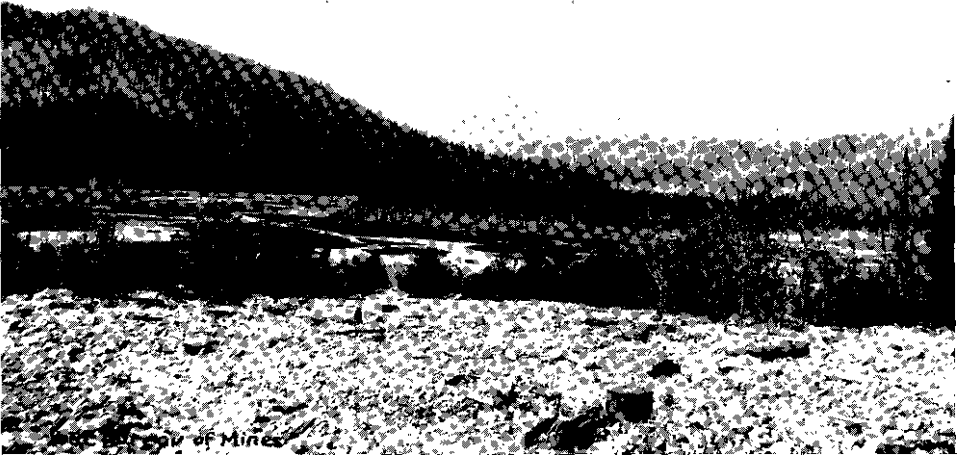
The property of the Copper River Coal Company is situated on Chettleburgh creek, a small tributary of the Zymoetz river, coming in just below the source of the river in Zymoetz lake.

This property was handled by the National Finance Company, as fiscal agents for the Copper River Coal Company. The former company went into liquidation some years ago and all its affairs have since been handled by the Yorkshire and Canadian Trust, Limited, as liquidators.

This coal property was developed to some extent by drift-tunnels more than ten years ago. A detailed description of the coal-seams and workings was given by the writer in the 1914 Annual Report. Since that time no further work has been done on the property until the summer of 1922, when diamond-drilling was commenced in order to prove the continuity of the seams. A drill had been taken into the property in 1914, but never used. This drill was found to be in good condition and was used by the contractors—the Robinson Contracting Company—for drilling. Three holes were drilled and the results were satisfactory. In two of the holes four coal-seams were found in much the same relative positions as indicated by the outcrops in Chettleburgh creek. The third hole only showed one coal-seam, but this is probably due to its not having been drilled deep enough to reach the other seams. Bad weather conditions in the fall of the year necessitated stopping the drilling before this hole was down as deep as was intended. Permission has been given to publish the logs of the holes drilled, and they are considered as being of sufficient interest to warrant publishing in full. In the logs as given, the names of the rock strata passed through are those given by the driller and some of these classifications, such as "diabase," may be erroneous.

Log, No. 1 Hole.

Depth.	Thickness.	Description.	Depth.	Thickness.	Description.
Feet.	Ft. In.		Feet.	Ft. In.	
0- 5	5 0	Mud and overburden.	592-604	12 2	Shale.
5- 10	5 0	Gravel and boulders.	604-606	1 10	Coal.
10- 17	7 0	Boulders; hit bed-rock at 17 feet.	606-618	12 0	Shale and sandstone.
17- 45	28 0	Shaley sandstone.	618-622	4 0	Conglomerate.
45- 53	8 0	Conglomerate.	622-633	11 6	Shale and sandstone.
53-136	83 0	Shale with seams of sandstone.	633-635	1 6	Coal.
136-174	38 0	Conglomerate.	635-637	2 0	Shale and sandstone.
174-181	7 0	Shale with sandstone seams.	637-662	25 0	Sticky shale.
181-201	20 0	Soft sticky shale.	662-668	6 6	Coal.
201-219	18 0	Shale and sandstone seams.	668-682	13 6	Sticky shale with coal markings.
219-294	75 0	Shale.	682-702	20 0	Shale.
294-300	6 0	Sandstone.	702-737	35 4	Sandy shale.
300-394	94 0	Sandstone with seams of shale.	737-740	3 6	Soft rotten coal too soft to coke.
394-400	6 0	Conglomerate.	740-742	2 0	Sandy shale.
400-403	5 0	Shale, sandstone, and conglomerate.	742-747	5 4	Good coal.
403-409	4 0	Sandstone and shale.	747-749	1 8	Sandy shale.
409-412	3 0	Conglomerate.	749-751	2 0	Conglomerate.
412-442	30 0	Sandstone and shale seams.	751-794	43 0	Sandy shale.
442-492	50 0	Sticky shale.	794-802	8 0	Diabase and seam of shale.
492-546	54 0	Shale and sandstone.	802-817	15 0	Diabase and few of shale.
546-551	5 0	Conglomerate.	817-832	15 0	Diabase and few chunks of shale and serpentine.
551-582	31 0	Sandstone and shale.			Diabase.
582-592	10 0	Soft shale.	832-852	10 0	



Williams Creek, Caribou M.D., below Barkerville.



China Gulch, Caribou M.D.

Log, No. 2 Hole.

Depth.	Thickness.	Description.	Depth.	Thickness.	Description.
Feet.	Feet.		Feet.	Feet.	
0- 7	7	Muck.	524-527	3	Sandstone.
7- 15	8	Clay boulder.	527-540	13	Shale.
15- 19	4	Gravel.	540-546	6	Sandstone.
19- 20	1	Shaly sandstone.	546-559	13	Conglomerate.
20- 35	15	Sandstone.	559-564	5	Sandstone.
35-106	71	Sandy shale.	564-577	13	Conglomerate.
106-122	16	Sandstone.	577-600	23	Sandstone and shale.
122-157	35	Shale.	600-619	19	Shale.
157-190	33	Sandstone.	619-621	2	Coal.
190-212	22	Sandstone and conglomerate.	621-635	14	Sandstone and shale.
212-230	18	Sticky shale.	635-638	3	Conglomerate.
230-255	25	Shale.	638-641	3	Shale and sandstone.
255-285	30	Sticky shale, very soft and cavy.	641-643	1	Coal.
285-300	15	Soft sticky shale.	642-650	8	Sandy shale.
300-356	56	Soft shale.	657-662	5	Conglomerate.
356-360	4	Sandy shale.	662-683	21	Sandy shale.
360-366	6	Soft shale.	683-698	15	Shale.
366-374	8	Shale and sandstone.	698-704	6	Coal.
374-388	14	Shale.	704-722	18	Sandy shale.
388-398	10	Sandstone and shale.	722-749	27	Shale.
398-413	15	Soft shale.	749-753	3	Coal.
413-414	1	Sandstone.	753-790	38	Shale.
414-420	6	Soft shale.	790-792	2	Coal.
420-434	14	Sandy shale.	792-799	7	Shale.
434-448	14	Shale.	799-803	4	Coal.
448-471	23	Sandy shale.	803-807	4	Shale.
471-483	12	Shale.	807-821	13	Conglomerate.
483-496	13	Shaly sandstone.	821-851	30	Shale.
496-507	11	Shale.	851-856	4	Sandstone.
507-524	17	Sticky shale.	856-863	..	Breccia.

Log, No. 3 Hole.

Depth.	Thickness.	Description.	Depth.	Thickness.	Description.
Feet.	Feet.		Feet.	Feet.	
0- 5	5	Mud.	508-523	15	Shale and sandstone.
5- 10	5	Boulders and mud.	523-525	2	Sandstone.
10- 19	9	Coarse gravel and boulders.	525-528	3	Conglomerate.
19- 26	7	Clay boulder.	528-539	11	Sandstone and coal markings.
26- 30	4	Coarse gravel and small boulders.	539-555	16	Sandstone and shale.
30- 35	5	Clay boulders.	555-559	4	Conglomerate.
35- 41	6	Coarse gravel and boulders.	559-562	3	Sandstone.
41- 48	7	Clay boulder.	562-608	46	Sandstone and shale.
48- 52	4	Soft shale, gravel, and boulder.	608-626	18	Shale.
52-218	166	Soft shale.	626-630	4	Shale and sandstone.
218-230	12	Conglomerate.	630-636	6	Shale.
230-244	14	Shale.	636-637	1	Dirty shaly coal.
244-251	7	Sandstone and shale.	637-645	8	Sandy shale.
251-253	2	Sandstone.	645-650	5	Sandstone.
253-259	6	Conglomerate.	650-654	4	Conglomerate.
259-262	3	Sandstone and shale.	654-659	5	Shale.
262-274	12	Conglomerate.	659-661	2	Sandstone.
274-284	10	Sandstone and shale.	661-665	4	Shale.
284-290	6	Shale and sandstone.	665-667	2	Sandstone.
290-316	26	Shale.	667-669	2	Shale.
316-358	42	Sandstone and shale.	669-670	1	Sandstone.
358-362	4	Shale.	670-688	18	Shale.
362-394	32	Sandstone and shale.	688-694	6	Sandstone.
394-395	1	Conglomerate.	694-697	3	Conglomerate.
395-418	23	Sandstone and shale.	697-700	3	Shale, brown and red.
418-419	1	Conglomerate.	700-720	20	Shale.
419-432	13	Sandstone.	720-724	4	Sandstone.
432-442	10	Sandstone and shale.	724-774	50	Conglomerate.
442-452	10	Conglomerate.	774-778	4	Crushed coal, too soft to core much.
452-472	20	Sandstone and shale.	778-795	17	Shale with coal markings.
472-475	3	Conglomerate.	795-817	22	Shale.
475-481	6	Sandstone and shale.	817-820	3	Sandstone.
481-498	12	Conglomerate.	820-822	2	Sandy shale.
498-502	9	Sandstone.	822-823	1	Sandstone.
502-508	6	Sandstone and shale.	823-824	1	Soft shale.

Hole caved 44 feet; stopped hole; left stand-pipe and casing in hole.

No analyses have as yet been made of the drill-cores of the coal-seams cut in the drilling. This drilling has shown the seams to be continuous for the extent of the formation drilled. The coal as shown in the drift-tunnel on Chettleburgh creek is of good quality and the 9-foot and 6-foot seams could be mined at low cost.

Cedar Creek Coal Property.

This coal property is situated on the western side of the Skeena river and on the southern side of Cedar creek, a small tributary of the Skeena coming in above the town of Hazelton. The property lies about 8 miles west and 1 mile south of Hazelton. It is reached by following the wagon-road on the western side of the Skeena (opposite the town of Hazelton) for about $1\frac{1}{2}$ miles, then an old trail for about 5 miles, and the remainder of the distance, another 5 miles, a blazed line through the bush. A wagon-road to reach the property would be about 10 or 11 miles long to connect with some point on the Grand Trunk Pacific Railway.

The coal-showings were first discovered by two Indians who told of their discovery to W. S. Sargent and A. R. McDonnell. During the past summer four coal leases were staked by Sargent, with the ownership divided between himself, McDonnell, and the two Indians. These leases have now been acquired under option by Hazelton people. A little later on a number of adjoining leases were staked by Angus Beaton. As yet no development-work has been done in the field.

The coal-measures are well exposed on the hillside sloping into Cedar creek and form a ridge of hills following along the southern side of the creek to its head, and, according to Mr. Beaton, they continue beyond that. The actual outcrop of coal is exposed where the measures have broken and slid away from the hillside towards the creek.

The measures consist of sandstone, shales, and coaly bands and are typical of the Skeena formation. This is the coal-bearing formation of the district as found in the Skeena, Kispiox, Bulkley, Telkwa, and Zymoetz rivers and the Groundhog coalfield.

No detail examination was made to outline the limits of this field, but it is apparent that it has a considerable development in this vicinity. In a northerly and southerly direction the field extends several miles and it may have considerable width as well as length. In outline the field represents a large remnant of an extensive basin dissected by Cedar creek and denuded on the north-eastern side of the creek. The general strike of the measures is approximately north and south, with a gentle dip to the west. As shown by the section formed by the erosion of Cedar creek, the measures have a thickness of at least 1,000 feet and possibly more.

The measures consist of alternating narrow bands of sandstone and shale, with narrow coaly bands occurring in places. The occurrence of hard, narrow, lenticular bands of sandstone surrounded by shale is typical of the Skeena formation.

The place where the coal has been discovered is where a small slide has exposed the measures along the hillside fronting Cedar creek. At this point the measures are very considerably crumpled and broken, with the result that the outcrops of coal are disconnected and discontinuous. There are a number of small outcrops of crushed coal, none of which at present show any continuity. The most important showing is a portion of a coal-seam which has a width of from 3 to 4 feet, but in length is apparently faulted at both ends and the continuation is not apparent. This outcrop is evidence that the measures did contain a coal-seam, but to be of commercial value this seam would have to be found in some part of the formation which was not so badly broken up. A short distance away from this point the measures become more regular and prospecting might be successful in picking up the seam.

The character of the coal is shown by the following analyses. Sample No. 1 is an average sample across $3\frac{1}{2}$ feet and No. 2 an average across 3 feet; both samples being taken across the full width of the seam as exposed.

Description.	No. 1.	No. 2.
	Per Cent.	Per Cent.
Moisture	1.2	1.4
V.C.M.	10.0*	10.3*
Fixed Carbon	79.8	78.3
Ash.....	9.0	10.0

*Non-coking.

By applying Dowling's split volatile ratio to the above analyses the coal would be classed as a semi-anthracite. The ash content—between 9 and 10 per cent.—is somewhat higher than is desirable, but still is no higher than that of much coal now being mined in the Province.

The coal as exposed is soft and crumbly, and is very much "slickensided" and shows shiny faces on breaking. This coal has been subjected to extreme crushing and pressure and has apparently been partially graphitized. This has the effect of causing the coal to be slow burning and difficult to ignite. With a forced draught it might prove to be excellent fuel.

Where this coal-seam is exposed is a region of maximum disturbance and local crushing, which undoubtedly has had a considerable effect on the physical character of the coal. Where the measures are more regular, coal, if occurring, would probably be less altered and have a different analysis, with a lower graphite content.

There is exposed in this locality a considerable area of the Skeena formation, which formation is the important coal-bearing series of the northern interior of British Columbia.

The actual exposure of coal at present known is not of economic importance. The measures at this point are too badly broken and the coal-seam too discontinuous to be likely to prove of value.

The quality of the coal as shown by analyses is good, but owing to its physical character the coal does not burn freely. This, however, is possibly a local feature which would not necessarily hold were coal discovered at some other point in the formation where there had not been so much disturbance of the strata.

This area of coal formation and the indications of coal contained in it is of sufficient importance to warrant its being carefully examined to see if it contains a continuous, commercial-sized seam of coal. The nearness of the area to the railway and general features warrant the expenditure of some time and money in thoroughly prospecting it.

OIL POSSIBILITIES OF KISPLOX AND SKEENA VALLEYS.

A two-day examination of the Kisplox valley was made to look over some of the oil leases that have been staked. Leases have been staked in several places for a distance of 50 miles up the Kisplox and Skeena valleys from Hazelton.

Dr. G. Hanson, of the Canadian Geological Survey, looked over the area for a few days. It is hoped that a detailed examination of the area will be made by a Geological Survey party during the season of 1923.

As far as is known, there is no definite evidence of oil in this area, in the shape of seepages, etc. It is known that between Hazelton and the Groundhog coalfield there is a large area of sedimentary rocks, belonging mainly to the Skeena and Hazelton formations. Detail investigation of the area will be necessary before a definite opinion could be expressed as to whether or not these sedimentary rocks might contain oil-bearing horizons.

CARIBOO MINING DIVISION.

There was a considerable revival of mining activity throughout the Cariboo Division during the year 1922. In the Barkerville area further geological work was carried out by the Geological Survey of Canada. Dr. W. A. Johnston continued the investigation of the placer-deposits which he commenced in 1921, the placer-mining area in the Barkerville section being examined in considerable detail. By an arrangement between the Hon. the Minister of Mines and the Director of the Geological Survey, Dr. Johnston was authorized to report to the British Columbia Mines Department regarding the desirability or otherwise of testing by Keystone-drilling certain placer properties. Under this arrangement drilling of the New Waverley Company's property on Grouse creek was commenced by the Department and is still being continued. Some encouraging results have been obtained.

Another party of the Geological Survey was at work in the Barkerville area during the season. Dr. W. L. Uglow, of the University of British Columbia, was in charge of this party and the bed-rock geology of the area was worked out. Much attention was paid to the numerous quartz veins in this section. The results of Dr. Uglow's work have not been issued yet, but in a paper before the annual meeting of the Canadian Institute of Mining and Metallurgy he presented a summary, with particular reference to the economic possibilities of the systems of quartz veins. This work of Dr. Uglow's will undoubtedly be of considerable value to this section, inasmuch as his conclusions with regard to the veins will assist any one engaged in developing them. Consequently it is deemed advisable to quote at some length from this paper, as follows:—

"CHARACTER OF THE VEINS.

"A fact of considerable significance in any estimate or prophecy regarding the quartz possibilities of the Barkerville district is that there are at least two very distinct types of veins. These have been called by the writer the A and the B veins.

"*The A Veins.*—This set of veins constitutes one of the most conspicuous features of the camp. They are usually large bodies of white quartz varying in width up to 100 feet and of unknown longitudinal extent. They are especially prominent in a broad zone of shearing which strikes about N. 35° — 40° W., nearly parallel to the trend of the formations. This zone varies in width from one-quarter of a mile to 1 mile or even more. Longitudinally it has been traced from Round Top mountain on the south-east to Sugar creek on the north-west, a distance of over 25 miles. This quartz outcrops conspicuously on the grassy uplands of the plateau surface—in places standing as much as 10 feet in relief. It seems probable that individual bodies of quartz in this zone are quite discontinuous and lenticular, but the country-rock in their vicinity is usually well charged with small bunches and stringers of quartz of the same character.

"These veins are abundantly intersected by crossing closely spaced fractures, so that the quartz is exceedingly friable and even tends to break into plate-like pieces. This face and the *en echelon* or step-like arrangement of adjoining lenses indicates that these veins are of pre-schist origin; that is to say, after their formation they were involved in the stresses which folded the rocks and formed the shear-zone.

"Veins of this class are only sparsely mineralized with sulphides. In places they appear to be quite barren, while in other places they are impregnated with pyrite, which usually is found in strongly cubical development. Other sulphides are typically absent. The country-rock in the vicinity of the pyritized portions of the veins is usually studded with pyrite crystals.

"No primary or originally free gold was found to occur in these veins. The only assays available at the time of writing indicate that the pyrite carries only a low content of gold.

"The following may be cited as examples of this class of veins:—

"(1.) The Bonanza vein of the British Columbia Milling and Mining Company near the head of Stout's gulch. Along its outcrop this vein strikes N. 45° W. and consists of 18 feet of banded white to pinkish quartz containing very small amounts of pyrite. Material now lying on the dump proves that in depth portions of the quartz are thickly studded with pyrite crystals and bunches. The vein appears to be a strong ledge, but in the distance for which it was followed for mining no shoots of high-grade sulphides were encountered.

"(2.) The large 'blow-out' of quartz exposed in the hydraulic pit in Stout's gulch, which is now exposed for a width of 50 feet and a length of 150 feet.

"(3.) Quartz ledges on the top of Mount Burdett, 7 miles south of Barkerville. Some of these are continuous for one-quarter to one-half mile and vary up to 100 feet in width. Only very small amounts of pyrite can be seen in these veins.

"(4.) Quartz ledges which outcrop on the top of Bald mountain, of the same general character as the last.

"Very little accurate information is at present available concerning the values in the veins of the A class. It is well recognized by those who have mined the quartz that no free gold has been found or is to be expected after the bottom of the zone of oxidation has been reached. Whatever gold the veins contain is inherently associated with the pyrite. Only low values can be expected from them, but large tonnages of quartz could be easily mined. Small amounts of finely crystalline gold may be washed from the oxidized portions of the veins, which indicates that the sulphides are at least somewhat auriferous.

"*The B Veins.*—The B veins are inconspicuous features of the district, yet they appear to be the ones with which the precious-metal values are predominantly associated and to which any mining developments that may materialize in the future will be entirely due.

"The rocks of the Cariboo series are strongly cross-jointed in a direction varying between N. 25° E. and N. 35° E. Some of these joints are faults of appreciable displacement, while others are simply fractures so closely spaced as to give the rocks a marked cleavage in those directions. This system of fracturing crosses the A veins and is the means of producing in them the sheeted structure already mentioned.

"These north-easterly-trending fractures are usually healed with quartz, perhaps only of the thickness of a sheet of paper. Quite commonly, however, the quartz-fillings are 12 to 15 inches

wide, varying up to 2 feet. In many places series of multiple veins occur, consisting of a number of parallel veins close together.

"The quartz of the B veins is easily distinguishable from that of the A veins by the fact that it is massive and unshered. The marginal portions of these veins are characterized by narrow comb-like bands of siderite and ankerite which are weathered to a yellow or dark brown near the surface.

"The veins are commonly well mineralized with galena, pyrite, and arsenopyrite, with minor amounts of sphalerite, barite, and scheelite. The sulphides carry high gold values in many cases. The unoxidized portions of the veins exhibit cavernous honeycombed quartz from which pyrite crystals have been leached, and in many places coarse crystal gold has been found in these cavities.

"The following cases may be mentioned as examples of the B type of veins:—

"(1.) The series of north-easterly-trending veins on the *Proserpine* surveyed claim, near its south-western line, on one of which the old Forrest shaft was sunk to a depth of 60 feet. The veins vary in width up to 2 feet and are well mineralized with pyrite, arsenopyrite, and galena.

"(2.) The series of north-easterly-trending veins on the *Warspite* and *Tipperary* surveyed claims on Proserpine mountain. These are exposed only by surface-trenching, and consist of quartz, well mineralized with galena, arsenopyrite, and pyrite.

"(3.) The *Beede* or *Perkins* ledge on *Burns* mountain, about 2 miles east of Stanley (Van Winkle). Here there are several parallel north-easterly-trending veins, varying in width up to 2 feet, containing pyrite and galena, with considerable free gold in the upper oxidized portions. The old workings, consisting of shafts and drifts, on these veins are now full of water and inaccessible.

"(4.) The scheelite-bearing veins of *Hardscrabble* creek,* 7 miles north-west of Barkerville. These are quartz-ankerite veins carrying pyrite, galena, and scheelite. The workings are not accessible at the present time.

"*Intersections of the A and B Veins.*—Veins of the B type are post-schist in origin. They crosscut the foliation of the schistose quartzites and are not involved in any shearing. They are found cutting through and meeting the A vein. From a study of several of these intersections it is inferred that mineralizing solutions travelling along the B set of joint fissures not only mineralized the fissures themselves, but impregnated the veins of the A type near their intersections with the group of sulphides above mentioned. A sufficient number of these intersections was seen to establish the fact that definite shoots of ore of fair size are to be expected at these points. Samples taken by the writer from these shoots have not yet been assayed (at the time of writing), so that it is impossible to give any figures for values.

"The following cases will serve as examples of the kind of shoots to be looked for at these intersections:—

"*Black Jack.*—This property is located on the south-east bank of Williams creek at the mouth of the Black Jack canyon, at the south end of the town of Barkerville. The belt of A veins is here intersected by a large number of mineralized cross-fissures of the B type, which have formed a well-defined shoot. Twenty-five mineralized cross-stringers from 2 to 10 inches in thickness were counted in a total width of 50 feet. A shaft 120 feet deep is on the property, but it is now caved and full of water. The records of the old Black Jack Mining Company show that from 202 tons of material taken from the 42-foot level \$3,573.10 in gold was recovered, an average of \$17.71 per ton. Of this amount, \$2,646.10 was recovered from 46 tons of sulphide concentrates at the rate of \$57.52 per ton. The property belongs to F. J. Tregillus and T. A. Blair, of Barkerville.

"*Independence-Kitchener.*—These are two adjoining claims situated on Proserpine mountain at an elevation of 5,600 to 5,700 feet. The *Independence* is recorded in the name of E. E. Armstrong and the *Kitchener* in the names of F. J. Tregillus, T. A. Blair, and P. Carey. Both are surveyed claims.

"Both claims are located on part of the main zone of A veins, where quartz lenses of the A type are intersected by the narrower quartz-ankerite-siderite veins of the B type. In the vicinity of the intersection the A quartz is heavily mineralized with arsenopyrite, foliated galena, and pyrite. A tunnel of shallow depth and three small open-cuts are the only workings on this

* Report on Tungsten Ores of Canada, by T. L. Walker, Mines Branch, Dept. of Mines, Canada, Pub. No. 25, 1909.

intersection. Insufficient work has been done to show the extent of the shoot of sulphides, either horizontally or vertically, but the intersection of the vein systems is quite clear, and a high percentage of galena and arsenopyrite can be seen in the faces of the open-cuts and in the several hundred pounds of vein material lying on the dumps.

"*Victory*.—This property, recorded in the name of A. W. Sanders, is also located on Proserpine mountain. Several small open-cuts reveal veins of the A and B types. Barren-looking white shattered quartz of the A class is exposed in two open-cuts for a width of 11 feet. These exposures belong to the main belt of A vein mineralization. About 500 feet to the north of these cuts are two others which have been given on veins of the B type. These veins are individually narrow, but they are closely spaced, and are exceptionally well mineralized with galena, arsenopyrite, and some sphalerite. The intersection of the two vein systems on this claim has not been uncovered, but there is every likelihood that a shoot of sulphides would be found to occur there.

"POSSIBILITIES OF THE QUARTZ VEINS.

"The facts which control the possibility of the successful quartz-mining in the district are the following:—

"(1.) The large irregular lodes of the A type will not contain throughout their extent and breadth sufficient gold values to make the mining of them profitable.

"(2.) The highly mineralized veins of the B class are as a rule too narrow to be mined alone, as the tonnage of ore that could be taken from them would be small.

"(3.) The unproved possibility which the district possesses is connected with the intersections of the two vein systems. It is possible that a careful and systematic exploration of some of the A veins, with especial reference to zones of intersecting B veins, might reveal shoots of auriferous sulphides sufficiently closely spaced and of satisfactory grade for commercial mining.

"(4.) The failure to recognize the importance of these intersections may have been largely responsible for previous failures to develop ore-bodies.

"(5.) The future of any quartz-mining enterprise will have to depend entirely on the auriferous content of the sulphides, and not on the free gold present in the upper parts of the veins.

"(6.) Any future exploration should proceed by the methods of locating the intersections and sinking on them. Surface work of less than 30 or 40 feet in depth is valueless, except for proving the horizontal extent of the veins."

As has been previously mentioned, the year was a very unfavourable one for the operation of hydraulic mines. The previous winter's snowfall, which was an unusually light one, went away very quickly in the spring, so that after a short period of high water the streams dried up quickly. Then followed an extremely dry summer. Throughout all the northern interior of the Province the past summer was about the driest ever recorded. Many creeks which usually run all year dried up completely. The usual hydraulic operations in the Cariboo were therefore materially curtailed, or stopped altogether, due to this shortage of water, for the greater part of the hydraulic season. Rains in the late fall brought a supply of water and enabled some small clean-ups to be made. The placer-gold production of the Cariboo and Quesnel Divisions for 1922 is estimated at \$192,300, but the increase from \$67,400 last year is largely due to the output from the Cedar Creek camp.

BARKERVILLE SECTION.

Two properties, *Lowhee* and *Mosquito Creek*, were operated by John Hopp during the season. The shortage of water greatly hampered the operation of these hydraulic properties, but in spite of this fair returns were obtained.

The *Lowhee* mine on Lowhee creek now has nearly a mile of flume to carry off the tailings. This is expensive to keep up, as it has to be paved with wooden blocks, and during the last two years it has been difficult to keep the grade down to bed-rock. It is planned next year to put in steel plates in this flume. This will allow the grade to be lessened and will do away with the heavy annual expense and time lost in the hydraulic season owing to the necessity of continually renewing the block paving.

A new reservoir to hold water for flushing was constructed this year. The head of the pit had been advanced to within a short distance of the old reservoir, so a new one at some distance up the gulch had to be put in. The hydraulic workings on the *Lowhee* claim have now practically

reached the end of the ground drifted out by the old-timers, and it is therefore expected that better returns will be secured in the future from working virgin ground.

Other Placer Properties.—Hydraulic operations were carried on at the *Point* mine, Slough creek, Perkins gulch, near Stanley, and at Devil's canyon, besides small-scale work by individual miners. The shortage of water prevented the accomplishment of much work at these properties, as they were closed down most of the season.

Drift-mining was carried on by J. McDougall on Jack-of-Clubs creek with successful results, by Muller on Dragon creek, and others.

Lode-mining.

Annual assessment-work was carried out during the year on a number of quartz claims on Proserpine mountain. These properties received an undeserved "black eye" when the Bryce Syndicate in 1920, after carrying out certain development-work, failed to take up the options on the claims. It has always been believed by the writer that a number of these veins may be found to contain shoots of ore which would pay to work, while the whole masses of quartz and associated schist were much too low grade to be profitably mined. The plan of the Bryce Syndicate would appear to have been an attempt to prove up enormous bodies of low-grade ore, consisting of quartz bands and associated schist. (For a description of these properties see previous Annual Reports.)

This group of mineral claims is situated on Cunningham mountain, near the **Hudson Group**, head of the right fork of Cunningham creek. The owners are E. Moore and Fred Wells. The distance from Barkerville is about 20 miles; the first 12 miles to McGregor's cabin is wagon-road, the remainder of the distance being trail. This property was examined in the late fall and unfortunately there was about 6 inches of snow on the ground, which made it difficult to see much. Only surface development has been carried out so far.

There are several quartz veins or bands on the mountain, but the most important showing is one about 50 feet wide. This has a north-west strike and consists of alternating bands and bunches of quartz and schist. The country-rock is the typical Cariboo schist of this section. The quartz carries pyrite and galena, disseminated throughout. No sampling was done by the writer, but all the showings have been thoroughly sampled by Mr. Wells and the results show very encouraging gold values. There is an abundance of mineralized quartz on the property and the question is simply one of average values. The galena content is not of great importance, as it is probable that the gold values are associated with the iron sulphides. It is the intention of the owners to commence operations in March, 1923, by running a tunnel under the main showing.

These claims are situated a short distance up the hill from the lower end of the *Lowhee* hydraulic mine and are owned by A. Sanders. The showing **Rainbow and Dolly Varden** consists of an irregular quartz vein from 2 to 4 feet wide, striking N. 60° E. (mag.) and occurring in schist. In one place a small cross-stringer comes into the vein and good gold values are obtained at the intersection and in the stringer. The surface outcrop is considerably oxidized, with a development of iron oxides. Very little sulphide was noted, but a little pyrite does occur.

When examined the showing had not been opened up much, but a good deal more work was done by the owner later on, who is an industrious and energetic prospector. Much of the oxidized vein material was being panned by Mr. Sanders, and in this way he recovered as high as an ounce of gold a day, and during the season made good wages. Much of the gold obtained is crystalline, although consisting for the most part of fine gold. More extensive development of the showing will be carried out next season.

KEYSTONE-DRILLING OF PLACER-GRAVELS.

During the year testing of placer-gravels by drilling was carried out at a number of places in the Cariboo Division. Much of this work was done by private companies or syndicates, and in addition some drilling was carried on by the Government. Drilling is the most efficient and economical method of testing low-grade areas of placer-gravel which it is proposed to work by dredging or hydraulicking. Besides giving a very close approximation of the values in the

gravel, the drill log gives valuable information regarding the bed-rock, character of gravel, clay, etc., and water-pressure.

Swift River. Eight leases on Swift river, about 5 miles above Cottonwood Post-office, have been secured by G. A. Dunlop, acting for an Eastern syndicate. This ground was pretty thoroughly tested this summer by means of drilling. A Union Construction Company gasoline-driven drill using a 5-inch casing was used for this work. This is a light portable outfit that can be easily taken anywhere over a very rough road, and is good for drilling to a depth of 75 to 100 feet in ordinary gravels and clays. The results of this drilling show that the Swift River valley at this point has a gravel-deposit varying from a few feet up to 40 feet thick, overlying a thick strata of clay. The drilling has shown that the gravels contain varying amounts of gold, but that there are no values in the clay. After the general character of the ground had been determined the holes were only drilled down to the clay; this clay may be considered as a false bed-rock. Mr. Dunlop says that the average values are satisfactory. The object of this drilling is to prove up, if possible, a sufficient yardage of gold-bearing gravel to warrant erecting a dredge. Mr. Dunlop's plans are not known, but it is understood that either a dredge will be erected next season or further drilling will be carried out.

During the season Mr. Dunlop moved his drill to the Larsen ground on the Cottonwood river. A few holes were drilled, but not sufficient to prove the ground.

Cariboo Exploration Co. This company was organized by H. C. Foster to prospect certain leases on the Swift river, held by option from James Harrison. The ground is situated about 10 miles up the Swift river from Cottonwood Post-office. A cross-section of nine holes was put down across the valley, but the results were disappointing, as the material was found to be mostly a thick strata of clay, carrying no gold values. One hole was put down 100 feet, almost entirely in clay, and bed-rock was not reached. As it was apparent that there was no ground of dredgable depth carrying appreciable values in the cross-section drilled, the proposition was abandoned. The drill was moved up to Cunningham creek and the latter part of the season was spent in testing certain leases along the creek. The results of this work are not known.

Grouse Creek. The New Waverley Mining Company is a reorganization of the old Waverley Company, which operated an hydraulic mine on Grouse creek for a number of years. The new company opened up a long bed-rock sluice in order to attack the channel at a point below the old workings. This work has been carried on for three seasons, but no appreciable values have been found in any of the gravels. During the season this section was carefully examined and mapped by W. A. Johnston, of the Geological Survey. From his work and on his recommendation the owners of the property applied, under the "Mineral Survey and Development Act," to have the property further tested by Keystone-drilling. The arrangements were made and drilling was started in September and was being continued at the end of the year.

The first part of the drilling showed conclusively that a supposed or possible extension of the old Waverley channel towards Grouse creek, as indicated by the surface topography, did not exist. The next drilling was to test a supposed continuation of the Waverley channel towards Antler creek. As far as it has progressed, this work has been encouraging. The bed-rock has been found at the right depth to give grade to the Waverley channel, and low values were obtained in some of the gravels. It is hoped that better values will be found towards the right rim, which is now being drilled. The best values in the old Waverley pit were on this right rim.

Cottonwood River.—Some Keystone-drilling was carried out by a California company on the lower end of the Cottonwood river, but details of this work are not known by the writer, as this section was not visited.

Peters Creek. The old Mathers property on Peters creek was taken up a year ago by a syndicate composed of members of the Northern Construction Company. This property was a producer some years ago, having been worked as a drifting proposition. The old flumes, water-wheel, etc., were repaired, the shaft unwatered, and development commenced by the syndicate in the fall of 1921 and continued steadily until this summer. The property was then optioned to a company, which sent in G. C. Hogg to report on the proposition. Mr. Hogg spent some time examining the property and then decided on doing some Keystone-drilling to further test the property. This drilling was proceeding in the fall of the year, but the writer has no information regarding the results. It is expected that if Mr. Hogg's company takes up the option and acquires the property it will be opened up as an hydraulic mine.



Stanley, Cariboo M.D.—Keystone Drill at.



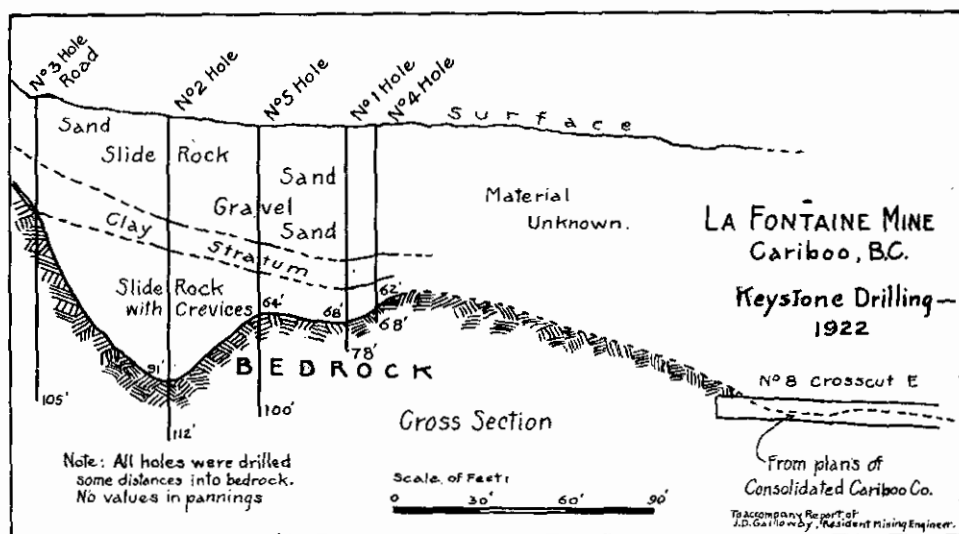
Spanish Creek Bridge, Quesnel M.D.

La Fontaine Mine.

General Statement.—The *La Fontaine* mine is situated on Lightning creek, some 2 miles below the town of Stanley. It was operated from 1903 to 1907 by the Cariboo Consolidated Company, which company spent about \$300,000 in exploring the ground. The operations were successful in opening up the ground by a bed-rock shaft and drifts, and a considerable length of the present channel of Lightning creek was thoroughly explored.

Financially the operations were not successful, as the gravel mined was on the average too low grade to be worked at a profit by the deep drifting methods used. It was concluded that the property had been sufficiently tested and the company suspended operations. Later the property was acquired by L. A. Bonner.

After studying the ground carefully Mr. Bonner reached the conclusion that the "rich lead" (or Tertiary channel) of Lightning creek would be found to lie in the right rim of the present creek and not in the ground tested by the Cariboo Consolidated Company. If Mr. Bonner's reasoning were correct, then a continuation of the phenomenally rich channel of Lightning creek through the *La Fontaine* ground was possible. The object of the Keystone-drilling carried out by the Government was to determine this point by drilling a cross-section of holes at a place where, according to Mr. Bonner's reasoning, the old channel might be found.



Details of Drilling.—Drilling was commenced in December, 1921, under the supervision of C. W. Moore. Two holes—Nos. 1 and 2—were drilled by Moore, when the work was stopped for a time. Later on, in April, 1922, Bonner contracted with A. Brown to drill two more holes—Nos. 3 and 4. When these were completed the work was again stopped. These two holes drilled by Brown were not done under Government supervision and no responsibility is assumed for the results. In making up the accompanying section, however, the figures supplied by Mr. Brown as to depths of bed-rock have been used.

It was agreed that to complete the section a fifth hole was required to determine whether or not there was a channel at this point lying between holes Nos. 1 and 2. Accordingly, the drilling of this fifth hole was started by C. W. Moore in November, 1922, and completed in December. On the accompanying section these holes drilled are shown plotted, with the contour of the bed-rock sketched in. This bed-rock contour is, of course, approximate, except at the points determined by the drilling. With such close drilling, however, it is apparent that the bed-rock contour as shown is probably approximately correct.

Results.—The drilling results, as plotted in the section, show plainly that there is no definite, well-marked bed-rock channel at this point. The section does show a depression between holes Nos. 3 and 5, but from the log of hole No. 2 it would appear improbable that this depression is a water-worn channel. It will be noted that the material in the lower part of hole No. 2 is slide-rock and the log shows that there was practically no gravel present.

In reporting on the drilling results, Mr. Moore says: "This hole (No. 5) was put down to determine whether there was a deep channel between holes Nos. 1 and 2. I think it showed beyond a doubt there is not."

It is possible, but not probable, that deeper ground would be found between holes Nos. 2 and 3. The distance between these holes is insufficient to make it at all probable that there is a channel at this point.

A short distance up the hill from the wagon-road (and No. 3 hole) bed-rock crops at the surface in a rock bluff. It is evident from the drilling results that between this rock bluff and the old workings of the *La Fontaine* mine the bed-rock descends in an irregular manner such as might be found in any hillside.

In the five holes drilled no gold values were obtained in the panning of the drillings. It is highly probable that if any of the holes were in the vicinity of a deep channel containing the rich lead of Lightning creek some indications of values would have been found. The conclusion therefore is that no old channel exists in the right rim of Lightning creek at the section drilled.

FORT GEORGE SECTION.

By the Fort George section is meant the northern and eastern parts of the Cariboo Mining Division, which territory is naturally tributary to the town of Prince George. A number of examinations were made in this section in the summer of 1922. Reported occurrences of iron ore near McBride were not examined, but Mr. Johnson, locator of the claims, was seen at McBride. The showings are situated some 60 miles northerly from McBride, and it was not possible to arrange with the owner to make the trip in at that time.

An examination of Goat river was made, as a number of men were engaged in prospecting along the stream for placer gold. Some assistance was granted the miners to finish a trail which they had commenced up the west side of the river. Placer operations on Hixon creek, quartz properties near Hansard, and other properties near Prince George were examined.

Snowshoe This property is situated about 15 miles north-easterly from Prince George.
Group. It was described in the 1918 Annual Report. The claims are now under option to W. Cbeer and C. Carter from the original owners, Framsted and Bonner.

The formation consists of a large diorite dyke, up to 300 feet wide, which is intrusive into slate. Development consists of a number of open-cuts and a shaft 30 feet deep. From these workings it is seen that the diorite and the diorite-slate contact-zone is in places very slightly mineralized with pyrite, pyrrhotite, and chalcopyrite. Assays show that the mineralized rock does not carry appreciable values in gold or silver, and that average samples have too low a copper content to be of commercial importance. This occurrence is simply an indication of mineralizing action in this vicinity, but none of the known showings are sufficiently promising to warrant development.

North Point This company was organized for the purpose of developing a number of mineral
Mining Co. claims owned by Oscar Eden. The property is situated on the Fraser river, about 24 miles down-stream from Hansard, a flag-station on the Grand Trunk

Pacific Railway 45 miles east of Prince George. A motor-boat is used down the river from Hansard; this stretch of the river is quiet, with no rapids. Prince George lies down-stream on the Fraser, about 50 miles from the property, but in this stretch of the river there are several rapids, so that the Hansard route is the better one. Outcropping on the property are several quartz veins occurring in a schist formation. These veins are irregular and lenticular; having been involved in the forces developing schistosity in the formation as a whole. They vary from 2 to 5 feet in width. The principal metallic minerals present in the quartz gangue are galena and pyrite, but the percentage of these sulphides present is not great. The most important vein has been prospected by a shaft 15 feet deep, which was filled with water and so could not be examined, and a 30-foot drift-tunnel. This tunnel shows the vein to be only slightly mineralized, although it is continuous throughout. An average sample taken across 5 feet at the face only returned traces of gold and silver. A grab sample of the dump assayed: Gold, trace; silver, 1.2 oz.; lead, trace. Selected galena gave: Gold, trace; silver, 40 oz.; lead, 58 per cent.

After the North Point Company was organized it was decided to develop this vein by means of a long crosscut tunnel. At the time of visiting the property this tunnel was in 630 feet and required about 100 feet to reach the vein. This tunnel will give a depth of 150 feet below

the outcrop of the vein. It would have been advisable to have done more testing of the vein on the surface before commencing this crosscut tunnel. It is not known whether or not work was continued in driving the tunnel during the fall.

There is a good camp, with necessary log buildings, at the edge of the river on a Crown-granted pre-emption owned by Oscar Eden. The crosscut tunnel is at a point about 1,000 feet from this camp.

Bull Moose. This group of four claims, owned by Carl Johannsen and Fred Petersen, is situated on Averill creek, which flows into the Fraser river about 1 mile up-stream from the North Point Mining Company's property. The showings are situated about a mile up the creek from its mouth. The property is reached by boat on the Fraser river from Hansard. The showing consists of a quartz vein exposed in a small canyon cut by Averill creek. It is developed by some open-cuts and a tunnel 180 feet long. The quartz occurs in bunches or kidneys, in graphitic and micaceous schist, and the mineralization is with pyrite and galena. The general strike of the zone is east and west (mag.), with a steep dip to the south. A grab sample of the quartz on the dump only returned traces of gold and silver, and a similar result was obtained from an average sample taken across 3 feet in one cut. A sample of selected galena and pyrite assayed: Gold, trace; silver, 10 oz.; lead, 11 per cent.

GOAT RIVER.

Goat river is a fairly large stream which rises in the Cariboo mountains and, flowing westerly, joins the Fraser river 25 miles to the west of McBride. One of the old trails to Barkerville followed up this river. The river occupies a comparatively narrow U-shaped valley and is a rapid stream, with a steep grade. There are very few benches in the valley, and it is apparent that for the part of the river examined, for some 12 miles up from its mouth, the stream is at present occupying an old well-marked and deeply cut Tertiary valley, which has been deepened by ice-action in the Glacial period. There are no indications of old channels lying at higher elevations than the present stream. The gravels and clays along the valley are largely glacial material or such material resorted by recent stream-action.

In the fall of 1921 some interest was attracted to this area by reports that a party of eight Chinese miners had struck some rich gold-bearing gravel. So far as can be learned, the Chinamen worked two or three months and took out a few hundred dollars' worth of gold-dust. The method of working was by wing-damming the stream and cleaning up the gravels to bed-rock. The bed-rock, however, is not a true one, but consists of a stratified-clay deposit, which is apparently of glacial origin. The Grand Trunk Pacific Railway crosses Goat river almost at its junction with the Fraser river, but the nearest station is Rooney, 2 miles westerly.

In the summer of 1922 from twenty to thirty men were prospecting along the river from the mouth, up-stream for 20 miles. Most of these men only prospected a short time and then left, but small-scale mining was attempted by some of them.

Just below the mouth of Boulder creek, which joins Goat river about 7 miles up from the mouth, two leases have been taken up by M. C. Kendall and Archie Stewart. They had constructed a quarter of a mile of ditch-line to take water from Boulder creek and intended ground-sluicing a portion of their ground.

Two miles above this two record claims have been staked by Ed. Smith, who is working the ground by means of ground-sluicing. The bed-rock showing at this point is a schist and in places there are quartz stringers cutting it. The deposit being worked is a bench and consists of sand, chicken-feed gravel, and a stratum with coarse boulders.

Two miles farther up-stream two bench leases have been staked by K. W. Sherman and John Pallifer. A 1,600-foot ditch-line has been constructed to bring water from Diggings creek for ground-sluicing. The deposit is on a bench and consists of the usual recent stream-gravels. There are plenty of quartz boulders in the gravels and some quartz stringers in the schistose bed-rock were noted.

The party of Chinese who worked in 1921 had not returned to their ground at the time of examination, but it was said they intended to later in the fall.

It is not probable that much gold was taken out as a result of these various prospecting operations, but it is hoped that some ground that will pay to work by ground-sluicing or hydraulicking was proven.

There are a number of placer leases held on Hixon creek, which joins the Hixon Creek. Fraser river 40 miles south of Prince George. One of these, owned by Mrs. D. A. Cameron and situated just below the junction of Government and Hixon creeks, was secured under option by the Government-Hixon Creek Gold Mining Company, Limited. The company is capitalized at \$100,000 and the head office is at Prince George. The ground was tested slightly by means of shallow pits and panning, and it was considered by the company that it would pay to work by means of a scraper plant. The area covered by this lease is nearly flat and the gravels are apparently the ordinary stream-gravels, consisting for the most part of reworked glacial gravels, and some of recent origin. The creek runs through a wide flat, but it is only a few feet below the general level. The plan of operation was to divert the creek to one side and commence mining the present stream-bed.

A small dam was built on Government creek and a flume 1,700 feet long constructed to bring the water to the point of mining, at an elevation of 40 feet above the creek-level. The scraper plant pulls the creek-gravels up to a dump-box at the end of this flume and a short flume carries away the tailings, which are piled up on ground that is not intended to be worked. The scraper plant consists of a steam boiler and engine, which by means of a system of cables pulls backward and forward a 1¼-yard scraper, which after digging the gravel is pulled up an inclined timber approach to the elevated dump-box. Such scraper-dredges as these have been worked successfully in a number of places, but only where the gravel is easy to dig—uncemented—and not too large boulders. The plant on this property has not so far been satisfactory owing to a number of reasons. The gravel is not cemented, but contains some very large boulders, and the particular scraper in use did not seem to dig very well. A different design of scraper might be more efficient. For the efficient working of the scraper more power would seem to be required. Not sufficient ground was handled during the season to give any idea as to the results that may later be obtained.

Only surface gravels were dug and the depth to bed-rock is unknown. The company is now being reorganized and it is expected that more capital will be secured for a more extensive test during the coming season.

QUESNEL MINING DIVISION.

QUESNEL RIVER SECTION.

During the summer some testing of the gravels on a number of dredging leases on the Quesnel river, above the town of Quesnel, took place. The method used was to sink pits by hand as deep as was possible. Messrs. Whittier and Neal were in charge of the work, the latter being an experienced dredgeman from California and designer of the Neal jig. The work was done as a preliminary investigation to see if the ground was suitable for dredging.

The results that were obtained are not known, but it is believed that good values were found in places. None of the holes reached to bed-rock, but a number went down to a false clay bed-rock. It is apparent that on this part of the Quesnel river there is a gravel run of varying depth overlying the clay. It is believed the investigation will be continued during the season of 1923, when a drill may be used.

No further work was done by the Cariboo Gold-Platinum Extracting Company on its property on the Quesnel river. The construction of the company's black-sand plant for the extraction of platinum was started on the site on the Fraser river about a mile from the town of Quesnel. This plant has been designed by S. J. Marsh, president of the company, and will use the special patented Marsh process for treatment of black sands. When completed, the plant is to treat the product from the company's property and any custom ore offering.

QUESNEL LAKE SECTION.

The name "Quesnel Lake section" is used to designate the country from Quesnel Forks to the head of Quesnel lake and Clearwater lake and includes the Cedar Creek camp. The operations which were started on the old *Bullion* mine in 1921 were not continued during 1922. Apparently the syndicate in possession last year has not been able to continue operations and the future plans are not known.

Spanish Creek Gold Mining Co.—This company has been organized to take over and work certain placer leases owned by Geo. Moon and others. The property, consisting of seven leases, is situated on the south bank of the North fork of the Quesnel river, 7 miles east of Quesnel

Forks. So far, only prospecting-work has been done by means of a small stream of water used as a ground-sluiice. The deposit being worked is on the edge of the river, but it is believed by Mr. Moon, who was in charge of the work, that there is an old channel of the river at this point. The ground-sluiicing had cut through the rim-rock near the edge of the river and exposed bed-rock, dipping in the opposite direction or away from the river into the hill, thus indicating the possibility of a channel parallel to the river.

Some gold is obtained in the rim-gravels. This gold is well worn and in small particles. Besides the gold, the concentrates in a pan show some pyrite and a little galena.

G. Kent was engaged during the season in making a survey of the property with a view to equipping it with an hydraulic plant. A ditch-line from the property to points on Black Bear and Spanish creeks was surveyed; water rights have been filed on these two creeks to give 2,000 miners' inches of water. A 6-mile ditch and 1,400 feet of pipe-line would be required to give an effective head of about 350 feet at the property. Work was stopped in the fall and the plans for next season will depend largely on the financing that the company is able to do.

C. Macdonald and partners were working during the season on the *Standard Standard Group*. group of five leases, situated a mile up Spanish creek from its mouth. This portion of the creek was worked many years by drifting methods. The present owners were ground-sluiicing in order to find, if possible, a continuation of the old pay-streak on the right bank of the creek.

This placer property consists of three leases and is owned by King & Ramsay.

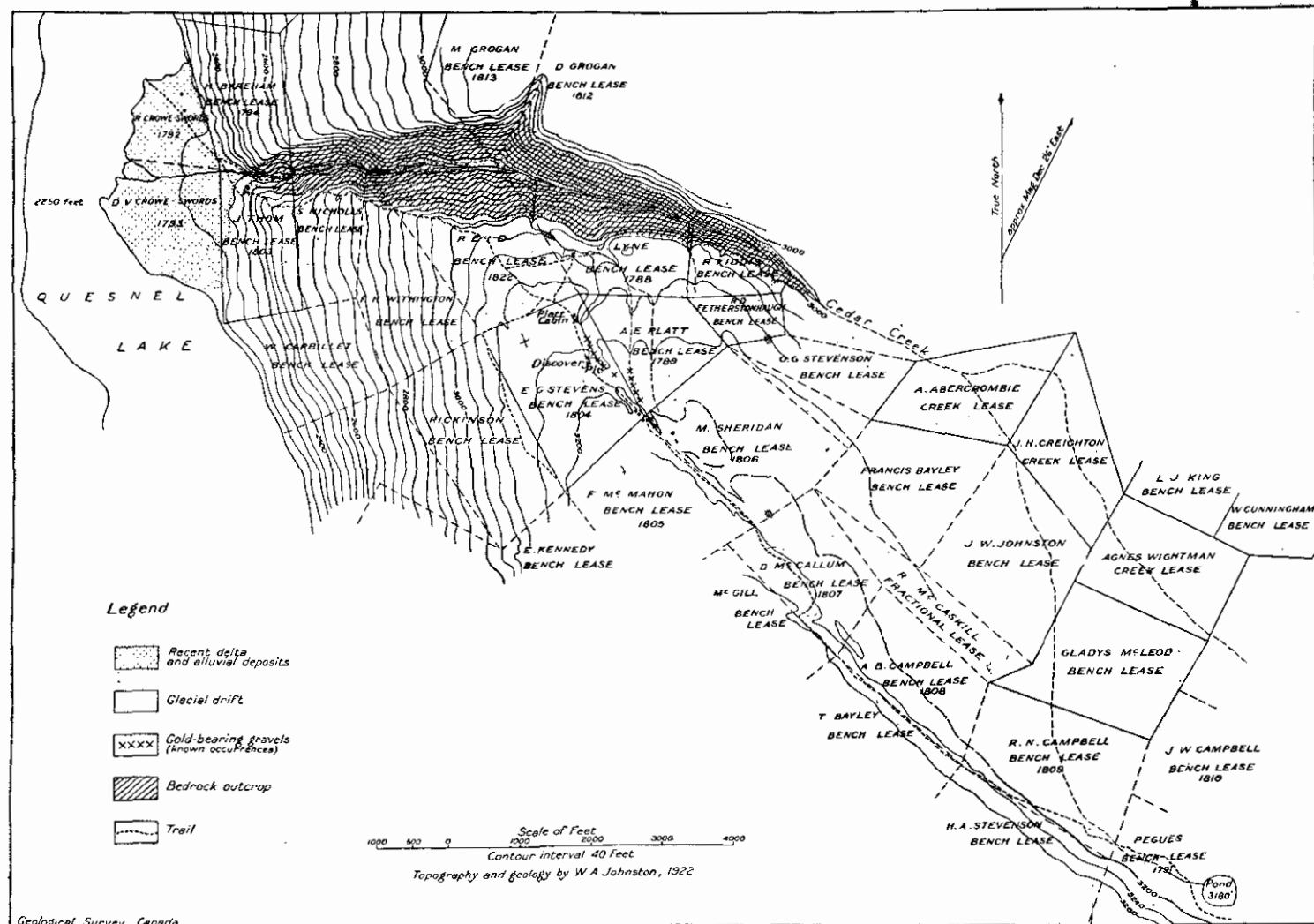
Hardscrabble. It is situated about three-quarters of a mile from Quesnel Dam, on a bench a few hundred feet above Quesnel lake. There is at this point some evidence of a gravel-filled channel of considerable size. The owners sank a shaft 23 feet deep which failed to reach bed-rock. A ground-sluiice was then started which comes in on a level 5 feet below the bottom of the shaft. This sluiice cuts through the rock-rim of the channel, but apparently was not low enough to reach the deep ground in the centre.

The top material consists of yellow oxidized gravel which contains some colours of gold. This is underlain by a blue glacial clay which is partly cemented. Whether or not this clay extends to bed-rock or is underlain by gravel had not been determined at the time of visiting the property. It is not known what results were obtained by King & Ramsay from their season's work. They are industrious prospectors and it is to be hoped they will be successful.

CEDAR CREEK CAMP.

The Cedar Creek camp has attracted considerable attention during the year and much publicity has been given to it in the daily papers. An excellent article on the camp by W. A. Johnston, of the Canadian Geological Survey, is given in the *Canadian Mining Journal* of November 10th, 1922. The discovery of gold in this area was made by Lynes & Platt in the fall of 1921, and during the following winter numerous leases were staked in all directions from the discovery ground. There was a considerable rush of prospectors to the district in the early summer of 1922, most of whom spent some time looking over the country and then left, or remained to work for wages on the two productive properties of the camp. Up to the present time three leases have been shown to contain rich pay-gravel, but no extension of the known rich area has been made. The most important development of the year was the discovery of extremely rich ground in the left bank of the discovery draw. No efficient mining methods have been used as yet, the bulk of the production for the year having been made with the use of rockers. There is very little water-supply for washing purposes, and yet on many of the leases prospecting by hand methods is difficult owing to the seepage-water; in many instances prospectors were unable to sink holes through the gravel to bed-rock owing to this underground flow of water. The production from the camp for the year is estimated at \$125,500, and it is expected that with more efficient mining methods next year a much larger output will be made.

Cedar creek was mined for placer gold in the sixties and intermittently for many years after, but this mining was along the bed of the stream for about a mile up-stream from the lake. Apparently above this no appreciable gold was found, although it is claimed some prospecting was done on the benches above the rocky canyon in which the creek runs. From the old reports it is apparent that no phenomenally rich ground was found in these early workings. It had always been considered a possibility that the area south of the Cedar Creek gorge was good prospecting-ground, but it was not until the fall of 1921 that John Lynes and A. E. Platt made



the discovery. According to the local stories, Lynes had been told by old-timers, and particularly by John Likely, regarding the possibilities, and so he persuaded Platt to go in with him in prospecting. The actual discovery was made in a small flat draw draining into Cedar creek and about half a mile south of the creek. It is interesting to note that the old Mitchell trail, one of the first routes to Barkerville, went this way and is not more than a quarter of a mile away from the discovery.

Location.—Cedar creek is a small stream flowing into Quesnel lake about 3 miles above the westerly end of the lake. The outlet of the lake is the South fork of the Quesnel river, and at this point is situated the townsite known as Quesnel Dam, so named because at this point a dam was erected across the river for mining purposes some twenty years ago. Quesnel Dam is the outfitting-point and town for the new Cedar Creek camp. It has a hotel, stores, and a number of buildings. A motor-road runs from Williams Lake, a divisional point on the Pacific Great Eastern Railway, to Quesnel Forks, a distance of 64 miles. From this point there is an indifferent road to Quesnel Dam, a further distance of 8 miles. An old road leaves the main Quesnel Forks road at the *Bullion* mine and goes to the south side of Quesnel Dam. Part of the dam was removed two years ago, so that there is now no bridge at this point, and to get over to the town it is necessary to cross in a boat. This is the route which is principally used, as it is shorter than by Quesnel Forks, the total distance from Williams Lake to Quesnel Dam being about 60 miles.

The mouth of Cedar creek is reached from Quesnel Dam by boat up the lake 3 miles. From the mouth of the creek up to the diggings there is a rough wagon-road $1\frac{1}{2}$ miles in length. In the fall a trail was built along the shore of the lake from Quesnel Dam to Cedar creek. This will be needed when the lake is freezing up in the winter and breaking up in the spring. This trail was laid out on a suitable grade, so that it can be improved into a wagon-road.

Physical Features.—Topographically this section of country belongs to the Interior plateaus of British Columbia. It is characterized by a plateau-like elevated surface which is deeply carved by lakes and rivers. Quesnel lake at its lower end is narrow and steep-sided, with the enclosing hills flattening off to form the elevated plateau surface at elevations of from 800 to 1,500 feet above the lake. The upper parts of the creeks, as a rule, flow in broad flat valleys not much below the general level of the plateau, while their lower parts cut down deeply, forming gorges and hanging valleys. The uplift of the old plateau surface which revived stream-action probably caused changes of drainage which left certain old stream-channels stranded.

As a result of glaciation the country is almost everywhere covered with a mantle of glacial drift. The effect of glaciation has been to partially scour off the gravels left in any old stranded stream-channel, and in part to cover up and protect such gravels with a layer of glacial gravels and clays. The long-continued period of erosion in Tertiary times (as proven by a consideration of the plateau surface and its isolated hills) undoubtedly gave rise to rich concentrations of auriferous gravels in the Tertiary channels. In the Cariboo District generally it is in the portions of these ancient channels, which by one means or another were protected from glacial erosion or recent stream-action, that the richest placer-deposits have been found. In some instances a recent stream has undercut and robbed some ancient channel of its gold content, thereby also giving a rich deposit. A recognition of the elevated plateau and the possibility of ancient channels at that level is of great importance to the prospector.

The upper part of Cedar creek flows in a broad flat-bottomed valley, while the last 2 miles to Quesnel lake is in a narrow V-shaped rock gorge. This gorge portion of the creek has a fairly even grade, but it is a steep one, as the creek descends about 600 feet in $1\frac{1}{2}$ miles. The sides of the gorge are, in places, almost straight up and down for 200 to 400 feet. Bed-rock is well exposed in the gorge, but elsewhere in the area is rarely seen, except where exposed by the placer-workings.

Cedar creek is only a small stream of water and it is evident that a very much larger stream must have flowed to cut out the canyon, even allowing for some deepening by ice-action. The upper part of Cedar creek swings to the south and nearly parallels the lower end of Quesnel lake. The creek at its head rises in small ponds which are at about the general plateau-level.

The discovery of placer gold was made on a small tributary of Cedar creek, which hardly contains enough water to call it a creek. It consists of seepage-water which collects in a flat draw or slight depression and flows with a gentle grade to the edge of the Cedar Creek canyon, and then drops precipitately. This stream of water does not cut down to bed-rock and has had no effect in cutting out a bed-rock channel.

The discovery draw is a part of the elevated plateau surface. The surface is covered with vegetal material and glacial clays and the contour of the bed-rock is not indicated by the surface. The area is heavily timbered and this, together with the lack of defined stream-channels, has made prospecting difficult. It should be emphasized that the placer-deposit at this point is in no sense a bench of Cedar creek, as it is half a mile southerly and about 600 feet above Cedar creek.

Description of Leases.—After making the discovery Lynes & Platt staked two leases; the Platt lease was intended to include the actual discovery and the Lynes lease was adjoining, to the north. Owing to faulty location the Platt lease did not include the discovery, as was shown later when surveys were made, the discovery being on the Stevens lease, a later location. Later on, however, pay-ground was found on the Platt lease in a small draw to the east of the discovery draw.

After the news of the Lynes & Platt discovery became known a considerable number of leases in the surrounding area were staked. Most of this first staking was by local people in the Cariboo District, and by the time the rush started in the spring of 1922 a large area of country had been staked.

The group of leases known as the "Trappers Ground" consisted of six leases staked by Stevens, McMahon, McCullom, Sheridan, and the Grogan Bros. In July, 1922, these six leases were secured under option by the Cedar Creek Mining Company. Since that time steady work has been carried on by the company.

Difficulties arose between Platt & Lynes regarding the ownership of their two leases, but it was finally decided by the Courts that each of the partners had a half-interest in each lease. Pay-ground had been discovered on the Platt lease, to the east of the discovery draw on the Stevens lease, but no pay-ground has yet been found on the Lynes lease. The Platt & Lynes leases are now controlled or owned outright by McCaskill & Wright. Owing to litigation and injunctions the Platt lease was tied up most of the season and but little work was done on it. Once the ownership definitely passed to McCaskill & Wright, work was started and continued until the freeze-up in the fall.

Other leases in the immediate area are the Reid, Campbell, and Kennedy properties. On the map accompanying this report a number of the surrounding leases are shown. This map is copied from the map prepared by W. A. Johnston, which appears with his article, previously mentioned, in the *Canadian Mining Journal*.

With the exception of the Platt, Lynes, Stevens, and Sheridan leases, comparatively little work has been done to thoroughly prospect the numerous leases staked in this section. In many instances attempts were made, but the prospectors could in but few instances get down to bed-rock owing to the seepage-water.

The Finlayson Bros. sank a number of holes on their lease, which lies 4 miles to the south of the discovery. A number of these holes reached bed-rock at depths of from 10 to 20 feet, and some favourable indications found, including colours of gold, but not in paying quantities.

It is expected that further testing of some of the leases in this area will be carried out during the winter, when less difficulty from water will be experienced.

Origin of the Deposits.—The Cedar Creek placer-deposits differ considerably in their surface features from the usual types of placer-deposits in the Cariboo. The discovery draw is not in a defined creek; what water flows in it is seepage-water which runs over the surface and nowhere cuts down to bed-rock. There is no channel in the bed-rock under the surface flow of water and the surface is covered with a thick growth of timber.

The placer-gravels vary in character at different points in the area. At the discovery workings a layer of 2 feet of black muck, vegetal material, overlies the surface; below this is a bluish-grey clayey gravel and broken bed-rock from 2 to 3 feet thick. It is in this lower 2 feet that the gold occurs. On the Platt ground there is from 1 to 6 feet of overlying glacial drift, which is practically barren of gold and from 2 to 4 feet of brownish gravel which is gold-bearing.

On the left bank of the discovery draw some phenomenally rich pay-dirt has been taken out. The gold is in the lower 2 to 4 feet, resting on bed-rock, and is overlain by 2 to 12 feet of barren glacial gravels. The lower gravels are reddish with much clay in them. Undoubtedly this clay represents a weathering of some of the gravel in-place and is therefore a good indication that the gravels are not of recent origin. A characteristic feature of the pay-gravel is the



Cedar Creek, Placer Operations, Quesnel M.D.



Cedar Creek, Steven's Lease, Quesnel M.D.

presence of small cubic crystals of iron which occur in considerable quantity and consist of pseudomorphic crystals of limonite after pyrite.

The gold may be described as coarse and is as a rule well worn, although in places rough gold is seen. Nuggets worth a few dollars are common and some large ones have been obtained; a \$115 piece is the largest reported. Colours of gold from 1 to 10 cents in value make up the larger portion of the gold recovered. The average of a number of assays shows the gold to be worth almost exactly \$17 an ounce.

The writer is of the opinion that the rich gravel on the left bank of the discovery draw is of Tertiary age and probably in the place where it was formed. The pay-gravels of the discovery draw and Platt draw represent various degrees of intermixing of the original Tertiary gravels with glacial clays and broken bed-rock gravels. This has been partly accomplished by glacial action and partly by the resorting action of small streams subsequent to the glacial period.

Two or three test-pits have been sunk on the Sheridan lease and good "pay" is reported; this lease is controlled by the Cedar Creek Mining Company. This ground is from 10 to 15 feet deep and as the holes were full of water no information was available about the character of the gravels. It seems highly probable that the Tertiary gravels of this Cedar Creek camp were laid down in some old pre-glacial channel and that the present drainage-lines have but little to do with the course of this old channel. It is, of course, possible that Cedar creek at one time formed this old channel. There would seem to be good grounds for the supposition of the miners that extensions of this old channel will be found and the known area of pay-gravels considerably increased. This section of the country has been glaciated, but it is evident that the glacial action has not been such as to scour or erode deeply the country. The presence of undoubtedly pre-glacial gravels and lack of glacial striae in the bed-rock shows that in but few places did erosion take away the surface gravels entirely. Glaciation has, however, covered the area everywhere with a mantle of clays and gravels which effectually conceals the underlying gravels and makes prospecting arduous and difficult.

Operations.—The Cedar Creek Mining Company has employed a crew of from fifteen to fifty men on the Stevens lease since July. Two rockers have been kept steadily at work and at times four rockers were in use. Much heavy clearing was necessary to open up the ground. Necessary camp buildings were erected and a rough road from the mouth of the creek up to the workings was constructed. In the fall two small plants were put in, which commenced operations about the end of October. A small dam was built at the lower end of the discovery draw, which creates a reservoir to collect the surface water. At other points all the available water was collected by means of surface ditches to small ponds. The system used is to pump the water up to a sluice-box and use this water for washing the gravel, which is shovelled into the box; the water runs back into a reservoir and thus is used over again. Near the lower end of the draw a steam pump and boiler was put in for pumping water and higher up a gasoline-driven pump was used. The steam plant was only used for about a month, when it was connected up to the upper plant to give more water for the upper sluice-boxes. Shortly after this very cold weather commenced and the sluicing was discontinued. About the end of the year the sluicing plant was again started, as owing to milder weather a water-supply was available. The results obtained from this work are claimed to have been satisfactory, and it is expected that in the spring of 1923 a more extensive sluicing system will be constructed. There is no source of water-supply in this section which could be utilized for hydraulic mining, but by catching all the seepage and surface water a sufficient supply for sluicing will be available during part of the season.

With a proper sluicing system a considerable amount of gold should be taken out by the company during 1923. The production of the company for the year was approximately \$115,000. Under the terms of the option on the leases held by the company, 60 per cent. of the actual gold taken out is turned over weekly to the owners, which is credited to the company on the purchase price.

To begin with, the company worked the gravels in the discovery draw, and although the lower 2 feet on bed-rock is rich, running from \$50 to \$60 a yard, it is doubtful if much profit could be shown owing to the very inefficient and expensive methods used by the company. After working the discovery draw in an irregular and patchy manner to where it terminates in a bank of drift, prospecting of the left bank was commenced. It soon became apparent that the lower 2 to 3 feet of gravels on bed-rock here differed somewhat from those of the draw itself, and what

was most important to the company, that these gravels were extremely rich. When working in this place the daily clean-up varied from 30 to 60 oz. a day, and one day 103 oz. was obtained. These clean-ups were obtained with the use of two rockers, in which from 1 to 1½ yards of gravel (each) were treated. It is safe to say there is gravel at this point running at least \$200 a yard. After making a large opening on the left bank of the discovery draw two drift tunnels were started, which have been driven a short distance.

Summing up the results of the season's work by the Cedar Creek Company, it has been proven that pay-gravels extend for 500 to 600 feet down the discovery draw from its head and to have a width of from 20 to 40 feet. This whole area will probably pay to work out by some sluicing method. A shaft sunk in the left bank at the lower end of the draw, just below Platt's cabin, showed fair values. The rich place on the left bank of the discovery draw, near its head, has been shown to have a considerable areal extent. Holes sunk on the lower end of the Sheridan lease have shown good pay values in the lowest 3 to 5 feet of gravel on bed-rock. This occurrence has not been connected up with the occurrences on the Stevens lease.

On the Platt lease intermittent work has been carried out during the season, with the result that pay-gravels have been found to extend for a distance of about 400 feet up and down a shallow depression or draw. This occurrence, which lies a few hundred feet to the east of the discovery draw, has not been connected up with the occurrences on the Stevens or Sheridan leases.

HEMLOCK CREEK PLACER GOLD COMPANY, LTD.

The property of this company is situated on Hemlock creek, a stream flowing into the head of Hobson (Upper Clearwater) lake. The route to this place is by motor-boat from Quesnel Dam to the head of Quesnel lake, a distance of 90 miles. From this point there is a trail across to Hobson lake, 6 miles in length; then 3 miles to the head of Hobson lake and the mouth of Hemlock creek is reached. The placer leases of the company commence about 1½ miles up the creek from its mouth.

Leases were taken up by W. Westenhiser, J. McRae, and partners over twenty years ago, and several attempts have been made to work the property in past years. The old workings consist of tunnels to test the gravel-deposit, flumes, dams, and ditch-lines, and small-scale attempts at hydraulicking or ground-sluicing. Most of these previous attempts were unsuccessful in properly testing the gravels and lack of funds prevented the work being carried to completion.

The property was taken over in 1920 by P. J. Job, who organized the New Cariboo Goldfields Company. Very little was accomplished by this company, except some further testing of the property and a fairly comprehensive examination by Arthur M. Davis. In 1922 a reorganization of the company was effected and the name changed to the Hemlock Creek Placer Gold Company. This new company has an option to purchase certain leases held by Westenhiser and partners and owns some leases and interests in leases outright.

Hemlock creek is a fair-sized stream carrying in medium-water period from 10,000 to 12,000 miners' inches of water. For three-quarters of a mile up from Hobson lake it runs on a slight grade, but for some distance above this and extending above the property of the company it is a rushing torrent with about a 10-per-cent. grade. An adequate supply of water for hydraulicking operations could be secured from Hemlock creek and the creek would carry away any amount of tailings.

The deposit of gravel, which has been partially worked and opened up, is on the left bank of the stream and may be considered as a bench deposit rising from the creek-bed. It is claimed that it is a part of an older channel of the creek, and this is possible. Where opened up there is a face from 150 to 200 feet high, the upper portion of which consists of glacial clays and gravels. It was not possible to see the lower gravels as they were covered up, but the report of Arthur M. Davis says that there is a well-washed gravel of a bluish tinge resting on bed-rock.

The question of the average gold values in this gravel-deposit is of course the important one. It is claimed that the tunnel driven into the deposit showed an average value of 65 cents a yard. It is also claimed that there is a certain amount of fine gold in the upper gravels, and an average value of at least 10 cents a cubic yard is said by the management to be conservative. Mr. Davis estimates that a suitable hydraulic plant could be put on the property for an expenditure of \$35,000, and that costs of operation would be in the neighbourhood of 5 cents a yard.

The company is now engaged in financing and it is hoped that sufficient capital will be raised to go ahead with the erection of an hydraulic plant in 1923.

KEITHLEY SECTION.

Kitchener. This property, which is situated on Keithley creek about $1\frac{1}{2}$ miles up from its mouth, was secured in 1920 by J. H. Scattergood. Under the direction of K. C. Laylander, the property was equipped with a water system and opened up as an hydraulic mine. The plant was completed in 1921 and a description of this is given in the 1921 Annual Report. The season of 1922 was the first full season's run as an hydraulic mine, but most of the ground so worked had been previously drifted when the property was run as a drift-digging by Harrison & Worth. The hydraulic pit is now advanced to about the end of the drifted ground, so that next season's run should give better results. Some trouble was experienced in 1921 by slides, but this was obviated this year by running off a lot of the top gravels and clays by a separate temporary sluice to Keithley creek. Small slides occurred in the pit this year, but not such as to seriously interfere with the operations.

In ordinary years this property has an excellent water-supply from Keithley creek, but owing to the unusually dry season only a small head of water was available during a considerable part of the hydraulic season. Next season it is intended to put steel plates in the tailings-flume, which will facilitate the easy handling of the large boulders occurring in the deposit. At present the flume is paved with the customary wooden blocks, which are rapidly worn away by the sharp rocks going through. By paving with steel plates the time and expense of renewing the wooden blocks during the hydraulic season will be saved. A gasoline-driven hoist and derrick will also be erected, by means of which the largest boulders will be stacked. Formerly it had been necessary to drill and blast the boulders, but next year most of this work will be obviated. No production figures have been given out by the management, but it is believed that the season's results were satisfactory. The yardage of ground piped off was 649,442 cubic yards.

DeLong.—About 4 miles up Keithley creek from its mouth a small-scale hydraulic property was operated during the season by DeLong. The ground worked is on a small tributary creek just above where it joins Keithley. Satisfactory returns were obtained from the season's work.

CARIBOO DISTRICT.

CARIBOO MINING DIVISION.

REPORT BY H. BEECH, GOLD COMMISSIONER.

I have the honour to submit herewith the office statistics for the year ended December 31st, 1922.

OFFICE STATISTICS—CARIBOO MINING DIVISION.

Free miners' certificates issued	165
Mineral claims recorded	103
Certificates of work ("Mineral Act")	82
Placer claims recorded and rerecorded	40
Leaves of absence	11
Applications for placer-mining leases (of these, 248 are now in the Quesnel Division)	380
Certificates of work ("Placer Mining Act")	239
Powers of attorney recorded	58
Conveyances and agreements recorded	98

Revenue.

Mining receipts, general	\$32,844 31
Free miners' certificates	1,481 00
Other sources	840 10
Total	\$35,165 41

OMINECA AND PEACE RIVER MINING DIVISIONS.

REPORT BY STEPHEN H. HOSKINS, GOLD COMMISSIONER.

I have the honour to forward herewith the office statistics for the Omineca and Peace River Mining Divisions for the year ending December 31st, 1922.

No information regarding the progress in mining in the Peace River Mining Division has been received from the Mining Recorder for that Division, stationed at Fort St. John, so the information given below does not represent a full report for the two Mining Divisions.

OFFICE STATISTICS—OMINECA AND PEACE RIVER MINING DIVISIONS.

Free miners' certificates (ordinary)	490
Free miners' certificates (company)	9
Free miners' certificates (special)	3
Mineral claims recorded	295
Certificates of work recorded	519
Placer claims recorded	4
Bills of sale and mining agreements recorded	99
Powers of attorney recorded	16
Mining documents filed	64
Certificates of improvements recorded and issued	12
Crown grants of mineral claims issued	12
Applications for placer-mining leases (Omineca Division)	1
Applications for placer-mining leases (Peace River Division)	10
Placer-mining leases issued (Omineca Division)	1
Placer-mining leases issued (Peace River Division)	16

Revenue.

Free miners' certificates	\$ 2,491 90
Mining receipts	7,545 75
Total	\$10,037 65

The preceding report of J. D. Galloway, the Resident Mining Engineer of the district, very fully covers the various mineral developments of the district, so it will not be necessary for me to repeat them.

QUESNEL MINING DIVISION.

REPORT BY W. A. CAMPBELL, GOLD COMMISSIONER.

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, 1922.

As in the past, the Resident Mining Engineer is forwarding a report on the various properties throughout this Mining Division.

OFFICE STATISTICS—QUESNEL MINING DIVISION.

Free miners' certificates issued (individual)	798
Mineral claims recorded	130
Certificates of work issued ("Mineral Act")	6
Placer claims recorded and rerecorded	38
Powers of attorney recorded	414
Applications for placer-mining leases	295
Placer-mining leases issued	20
Certificates of work issued ("Placer-mining Act")	34
Conveyances and agreements recorded	37
Placer-mining leases in force	~~263~~

Revenue.

Free miners' certificates	\$3,290 25
Mining receipts, general	4,329 15
Total	\$7,619 40

CENTRAL DISTRICT (No. 3).

REPORT OF A. W. DAVIS, RESIDENT MINING ENGINEER.

INTRODUCTORY.

The No. 3 or Central Mineral Survey District comprises the seven Mining Divisions of Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale. The Resident Engineer's headquarters office is at Kamloops, from which point all parts of the district can be reached by a few hours' journey by rail or by motor over good roads.

For several years the mineral production of the Central District has been extremely small. It is probable, however, that the time has about arrived when there will be a marked improvement in this respect. There are two ways in which this result will be attained. One is through the finding of new deposits and the other through the reorganization and grouping together of various existing mines, which, while incapable of operating successfully separately, can do so, it is believed, when grouped together. For instance, on Cadwallader creek there are four small mills with a capacity of from 10 to 20 tons a day each. Were these replaced by one modern mill of larger capacity, the result would be one overhead instead of four, cheaper milling, and an increased saving in values.

With regard to the finding of new deposits, it has been noted that the old-time type of prospector, contrary to what some believe, is not yet extinct. There are still men in this area who are willing to endure hardships and carry their packs into some of the inaccessible areas.

As a future source of the non-metallic minerals this district, largely in the Dry Belt, would appear to be the most important of the Province. Large deposits of gypsum, magnesium sulphate, magnesite, sodium sulphate, and sodium carbonate are in existence; some of them near the railways. With the exception of gypsum, the market is nearly stagnant in connection with this material at the present time, but this condition may not continue indefinitely.

The eastern contact of the Coast batholith, which figures so prominently in the ore-deposits of the North-western Mineral District, crosses the Central District in the new Taseko area and also at Hope. In both places active mining is going on and successful development is to be expected.

Stimulated by the recent Cedar Creek discoveries in the North-eastern Mineral District, placer-mining and prospecting has increased. No large production of gold has as yet been reached. On one property, the British Columbia Alluvials, Limited, operating on Bridge river, a large campaign of construction has just been completed. With the successful operation of this plant next season this type of mining would be greatly stimulated.

For the last couple of months of the year the *Iron Mask* mine at Kamloops has been running one side of its mill, tuning everything up and experimenting in different oils used in flotation. The few hundred tons of concentrates resulting are still stored at the property. With the new year it is proposed to start up operations on full scale.

While the various Mining Divisions will be taken up in their turn, the non-metallic minerals contained therein will be dealt with under one heading.

LILLOOET MINING DIVISION.

BRIDGE RIVER SECTION.

The British Columbia Alluvials, Limited, has just completed construction-work at the Horseshoe bend of Bridge river, about 15 miles above its mouth. This construction has included about 3 miles of flume, several thousand feet of large steel pipe, the installation of derricks and monitors, and the construction of a sawmill and all necessary camp buildings. Operations had just about started this fall when the cold weather necessitated a shut-down.

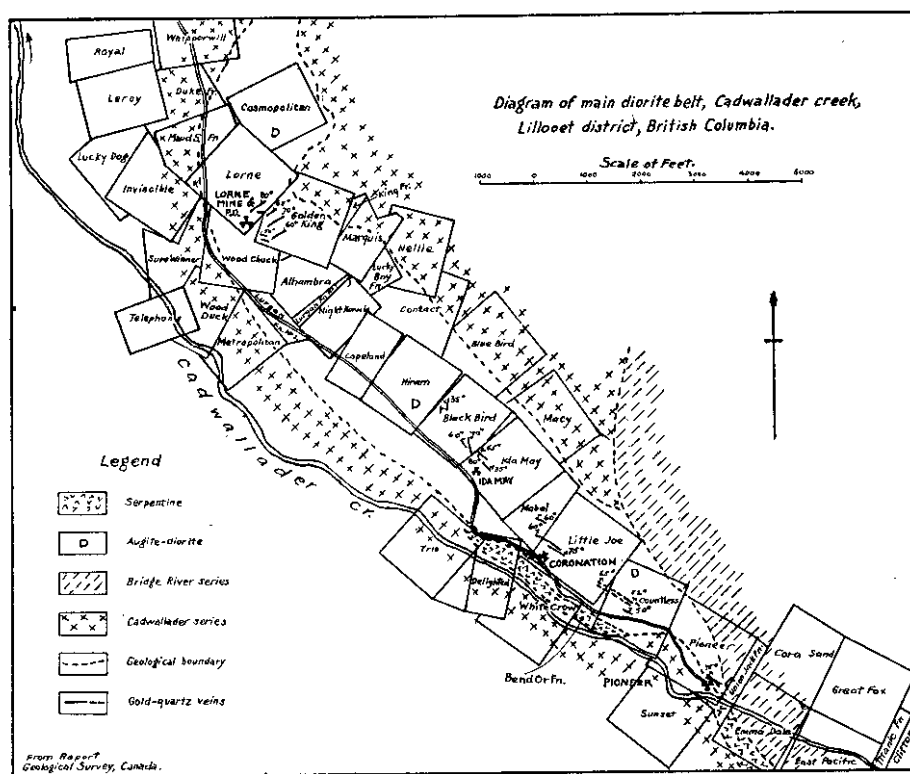
This particular point on Bridge river has attracted the attention of placer-miners since early days. Three separate old channels are the objective of the present company. At no time in the past has any of the previous installations permitted of operations being carried on in the large way which will now obtain. The bulk of the area which will be attacked under the present

campaign will be virgin ground. The final operation will consist in cutting through the Horse-shoe bend and laying bare the present channel of the river for about a mile. The manager of the company is Cooper Drabble, of Lillooet.

Cadwallader Creek Mines.

Cadwallader creek is a tributary of the Bridge river and is connected by a good wagon-road, about 50 miles long, with Shalath, a station on the Pacific Great Eastern Railway 15 miles west of Lillooet. The elevation of the camp is around 4,000 feet above sea-level. Conditions as regards water-power and timber are good. Almost all of the important properties of the camp are confined to an augite-diorite stock, about 2,000 feet wide by $2\frac{1}{2}$ miles long. The surrounding Cadwallader series, consisting mainly of greenstones, conglomerates, sandstones, and shales, is barren and the veins where they penetrate this formation play out.

There has just been published a geological description of this area by W. S. McCann, of the Canadian Geological Survey (Memoir 130, 1922); geological maps are included. Mr. McCann also gives detailed descriptions of the various mines of the district and sums up the situation in a very able manner. It will be noted in this connection that he believes that once below the oxidized portions of the veins, which he puts at about 100 feet, there is no reason to expect



decreasing values for a great distance. The lowest depth, it may be observed, opened up in the camp at present is around 300 feet.

There are at present four small mills in the district, two of them using stamps and two of them Huntington mills to reduce the ore. Amalgamation on plates has been in all cases the method used to recover the gold. At the *Pioneer* mine a cyanide plant has been installed recently to handle the tailings from the original mill and also to treat new ore. This is the old leaching type of cyanide-mill and a recovery of about 80 per cent. is claimed.

It is probable that a modern sliming cyanide-mill would effect around a 95-per-cent. recovery of the gold of the camp. This memoir of McCann's referred to above confirms one in this belief, as he states that the gold below the zone of oxidization, where not free, is contained mechanically in a very fine state in arsenopyrite and other minerals.

Timber for mining purposes is plentiful. The country is not rough and wagon-roads can be built anywhere. The transportation situation is not bad, and with the upper and lower Bridge River sections connected by wagon-road (a piece of construction now under consideration) will be distinctly good; that is, for a gold camp where no ore-hauling is necessary.

The *Pioneer* and *Coronation* mines are about stoped out to their bottom levels, and preliminary to their entering any scheme of amalgamation, further shaft-sinking and general development of the ore-bodies concerned would be necessary. Given below is an approximate estimate of the cost of putting the camp on an operating basis along the lines suggested in these notes:—

Approximate Estimate of Cost of putting Camp on Operating Basis.

(a.) Examination of the camp. This would include opening up bottom level of the <i>Coronation</i> (mouth of tunnel now caved in) and the pumping-out of winze. It might also take in unwatering of <i>Pioneer</i> mine. This would not be expensive as power is available. Past production records should be dug up where possible. A cyanide test on the ore would also be necessary	\$ 3,500
(b.) Development-work, to be governed by results of examination. It would, however, include sinking on both <i>Pioneer</i> and <i>Coronation</i> veins	40,000
(c.) Construction of mill, including water-power development	\$115,000
Construction of main aerial tramway	15,000
Construction of short tramways to main tramway	5,000
General mine equipment	10,000
	145,000
Total	\$188,500

Summing up matters, this camp has struggled along for years, operating under most adverse conditions. From the little 10- and 20-ton mills installed probably not two-thirds of the gold has been recovered. An examination of all records available from the time the arrastras were used would, it is very probable, show a large production of gold.

With a modern mill for the whole camp, getting practically all the gold, the case would be entirely different. There is also no question about the fact that, with only one overhead, an efficiently run organization would bring down both mining and milling costs.

While all the bonanza surface ore has been mined, if enough milling-ore can be located to justify this new construction, there is an extremely good chance that aggressive and well-planned surface and underground work might, as time went on, easily develop some entirely new veins, where the rich ore from the top would be available.

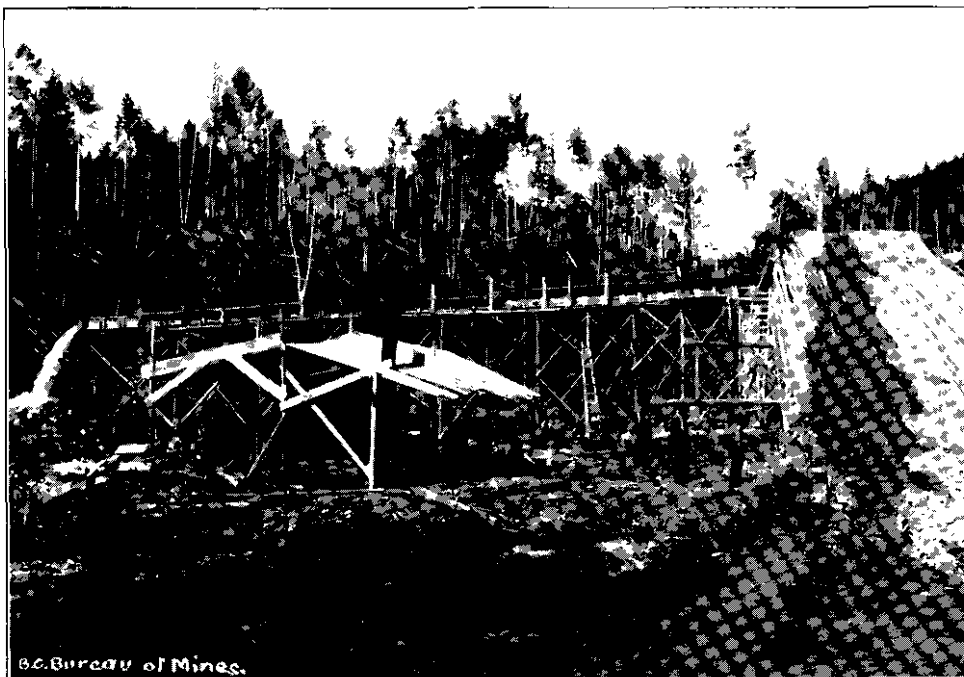
The veins of the camp are narrow, not averaging over 2 feet or thereabouts, and the ground is hard. However, the hanging-wall is good and not much timbering is necessary. It is probable that the total cost of mining and milling and ordinary development-work for the camp would be something around \$6 a ton.

To the large operator this proposition might not appeal very greatly, but to a syndicate looking for a fairly small gold-mining enterprise it should present attractive features.

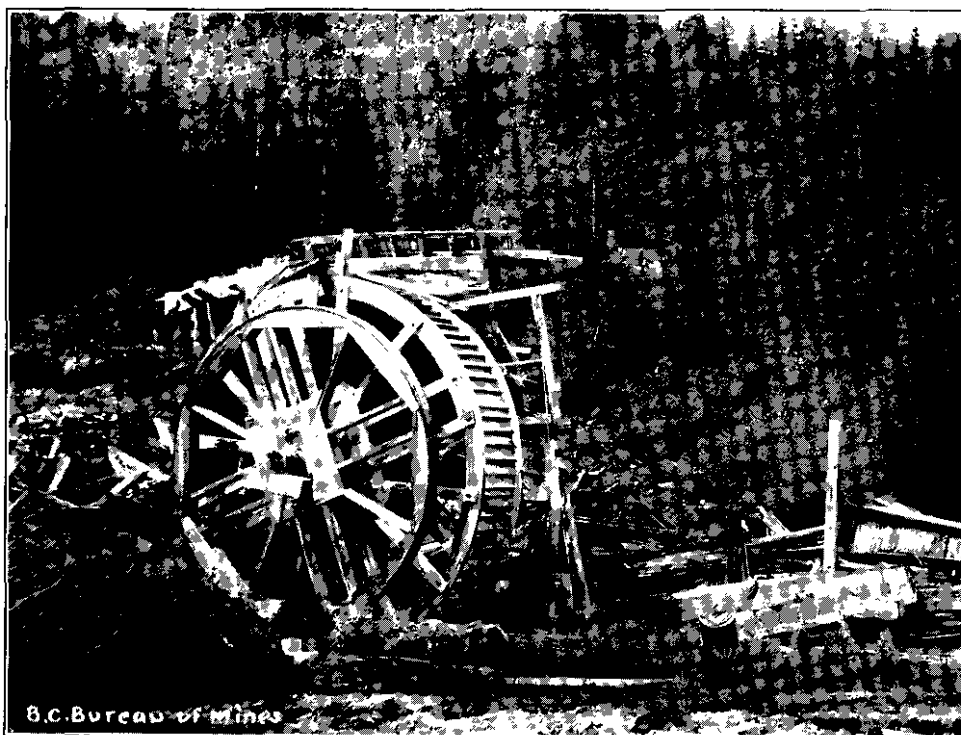
The activity on Cadwallader creek has been confined in 1922 to mining and milling operations at the *Pioneer* mine, at present under lease and bond to A. H. Wallbridge and associates, of Vancouver, with Mr. Copp as manager, and to a very limited amount of development-work at the *Lorne* mine under the direction of Arthur Noel.

At the *Pioneer* mine a small cheaply constructed leaching type of cyanide plant was installed, which appeared to be effecting a substantial saving in connection with the handling of the old tailings.

A little mining has been carried on during the year at certain points adjacent to Cadwallader creek. At the *Wayside* mine considerable work has been done. This property is on the west side of Bridge river a short distance below the mouth of Cadwallader creek, and occurs in a minor exposure of the augite-diorite formation mentioned above. Apart from the main augite-diorite stock where the mines in the vicinity occur, the same formation can be found covering smaller areas higher up Cadwallader creek, on the west side of Gun lake. These areas constitute very likely places for prospecting.



Hixon Creek, Cariboo M.D.—Scraper-dredge on.



Nason Hydraulic, Antler Creek, Cariboo M.D.

Copper Mountain.

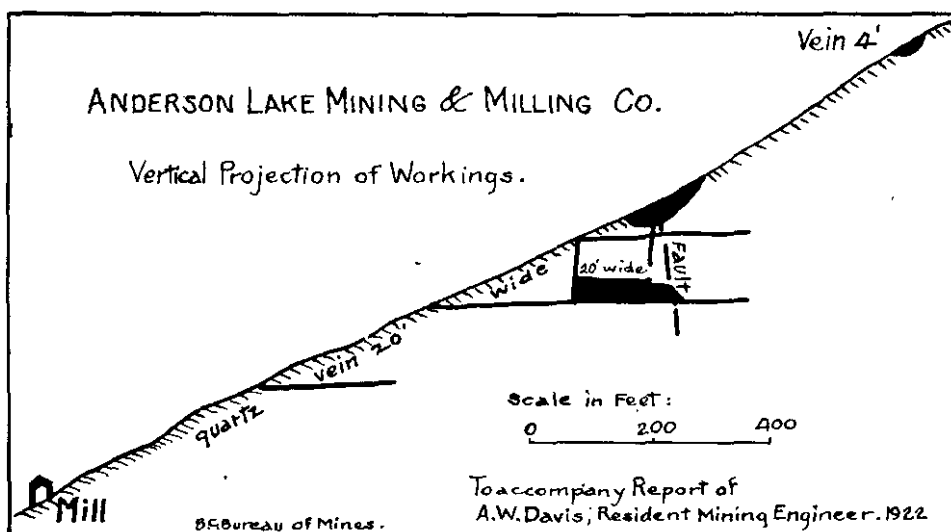
The copper-showings at this point are located a mile or so on the south side of Gun creek in the vicinity of Green lake. The distance from the Pacific Great Eastern Railway down Gun creek and Bridge river to its mouth is at least 70 miles.

Charles Camsell has made an examination of the area (*see* page 25 B, Summary Report for 1918, Part B, Department of Mines, Ottawa). In his report he states as follows: "The nature of the deposits and the large area over which sulphide mineralization extends would suggest the possibility that a large low-grade copper-deposit might be developed which would stand the heavy expense that must be incurred before the stage of actual production is reached."

Also a little farther on: "The deposits are situated on the eastern border of the great Coast Range granodiorite batholith where this batholith is in contact with stratified rocks of both sedimentary and volcanic origin, and experience has already shown that it is under such geological conditions that a great many of the deposits of metallic ores of the North American continent occur."

ANDERSON LAKE SECTION.

This property is located about 3 miles up McGillivray creek from the Pacific Great Eastern Railway, at a point about 30 miles south of Lillooet. A limited amount of work was done during the summer, a cave near the entrance of No. 2 tunnel being penetrated and the tunnel made accessible to its face. T. A. Brett, of Vancouver, has been identified with the property for the past twenty years or more, and, in fact, was one of the stakers. According to him, the company



formed shortly after the property was staked handled about 5,000 tons of ore in the 10-stamp mill which was erected and then shut down, operations not having been very successful. Mr. Brett states that he then assumed control, ran through 2,000 tons more, and that he recovered \$4 a ton from this last ore put through.

The vein has a strike of, roughly, north and south and dips at about 70° to the west. It has a width in some of the stopes of 20 feet or more. The vein-filling is quartz. There is a large tonnage of quartz in sight, but the average grade is liable to be low. Possibly certain ore-shoots occur in the vein where values are such that it would pay to mine them. Mining costs should be very low, as the vein is wide and timber is plentiful, with general conditions very favourable for cheap operating.

Wm. Nobbs, of McGillivray creek, and associates have done considerable work in opening up a bench placer claim located about a mile above the mouth of the creek. Mr. Nobbs, after a lot of hard work, considers he has located an old river-channel with good values in it. He has opened up a face of gravel about 30 feet high by 70 feet long at the lower end of his claim, on which he has made several

trial runs, handling each time about 80 yards of gravel in a small sluice-box. The actual recovery of gold in these tests, according to him, figures out the gravel as running about 75 cents to \$1 a yard. To start hydraulicking the construction of a flume about 2,000 feet long and some pipe installation are necessary, the cost of which is above the owners' means. This proposition would appear well worth an examination, although the yardage would not probably be big enough to interest a very large company.

PEMBERTON-BIRKENHEAD AREA.

Some activity in mining has been noted in the area between the Lillooet river, above Pemberton, and the Birkenhead river. A bond has been taken up on the *Crown* group, which is owned by Alexander McLeod, of Pemberton, and Marshall Bond, of Seattle, with C. G. Codman as manager and Pat Carnody as foreman. The property was shut down during the winter owing to lack of camp accommodation, but it is proposed to carry on active development-work in the spring. The development-work up to date is stated to have been satisfactory. High gold values are reported in certain fissures in a big magnetite vein.

Adjoining the *Crown* group is the *Gold King* property, said to be a similar type of deposit. Farther to the north, near the head of Tenquille creek, some work is reported on the Lewis & Moffatt and White properties. This area will be visited by the writer next spring.

CLINTON MINING DIVISION.

TASEKO DISTRICT.

Interest in the Clinton Mining Division has been centred in the Taseko district. The accompanying sketch-map shows the routes into this area and the approximate locations of the principal mineral groups.

Gold is the prevailing mineral, and, in view of the extreme inaccessibility of the camp, with any other metal involved, where transportation would have to be considered to a greater extent, the situation would be distinctly bad. However, as a prospective gold camp, where most of the freighting would be confined to getting machinery on the ground, it is worthy of consideration.

The natural means of access—that is, where heavy equipment is involved—is from the existing wagon-roads in the Chilcotin country to the north; then up the Chilko and Taseko rivers to Taseko lake, which is near the mineralized area. For the preliminary prospecting, for the camp has not yet reached the stage where much equipment will be involved, the best method of access is from Bridge river and Gun creek. The Government some years ago built an admirably constructed trail, 22 miles long on very easy gradients, from the Bridge River wagon-road up to Green lake opposite Copper mountain. From this point the prospectors are now taking their pack-horses over either the Taylor or the Warner pass into the Taseko valley. Five or six miles of trail-construction over the Warner pass will connect Green lake with the open grass-covered country which comprises the upper Taseko valley, and this trail should be built as soon as possible. At the present time the prospectors are getting through without any. Even if, on the camp proving successful, connection be made from the north, this method of access would still be used by the people from Lillooet and the Bridge River country. The Taseko valley is in the vicinity of the eastern contact of the Coast batholith and from experience elsewhere in the Province it would appear a likely field for prospecting.

This group, belonging to E. J. Taylor, is the property which has attracted the **Windfall Group.** most attention. Bonded for the second time, active development-work is being carried on during the winter. W. H. Edgett, of Vancouver, is said to be the holder of the option; G. Allen Crane is in charge at the mine. At the time of my visit early in the fall of 1922 a few shallow open-cuts comprised all the development-work. Outcropping on the east side of Battlement creek a flat seam or gouge a few inches thick occurs, going horizontally into the hillside. Just what this is, whether a break-over from some vein or in-place where it now lies, it was hard to determine.

Two samples from this gouge in the two open-cuts I inspected, about 100 feet apart, ran, respectively, 187.8 oz. in gold, 23 oz. in silver, and 12.74 oz. in gold, 2.8 oz. in silver. A third sample taken from the hanging-wall above the gouge ran 47.78 oz. in gold and 4 oz. in silver. This was hard white flinty-looking rock and it is possible that some of the richer material from below may have been included in the sample. Be that as it may, such sensational gold values

render this property of great interest. The underground work being done now will be of great aid in making clear a great deal that is now obscure. A lot of the gold in this high-grade material is free. There is also some bismuth telluride, a steel-grey-looking mineral.

A few hundred feet to the east of the *Windfall* showings a tunnel has been driven on the *Province* claim. This tunnel, about 140 feet in length, is cross-cutting a large quartz-porphyry dyke which has a general east-and-west strike and heads straight for the *Windfall* workings. Nothing of any great value, as far as could be seen, the owners not being present, has as yet been opened up on this claim.

The owners of this group are Joe Russell & Son, Henry Swartz, and Bert Durban. This property had been staked only a short while at the time of my visit. The workings lie about 4 miles up Cross creek, a tributary of the Taseko river. A striking feature of the country is the presence of a porphyry dyke 500 feet or so in width, with a strike a little west of north, which can be traced for a mile or more through the prevailing quartz diorite. In this dyke some small parallel veins occur; only one had been opened up at the time of my visit, but I understand from one of the owners that two more were subsequently located and were accompanied by satisfactory values. The elevation of the ground is about 7,200 feet above sea-level. A sample taken across 16 inches of oxidized material in one shallow cut ran 0.20 oz. in gold and 4.6 oz. in silver. Another sample across 6 feet in another cut about 200 feet distant ran a trace in gold and 2 oz. in silver. Good colours were obtained in every case where this vein-matter was crushed and panned, and the two assays given above were much lower than I had in consequence anticipated. This property would appear worthy of vigorous prospecting on the surface.

Owner, W. C. Elliot, of D'Arcy. The location on the north slope of McClure mountain can be seen from the attached map. The elevation of the showings is about 7,200 feet. A 30-foot porphyry dyke on the lowest of the three claims ran a trace in gold and 0.7 oz. in silver. Some float from the upper claims, which are partly on a glacier, ran 0.46 oz. in gold and 0.20 oz. in silver.

Owners, C. A. Baldwin, George A. Gibson, A. Swanson, and Brunquist. Only part of these claims, which had only recently been staked, were visited. Almost at the head of a basin (elevation 7,500 feet) lying about a mile to the north of the *Algoma* group certain iron-stained oxidized zones occur in the prevailing quartz diorite. Not enough work had been done to arrive at any estimate concerning any veins or their location, etc. A sample of oxidized surface material from one point ran a trace in gold and 0.4 oz. in silver. Another sample from a similar exposure half a mile to the north ran 0.22 oz. in gold and 0.40 oz. in silver.

The owners of the *Spokane* group had just staked some other ground at the time this property was inspected, but the opportunity did not afford itself to look it over.

The Taseko district is not one of definite quartz veins such as are found in connection with most gold-quartz camps. At the *Windfall* group, as stated above, the situation is obscure. Recent reports would indicate that the development-work being carried on there now is successful. On the *Massena* group the nearest approach to anything like a vein-structure with a definite strike and dip was seen; although even there no great continuity had been proved at the time of my visit.

I consider the camp as a whole well worth the careful consideration of engineers next season. A portable assay outfit is the best thing to take in. One would then be in a position to acquire definite information as to values, without the prolonged delays which would otherwise be entailed. Although the showings are mostly very high up, aerial tramways of moderate length would connect them with a timbered country in the valley below. The water-power situation is good.

From what information I could gather, about 20 miles of wagon-road construction through an easy country from the north end of Taseko lake would effect a connection with the existing wagon-roads to the north. Conditions as regards transportation, therefore, would not be too bad in the event of any property making good and requiring it.

A number of limonite-deposits occur on the slopes of the Taseko valley. Included in Summary Report, 1920, Part A, Geological Survey of Canada, is a report by J. D. MacKenzie entitled "The Limonite Deposits in Taseko Valley, B.C." This gives the total tonnage of this material in the area as approximately 700,000 tons.

ASHCROFT MINING DIVISION.

There has been practically no activity in the Ashcroft Mining Division during the past year.

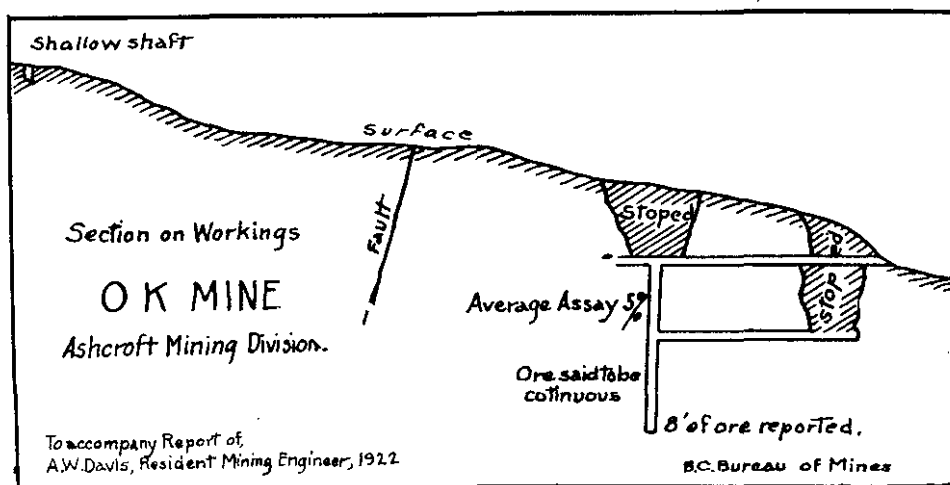
Index. This molybdenum-deposit at the headwaters of Texas creek, which flows into the Fraser river about 11 miles below Lillooet, was visited during the season.

To be brief, there is a chance that systematic development-work might prove up enough ore to make the property of some value. The ore occurs in irregular bunches in a granitic formation. The elevation of the ground is around 8,000 feet above sea-level. There is no timber nor soil to obscure the exposures and any development should be in the nature of surface work. A sample from one exposure of ore ran 7.8 per cent. molybdenum. The property is held by the Index Molybdenite Mining Company, Limited.

HIGHLAND VALLEY SECTION.

Beyond a certain amount of assessment-work nothing was done in this area during the year.

The late Chas. W. Drysdale, in his report on Highland valley (*see* Summary Report of the Geological Survey, Ottawa, for 1915, pages 85 to 91), expresses the opinion that this copper area has a chance of making good. In the conclusion of his report on the area he states as follows: "With further careful prospecting and systematic development, it may be expected that a sufficient quantity of copper ore will be blocked out to warrant the construction of a spur line to connect the Highland Valley camp with the Canadian Pacific Railway at Spatzum. Until such transportation facilities are afforded it will be practically impossible to operate the mines successfully."



In the Reports of the British Columbia Minister of Mines for the years 1915 to 1920, inclusive, are included reports on the Highland Valley district which cover the ground very well. Since the last year specified, only a certain amount of assessment-work has been done in the district.

O.K. Further mention might be given to this mine, on which a mill was built in 1916 and operated partly in that year and partly in 1917. The original owners were Geo. H. Chataway and associates. Taken up on a bond by Frederick Keefer (formerly of the British Columbia Copper Company) when the price of copper was high during the war, a mill with a capacity of about 35 tons a day was built and operated for a certain time. The following information was obtained from Mr. Chataway, who was seen on the ground last summer.

This property occurs in the prevailing granitic batholith, which comprises the southern half of the district and in which most of the ore-showings are located. The elevation is over 5,000 feet above sea-level and over 4,000 feet above the Canadian Pacific Railway track, about 10 or 12 miles to the west.

About 10,000 tons of ore running approximately 3.6 per cent. copper was milled. After flotation was installed an 85-per-cent. recovery was obtained; 1,487.3 tons of concentrates (wet)

was shipped, the average assay being 20.33 per cent. copper and 1.19 oz. silver—the equivalent of 543,348 lb. or 272 tons of copper. The president of the company, Mr. Keefer, claims that, by bringing the mill up to 100 tons a day basis, operations can be made to pay.

The underground workings were inaccessible last summer, with the exception of one adit. A rough sketch is given showing the approximate situation. The ore is chalcopyrite in a sericite gangue. The vein is strong, well defined, nearly vertical, and in some places where stoped as much as 15 feet or more in width.

The 10,000 tons of ore mined nearly all came from a small area above a shallow tunnel. Taking into consideration the general outlook, it would appear that \$15,000 or \$20,000 spent in actual development on the mine proper and on the extension to the vein might open up enough ore to warrant arrangements for better transportation. It would seem fairly obvious that unless this factor be improved no profitable mining can be undertaken.

Without having gone into the matter exhaustively, it might be suggested that the construction of 6 or 7 miles of good wagon-road on a very easy grade to the brow of the steep mountain-side overlooking the Canadian Pacific Railway on the Thompson river, and an aerial tramway from this point to the track, would be worth investigating.

Behind the O.K. group lie the *Tamarack* and *Eagle* groups on what is supposed to be an extension of the O.K. vein, and with good showings reported on them.

If the O.K. mine were to be developed successfully it would be an important factor in calling attention to Highland valley once more and thereby aiding in the development of some of the other groups in the district. It is the nearest approach to a shipping property that the camp has produced and appears well worth a thorough investigation.

About 3 miles to the south of the O.K. mine and at about the same elevation **Kathleen Group.** is the *Kathleen* group. The formation is the same granitic rock. Some high-grade bornite ore has been uncovered on this group, but up to date not in any great quantity; this would appear good ground to prospect in. With transportation improved at the O.K. mine, this property would, of course, directly benefit as well. Unfortunately the owners were not present when the claims were visited last summer. The owners of this property are J. N. J. Brown and associates, of Vancouver.

Highland Group.—George Novak, of Rossland, the owner, continues to do a little development-work on this property, which has been described in preceding Annual Reports.

YALE MINING DIVISION.

HOPE AREA.

Most of the activity in this area has been centred on Ladner creek and its vicinity. One property, the *Emancipation* mine, has reached a producing stage. The eastern border of the great Coast batholith occurs here. Most of the properties are located on or near a contact between a serpentine of igneous origin, adjacent to the batholith and slates and schists to the east.

Active prospecting of the claims of the area has been carried on during the season by a group of men whose persistence and courage are to be admired. While no spectacular values have been found nor any very important discoveries made during the year, it can be remembered that other camps, such as Stewart, have gone through the same experience, and it is the persistence referred to above which sometimes brings success in its train.

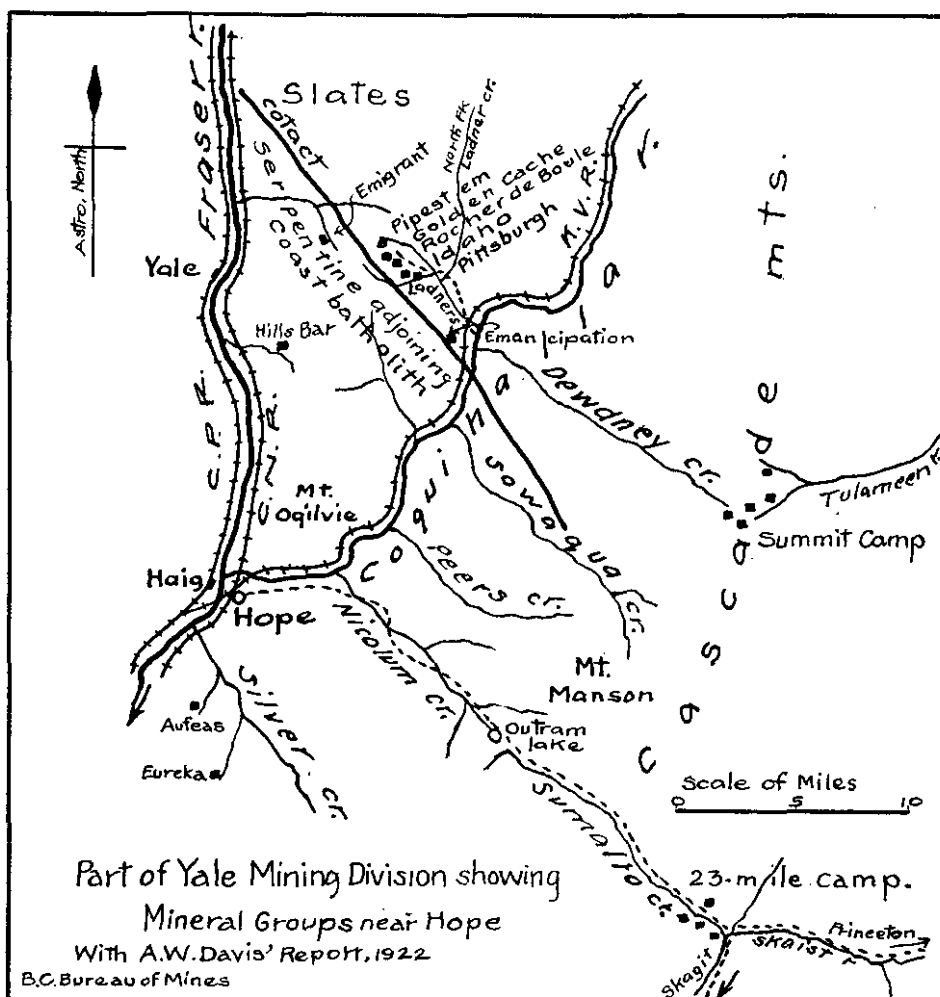
This property is under bond to the Liberator Mining Company, of Vancouver;

Emancipation. Wm. Thomson, of Hope, is the owner. The small mill on this property was overhauled early in the summer and milling operations carried on for three or four months, the property being shut down in the late fall. The capacity of this mill is very small, about 12 tons in two shifts, which makes milling costs extremely high. The equipment includes a 7- by 9-inch crusher, five stamps, one Wilfley table, and one 3-cell flotation-machine. The mill is operated by a 50-horse-power gas-engine, which also has to run a small compressor for the mine during the shift when the mill is shut down. Lack of power obviously hampered operations greatly.

There are two parallel veins on the claims, a small vein to the west on a serpentine-slate contact and what is called the "big vein" a few feet to the east, with slate on both walls. All the ore production up to date has been from the small vein, which has usually a stoping width of around 2 or 3 feet and which carries most of the values. The hanging-wall is defined,

but on the foot-wall the ore merges gradually into the slate. The gangue is quartz. Some of the gold is free and some contained in iron pyrites.

It would appear that above the workings there is room for considerably more surface prospecting of both veins. A tunnel several hundred feet long has just been completed to a point below the main working-tunnel near its mouth, where most of the high-grade ore found on the property has been mined. There is over 200 feet in elevation between these two workings and the ground between should be productive, although up to date nothing much has been opened up in the bottom level.



Some sensational shipments of high-grade ore have been made from this property by the original owners, and whilst operations this year have not been very successful it must be remembered that development-work was behind and the milling costs excessively high.

The owners are J. O'Connell and associates. This property lies on the South fork of Ladner creek and, roughly, along the same contact obtaining at the **Pittsburgh Group.** *Emancipation.* Mr. O'Connell has opened up several very large veins on the property. By diverting a small creek he has been able to do some very effective ground-sluicing. On what is called the "Bluff Cut" of the vein he opened up during the summer, I took a sample across 25 feet which ran 0.12 oz. in gold. A grab sample taken from the north vein of typical-looking siliceous vein-matter carrying a little fine-grained iron pyrites ran 0.16 oz. in gold.

This group looks promising. There would appear to be a possibility of opening up a large tonnage of low-grade ore, with always the chance of uncovering a high-grade shoot similar to that found on the *Emancipation*.

This property adjoins the *Pittsburgh* group on the north. It is owned by **Idaho Group**. A. E. Raab, R. Palmer, and associates. A grab sample taken from a vein exposed in a cut for a width of 8 or 10 feet ran 0.16 oz. in gold. The late R. W. Thomson took two samples from this vein in 1919, which resulted as follows:—(1.) Across 4 feet on hanging side of vein (23 feet wide): Gold, 0.44 oz.; silver, 0.06 oz. (2.) Across 5 feet near centre of ore-body, which is exposed for 20 feet, with walls not yet uncovered and 150 feet north-west from (1): Gold, 0.16 oz.; silver, 0.04 oz.

This group is owned by G. Fagan and associates. It lies near the same main **Pipestem Group**. contact and in the slate formation, almost on the summit between Ladner and Siwash creeks. A tunnel nearly 300 feet long has been driven to crosscut a vein outcropping above. Some high-grade ore has been located on the surface. The extent of this vein and its dip are, however, somewhat obscure, and it would appear that if any difficulty be experienced in locating it in the tunnel a little further surface work would be in order. A grab sample from the outcrop ran 0.64 oz. in gold. A sample taken about 500 feet to the south-east of the surface showing above the tunnel across 5 feet of quartz, on what would appear to be an extension of the vein, although there is no certainty about it, ran a trace in gold.

Other properties in this same belt and lying between the *Pipestem* and *Idaho* groups, on which prospecting was being carried on during the summer, include the *McLean* group (owner, Alec. McLean); the *Rocher Déboulé* (J. Bailey, owner); the *Golden Cache No. 1* and *No. 2* (owners, J. Bailey and A. W. Palmer respectively); the *Jem* group (owners, Bailey & Beck).

Four placer leases have been taken up on this creek by Captain J. D. Fullbrook and associates, of New Westminster. The ground staked is about 5 miles above **Sowaqua Creek** (formerly **"Pierre Creek"**) where the creek empties into the Coquihalla river. The grade of the creek where operations are being carried on is about 6 per cent. Platinum values as well as gold are claimed by the owners. It would appear that the contact on which the *Emancipation* and other properties are located crosses this creek somewhere in the vicinity of these claims. Some new mineral-claim stakes were noticed last fall, but the ore discoveries were not examined owing to the owners not being present and lack of time being available to permit of their being hunted up independently.

This is a likely district to prospect in. Jack Nesbitt, an old Slovan prospector, this season covered the country to the north of the creek.

Hills Bar Claims.—At the head of Hills Bar creek on the Fraser River slope of the mountains some high-grade gold ore was discovered this fall. The owners, Bradley & Viking, have built a camp on the ground and are putting in the winter on the property.

Twenty-three-mile Camp.—Nothing but assessment-work has been done in this camp, which will be visited next season. There are reported to be some large low-grade complex ore-bodies opened up and also a certain number of small high-grade veins.

Siwash Creek Siwash creek enters the Fraser river from the east, 2 miles above Yale and heads into the same country where Ladner creek originates. Near its mouth **Placer.** it rises precipitously until about 1,000 feet in elevation above the Fraser.

The average grade for the next 4,000 feet is approximately 3.25 per cent. The history of the former operations on this creek is not available. Camp buildings and a sawmill were erected years ago and a tunnel driven from the steeper part of the creek, the upper end of which lands, however, just below the present water-surface. As a result it would appear that a flume could not be carried up the creek from this point at a grade which would carry off the tailings.

* The name "Pierre" creek was incorrectly used for many years on maps of this locality for the second creek entering the Coquihalla river from the east above the Nicolum river, but has now been corrected by the Geographic Board of Canada to "Sowaqua" creek, while the name of the first creek above the Nicolum river has been corrected to "Peers" creek, to conform with the original manuscript map by A. C. Anderson, of the Hudson's Bay Company, made under orders of Chief Factor Sir James Douglas about 1849, and also with the survey and plans of Lieutenant Palmer, of the Royal Engineers, in 1859. Henry N. Peers, H.B. Factor at Fort Langley, was ordered by Sir James Douglas to build a "mule-trail" from Hope to Tulameen as the H.B. Brigade trail to go up the first creek (Peers creek) and cross the headwaters of Sowaqua creek, and thence over the main summit to the Tulameen river. This was never completed. (See official notice of the Geographic Board of Canada in the Canada Gazette, February 4th, 1922.)

The valley of Siwash creek is narrow and the yardage available would not be extremely great. From all accounts, however, the gold values are good. This proposition would therefore appear worth investigating, when, if the gold values proved satisfactory, a study of the location of the bed-rock would next be in order.

NICOLA MINING DIVISION.

There is very little to report in the way of mining activity in connection with this Division.

STUMP LAKE AREA.

A rumour has been in existence for some time that the *Donohue* mines at Stump Lake were to be reopened, but so far this has not been the case.

The ores of the Stump Lake area, including the *Donohue* mines and the *Mary Reynolds* mine, are complex, containing mostly iron and copper pyrites, galena, blende, and grey-copper in a quartz gangue.

To be brief, the district is one of small tonnages and high silver values. With the development of new metallurgical processes the camp may become active. A full description of this area is contained in the Annual Report of the Minister of Mines for 1917.

MERRITT COAL AREA.

At Merritt is located the only coal camp of any prominence in Mineral District No. 3. On the south-west end of the field are located the Middlesboro Colliery and the Fleming Coal Company's mine. In the centre of the valley are situated the holdings of the Diamond Vale Coal Company, while on the north-east side lies the Community Coal and Coke Company's property. The production for 1922 consists of about 38,485 tons from the Fleming Coal Company's mines and 69,330 tons from the Middlesboro Colliery. The Community Coal and Coke Company is a new enterprise which has only shipped up to date a few hundred tons.

The coal in this area is rich in by-products and an amalgamation of all the mines and the erection of a suitable plant might appear a sound proposition.

VERNON MINING DIVISION.

White Elephant Group. This property is located on the west side of Okanagan lake near Ewing's Landing. This point is about 17 miles south of the northern extremity of the lake and within two hours by car from Vernon. The mine is on the mountain-side, about $3\frac{1}{2}$ miles by wagon-road from the shore. An aerial tramway about 2 miles long could connect the workings with a dock on the lake-side. Timber is plentiful, but water is scarce. The workings are all confined to one spot. An open-cut 40 feet long leading to a tunnel about 20 feet in length exposes the formation for about 60 feet. In the tunnel a winze has been sunk about 15 feet. The country rock in the vicinity of these workings is granite. The nature and trend of the ore-body are obscure. In the absence of further work any calculations as to the walls, dip, etc., are futile.

The ore occurs in quantity and it varies from almost pure pyrrhotite to white quartz. Associated both with the heavy sulphide ore and with the siliceous ore is a certain amount of a bismuth telluride, which brings the gold values up to an important extent. A flat narrow dyke cut off the ore in the winze referred to, but I am informed that on going through it values were picked up again. About 300 tons of ore carrying about $1\frac{1}{2}$ oz. in gold and about $\frac{1}{2}$ oz. in silver was shipped during the spring and summer from this one working. Gold ore of this grade occurring in quantity on the surface renders this property of peculiar interest, and not very much depth would be required on an ore-body, such as this may easily develop into, to make it a paying enterprise.

Unfortunately the property has been idle for the latter part of the year. The property is under bond to W. D. Renner and associates. The owner is A. P. Clark, of Vernon.

Black Hawk Group. This property is reported on in the Annual Report of the Minister of Mines for 1920. As stated therein, all the underground work was unproductive, and whilst a strong quartz vein can be traced on the surface for a considerable distance, not a foot of the several hundred feet of tunnelling has been on the vein. Some further surface work would appear to be in order and the elimination of all underground work, except when actually on the vein, irrespective of where it took you. It would appear



Okanagan Lake,

PENTICTON,

Dog Lake,

from an examination of the property that one of the long crosscut tunnels was actually started in the foot-wall just below the vein, but, from the course taken, had no possible chance of ever reaching it. The country-rock is a fine-grained volcanic. The vein, which is quartz (at some points showing considerable calcite), has a width of from 4 to 6 feet.

Samples taken along the outcrop near the workings and covering a distance of about 100 feet ran as follows:—(1.) Open-cut above main crosscut tunnel, across 6 feet: Gold, trace; silver, trace. (2.) Grab sample of outcrop, 25 feet south-east of sample (1): Gold, 0.24 oz.; silver, 0.2 oz. (3.) Across 3 feet on surface, 20 feet south-east of (2): (vein wider, but not accessible): Gold, 0.42 oz.; silver, 0.2 oz. (4.) Dump sample from ore at mouth of 100-foot tunnel (mouth of this tunnel crosscut the vein): Gold, 0.3 oz.; silver, 0.1 oz.

About 1,000 feet along the strike of the vein in a south-westerly direction from the workings, where the surface soil permits of it outcropping again, a sample across 2 feet ran: Gold, 0.3 oz.; silver, 0.1 oz. A vein showing gold values to this extent would certainly appear worthy of some further development.

F. Mitchell and A. Cochrane have done considerable work during the year on this group, which is located on the west shore of Okanagan lake, about 5 miles from its northern extremity. Two quartz veins, one of them showing a little galena, have been opened up on the surface. A sample of some of the sorted ore from the smaller of the two veins ran: Silver, 9 oz.; lead, 15 per cent. Samples taken from the larger vein consisting of quartz impregnated with iron pyrites yielded no appreciable values in gold and silver.

Cherry Creek Placer.—There has been more or less placer-mining in a very small way in this Division. The only operations on an extensive scale of this type of mining took place at Cherry creek, near Monashee mountain, where Joe Errington, of Vancouver, after some construction-work, carried on hydraulicking operations for a considerable period, but finally shut down in the latter part of June.

KAMLOOPS MINING DIVISION.

The *Lidia* group and the *Queen Bess* mine, two properties up the North Thompson river not now on the active list, can be referred to in the Minister of Mines' Reports for 1915 and 1918, pages 221 and 234 respectively.

HEMLOCK CREEK AND VICINITY.

Some encouraging reports have come in relative to some new placer discoveries on Hemlock creek, at the north end of Clearwater lake, and about 80 miles east of the recent Cedar Creek placer discoveries. No details are available.

A few miles to the east of Hemlock creek Norman and Adolph Anderson, of Swift Creek, and G. L. Stewart, of Blue River, have located some mineral claims on a tributary of Blue lake. They go in from Lempiere, on the Canadian National Railway, and have spent the season opening up their ground. The distance from transportation is a bad factor. The ore they state to be galena and other sulphides carrying high gold and silver values.

RAFT RIVER COUNTRY.

Raft river is a tributary of the North Thompson, paralleling the Clearwater river and entering the former river from the north a few miles below Vavenby.

Neil Morrison, of Vavenby, last summer built a trail to this area through the Hole-in-the-Wall pass from Irvine Station, 6 miles above Vavenby, and prospected it as much as the balance of the season would permit. There is a large area of country there heretofore practically inaccessible.

This property is located on the west slope of the North Thompson river, about 4 miles below Vavenby and about a mile back from the railway. Neil Morrison, of Vavenby, is the owner. A little high-grade ore (galena) was found on the surface of the gulch when the discovery was made, but was rapidly dug out.

A tunnel 150 feet long was driven into the hill from the discovery, going through a lot of quartzose material impregnated with iron pyrites. The tunnel is caved in; but a sample of some of this quartz on the dump, which apparently is in quantity, ran: Gold, 0.6 oz.; silver, 0.4 oz.

Higher up the mountain Mr. Morrison has done considerable work on this **Naomi Group.** group, mostly on the surface. The formation is a flat dipping schist. The ore is siliceous iron material lying in streaks conforming with the schist. There is one tunnel on the claim, 30 feet long, which has not yet reached the vein. The following samples were taken from open-cut 150 feet above tunnel:—(1.) Upper 4.5 feet: Gold, trace; silver, 1 oz. (2.) Lower 5 feet: Gold, trace; silver, 2.4 oz. (3.) Picked sample from same cut showing streaks of black material: Gold, 2.9 oz.; silver, 2 oz. (4.) Along outcrop 600 feet east of tunnel: Gold, trace; silver, 15 oz.

This property, a high-grade gold-quartz proposition, was bonded late in 1922 **Windpass.** to General R. G. Edwards Leckie and associates. Active development-work has been carried on every since under the management of General Leckie, with Al Harris, late of Stewart, as foreman. Should the preliminary development-work be satisfactory, it is the intention of the bonders to erect a small mill. A description of this property is given by Dr. W. L. Uglow in the Summary Report for 1921, Part A, of the Geological Survey; also on page 219 of the Minister of Mines' Report for 1917.

Chu Chua Coal Co.—This property, after operating for some months, shut down in January, 1923. Practically no coal was shipped during this period. A full description of the mine is given by Dr. Uglow in the report mentioned above.

For several years a group of placer-miners have been holding some ground on **Three-mile** 3-Mile creek, which enters into Lemieux creek from the west, about 3 miles **Placer.** from Mount Olie, a station on the Canadian National Railway about 50 miles north of Kamloops. The creek is staked for a distance of $1\frac{1}{2}$ miles from its mouth. There are also some bench leases at the lower end. The situation is about the same as when Dr. Uglow described the camp in his Summary Report for 1921.

While it would appear doubtful as to whether some of the high benches staked near the mouth of the creek carry enough gold to enable them to be handled at a profit, the low flat near the mouth of the creek would seem worth investigating as a dredging proposition. Another low bench near the upper end of the claims (the Mackay discovery claim) should be looked into as well, although here it would be a case of some flume-construction and hydraulicking.

Considerable coarse gold has been found on 3-Mile creek, and, according to the owners, the prospecting carried on has produced satisfactory results with regard to average values. As a preliminary, however, to any installation of equipment in the camp, the ground should be thoroughly sampled, say, with a Keystone drill.

J. T. Robinson, now has an option on several of the claims and, before cold weather stopped him, had already done a little preliminary prospecting, with, he states, satisfactory results.

NORTH BARRIERE LAKE DISTRICT.

This district was reported on by Dr. Uglow in the 1921 report referred to above. Since his report was written considerable development-work has been carried on, mostly on the *Anaconda* group.

This group is owned by Karl E. Johnson and associates, all of Barriere. **Anaconda Group.** The showings all occur in the prevailing quartzites and schists of the district.

Conforming with the strike and dip of the country-rock a few mineralized zones occur; the mineral in most cases being iron pyrites, although here and there a little galena and chalcopryite are in evidence. Ten samples were taken by me last summer from these claims, some of them average samples. The assay results would indicate that the gold and silver values are negligible and that the copper values are low. Johnson and his partners have done a lot of hard work on the group, including the driving of several tunnels. Two samples sent in by him early in 1923, from what he states is a new working, ran: (1.) Gold, 0.2 oz.; silver, 6 oz.; copper, 4.2 per cent. (2.) Gold, trace; silver, 0.4 oz.; copper, 2.7 per cent.

Owner, H. F. Kelly, of Barriere. On this claim a 2-foot vein of chalcopryite **Sitting Bull.** ore outcrops on the steep bank of a creek, which assayed as follows: Gold, trace; silver, 1 oz.; copper, 3.5 per cent. At the time of my visit no ore-shoots of commercial size had been opened up in this mineralized quartzite belt, where nearly all the prospecting in the North Barriere Lake area has, so far, taken place.

This property is controlled by J. L. B. Abbott, of Vancouver; W. F. Wood, of Kamloops, and associates. It is located about 3 miles from Squam bay on Adams lake. The workings are only a few hundred feet vertically above the valley of Sinmax creek, in which is located the wagon-road between Squam bay and the Canadian National Railway at Louis Creek. The wagon-haul from the mine to Louis Creek Station would be about 18 miles. For economical operating the road should be partly rebuilt to avoid some unnecessary hills.

On this property is located a big vein carrying fair silver values. The gangue is solid barytes and the silver occurs mostly in tetrahedrite and galena disseminated throughout it. In the case of the low-grade ore, barytes apparently carrying very little sulphides will still assay 10 or 12 oz. in silver.

The property is opened up by a crosscut tunnel about 180 feet long to the vein. Some drifting was done and a raise about 150 feet long driven to the surface. This raise is all in ore. According to the old records, 669 mine-cars of ore were drawn from the raise, which averaged: Gold, 0.04 oz.; silver, 15 oz.; although the average mine-run of ore would be slightly lower grade. The vein is wider than the raise, having a width of around 12 feet. A sample taken from the top 2 feet of the raise about half-way up ran: Gold, 0.1 oz.; silver, 42 oz. This included, however, a thin streak (not very apparent) of grey-copper near the hanging-wall.

On the bottom level the vein is cut off by a fault a short distance to the west of the main crosscut. The situation to the west of this point is obscure. On the surface the ore outcrops for about 100 feet to the west of where the long raise previously referred to breaks through. About a car-load of 80-oz. ore was shipped some years ago from the high-grade material on the surface. A sample of high-grade ore I took from the outcrop ran: Gold, 1.02 oz.; silver, 212 oz.

The formation is a schist. The baryte vein conforms with it and according to the Geological Survey is, along with the accompanying minerals, a replacement of it. Dr. Uglow believes that both the silver-bearing tetrahedrite and galena in the barytes and the barytes itself were deposited from ascending solutions. Apart from the vein worked on, another is in evidence paralleling it a short distance away, but with poorer silver values. The gangue is also solid barytes.

Irrespective of the fault which cuts off the values to the west, the size of the ore-body, the silver values, and the considerable tonnage which is in sight at the present moment make the property of great interest. A limited amount of development-work might easily double the tonnage, which is a good many thousand tons now.

The barytes gangue might prove a valuable by-product. If, for instance, a mill were installed and ground barytes produced at the rate of 50 or 75 tons a day, this material, according to present quotations, would have a market value of around \$13 a ton at the Coast and could be landed there for several dollars less than this amount.

Timber is fairly plentiful, but the water-power situation is not good, and while there is enough water for a mill, it would probably be necessary to use steam for power. With such a heavy ore, occurring in such quantity, mining costs would not be high, although the hanging-wall is not good and the ground would have to be timbered. There would also be more or less shoveling in the stopes, as the vein is flat (around 25° or 30°).

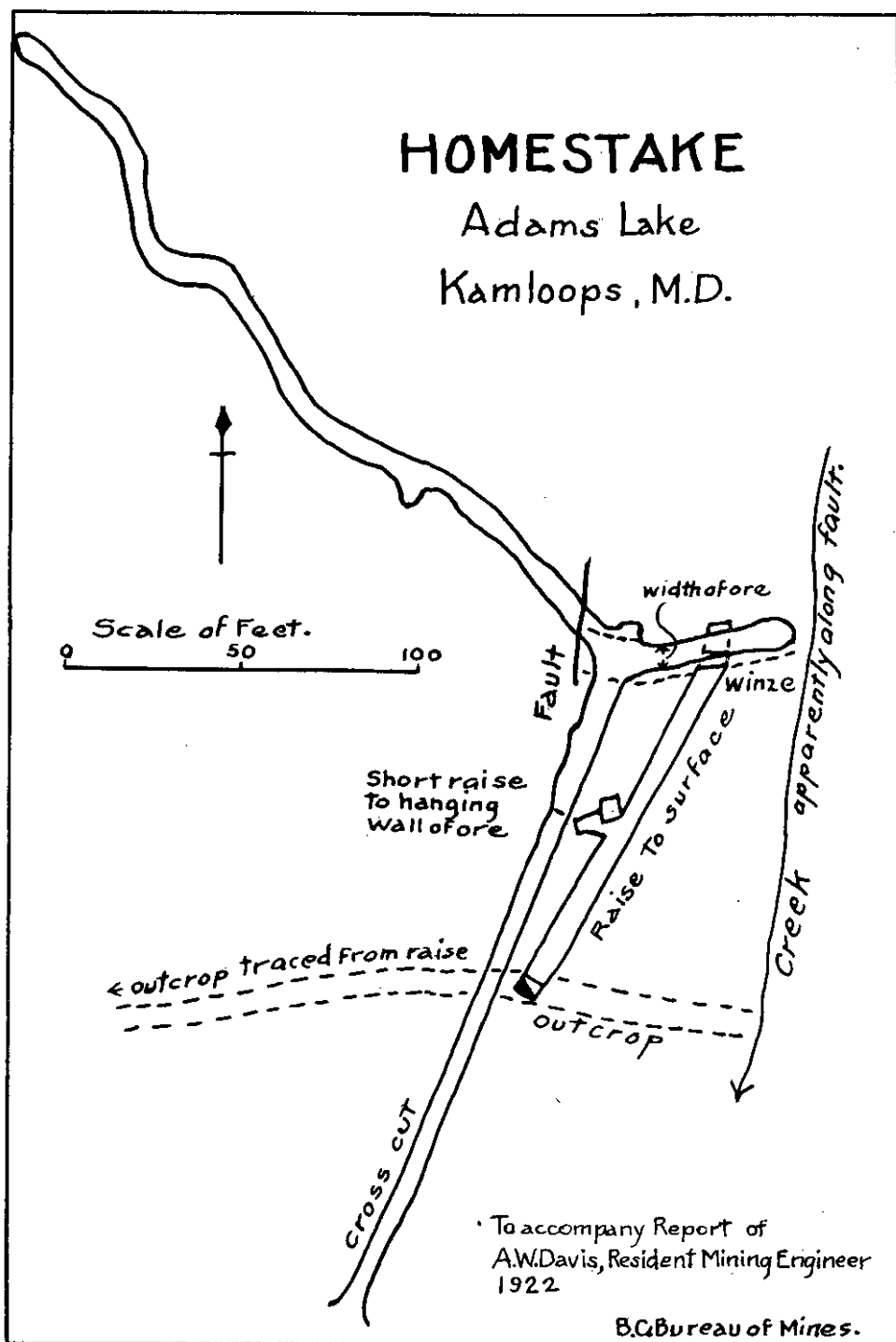
Louis Creek Placer.—About 1½ miles above the mouth of this creek J. W. Smith and associates have about completed the driving of a tunnel several hundred feet long through a horseshoe bend in the stream, with the object of diverting the water and uncovering the bed of the creek for a considerable distance.

KAMLOOPS SECTION.

South of Kamloops lake a copper-ore-bearing area extends for about 10 miles along the shore and for 5 or 6 miles to the south. The ore occurs mostly in crushed zones in a gabbro formation.

A good many years ago this district was active, but now most of the un-Crown-granted claims have lapsed. Only one producer on an important scale, the *Iron Mask* mine, has so far been developed.

On what was the *Laura* claim, but on ground which has been allowed to lapse and which is situated about a mile west of the Beckwith ranch, are very large surface exposures of ore. An engineer's report to hand gives 2 per cent. copper over large areas on this claim.



The impression gained by going over this district is usually that of enormous surface exposures slightly too low grade to be classed as ore.

Copper King Group. On this group near Cherry Creek Station, on the Canadian Pacific Railway, 900 tons of bornite ore was shipped a great many years ago. The average gold value in the ore shipped was around 0.3 oz., and the copper ranged from

19 to 3 per cent., the average being, say, 6 or 7 per cent. This ore was all from a high-grade shoot encountered at one point. The gold values on this property are much higher than in other parts of the district, where they are almost negligible.

Star Group. This group adjoins the *Iron Mask* holdings on the south. The owners are J. H. Morrison and associates, of Kamloops. The shaft on the property has caved and heavy wash obscures the surface. It, however, appears very probable that the ground is located in one of the zones of copper mineralization. Some high chalcopryrite ore was shipped from this shaft in early days. Mr. Morrison is one of the few men, amongst whom may also be included O. T. Batchelor, who has claims elsewhere, who is still taking an active interest in the district.

Iron Mask. On this property, located about 6 miles by wagon-road to the south-west of Kamloops, operations on a full scale are just being started. The capacity of the mill is 300 tons a day. Straight flotation is used. The concentrates are delivered to the railway siding 3 miles below the mill through a buried pipe-line. Power for operating the mine and mill is purchased from the city of Kamloops. Wash-water for the mill is pumped 1,650 feet vertically in one lift from Kamloops lake.

It has not been possible to examine the mine. The manager reports that conditions are good as regards ore in sight and also that a large amount of ore is broken in the stopes. With regard to a description of the workings, reference can be made to the Minister of Mines' Report for 1915 and 1918, pages 210 and 233 respectively.

The mill appears to be most efficiently constructed and to operate very smoothly. In fact, the general layout on the surface, for the shaft-house, blacksmith-shop, and mill are all together, creates a very favourable impression with regard to the way things are being run. The essential parts of the mill comprise a No. 4 Gates crusher, 16- by 42-inch rolls; one 450-ton ore-bin; two Dorr classifiers; two 64½ Marcy ball-mills; the Callow system of flotation; two 10- by 14- by 50-foot conical-bottom Dorr thickeners and two 12- by 14-foot Dorr thickeners.

Magnetite-deposits.—At Cherry Bluff and elsewhere some veins of magnetite were examined during the summer. In the aggregate the tonnage of iron ore is fairly large. The phosphorus content from the samples taken would appear to run over 1 per cent.

The number of claims still alive in the camp is large and most of them are Crown-granted. It has become the fashion in recent years to consider this area as hopeless, I will quote, however, one sentence in the summary of a report which has recently come into my hands, written by an engineer of recognized ability who formerly operated in the Kootenays, and who made an exhaustive examination of the district some years ago. He states: "Broadly, the district should not be neglected by a company anxious to increase its ore reserves to provide for a long life." Since this was written the Granby Company during the war did a limited amount of drilling at two or three points in the district, but not enough, in my opinion, to affect the above statement.

On the other hand, the *Iron Mask* mine is just now starting operations with its new mill fully overhauled, and if operations prove successful here they will certainly constitute an argument in favour of trying out the district elsewhere.

SEYMOUR ARM AREA.

About 14 miles north of Seymour arm of Shuswap lake is located a mineralized area which is worthy of close attention. The ores are mostly complex, carrying zinc, lead, and silver, although there is one copper-bearing vein (*Copper King* group) where the vein-filling is quartz with chalcopryrite.

There are three main vein systems—the *Cotton Belt* vein, on which are located the *Cotton Belt* and *Bass* groups and other mineral claims; the *Complex* vein, covered by the *Complex* group; and the *Copper King* vein referred to above.

The accompanying map shows the general situation. The elevation of the **Cotton Belt and Bass Groups.** *Victoria* shaft on the *Cotton Belt* group is 6,100 feet above sea-level, or about 4,800 feet above Shuswap lake. The *Cotton Belt* and *Bass* groups are located on the same vein, the ground gradually falling towards the *Bass* group, the shaft on the latter property being about 1,000 feet lower than that on the *Victoria*. The vein has a strike of about N. 30° W., with a dip of approximately 40° to the east, both of which conform with that of the formation. The general formation in the district is mica-schist. Paralleling the vein over its entire course and several hundred feet to the east of it is a 50-foot belt of pure crystalline limestone. Impure limestone, in some cases completely altered to schist, is the characteristic rock formation on both foot and hanging walls of vein.

The vein-matter consists mainly of an intimate mixture of magnetite, garnet, chlorite, black biotite mica, together with some zinc-blende and galena. It would appear to be a replacement of the country-rock. The width would average 3 or 4 feet. It is narrower and wider in some places, but where mined would have this width or more. At the *Bass* shaft, for instance, the ore is 6 feet in width.

A 40-foot shaft on the *Bass* claim, a 150-foot tunnel on the *Cotton Belt* claim, with two other shallow shafts, one on the *Cotton Belt* claim and one on the *Victoria* claim, constitute the principal development-work. There are a number of other open-cuts as well. The tunnel on the *Cotton Belt* claim was started where the vein was poor and is just about getting into the country below where the *Cotton Belt* shaft is located and where values can be expected to improve.

The following samples were taken on the *Cotton Belt* vein:—(1.) *Cotton Belt* claim, shaft-dump: Gold, trace; silver, 1.2 oz.; lead, 4 per cent.; zinc, 13 per cent. (2.) *Bass* claim, shaft-dump (lower-grade material): Gold, trace; silver, 1.2 oz.; lead, 8 per cent.; zinc, 10 per cent. (3.) *Bass* claim, shaft-dump (higher-grade ore): Gold, trace; silver, 5.6 oz.; lead, 22 per cent.; zinc, 8 per cent. (4.) Face of *Cotton Belt* tunnel: Gold, trace; silver, 0.6 oz.; lead, trace; zinc, 9 per cent. (5.) *Victoria* claim, dump: Gold, trace; silver, 4 oz.; lead, 14 per cent.; zinc, 12.5 per cent.

The *Cotton Belt* tunnel is not in ore which would be stoped in the event of the property being worked. The assay (No. 4) from the face is therefore ignored. The higher-grade ore from the *Bass* shaft is also ignored, and for the purpose of arriving at the grade of ore that could be expected to be stoped when operating, an average of samples 1, 2, and 5 is taken, with the following result: Gold, trace; silver, 2 oz.; lead, 9 per cent.; zinc, 12 per cent.

A preliminary concentration test made this fall by G. S. Eldridge & Co., of Vancouver, would indicate that straight selective flotation would probably be a proper method of handling the ore, and also that the bulk of the silver is associated with the lead.

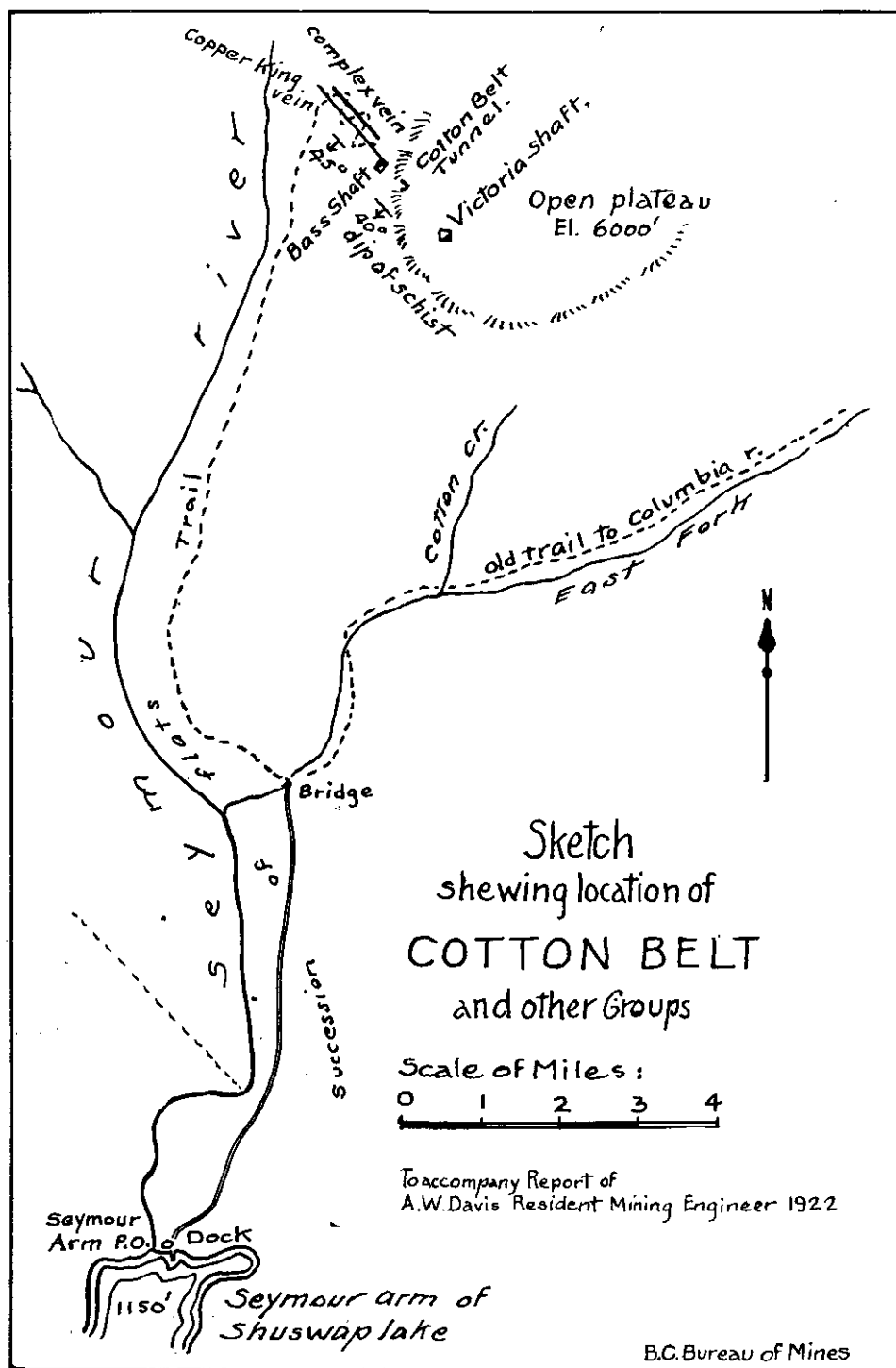
Since my examination of the ground I have been informed that a series of cuts between the *Bass* shaft and the *Cotton Belt* tunnel show a bigger width of vein and better values than obtain on the *Cotton Belt* ground. Unfortunately, the ground was covered with timber and my guide was not familiar with this lower area.

However, assuming an ore of the average value worked out above—namely, 2 oz. silver, 9 per cent. lead, and 12 per cent. zinc—and taking present prices of metals and freight and treatment rates (Trail) into consideration, it is estimated that a small profit of around \$1.50 a ton is obtainable. In arriving at this calculated profit, it is assumed that, in connection with the concentration of the lead and zinc, an 80-per-cent. saving would be made and 75 per cent. as regards the silver. It is also assumed that a 60-per-cent. lead and a 40-per-cent. zinc concentrate are turned out. The price of lead was taken at £25, zinc at £35, and silver at 65 cents. Below are given the figures indicating how this estimate of profit was arrived at:—

Value of lead and zinc concentrates in 1 ton of ore (concentrates, total weight 720 lb.)—

Silver	\$0 93
Lead	4 86
Zinc	4 90

Carried forward \$10 69



<i>Brought forward</i>	\$10 69
Zinc-smelting charge	<i>Nil</i>
Lead-smelting charge	\$1 32
Railway freight (to Trail)	1 44
Water freight (Shuswap lake)	18
Wagon-trail	72
	———— \$3 66
Stoping cost	\$2 50
Development	1 00
Milling	1 00
Overhead	50
Depreciation	50
	———— 5 50
	———— 9 16
Net profit	\$ 1 53

With the prospects for better rates for both lead and zinc concentrates distinctly bright, owing to new developments pending in the treatment of these ores, this small profit might easily be doubled or trebled. For instance, in the zinc settlement used above only 75 per cent. of the zinc in the concentrate is paid for, and besides 3.6 cents is taken off the current quotation for that metal. Moreover, some careful concentration tests as a preliminary to any work on the property might indicate better savings than have been assumed above.

The ore in this vein is not liable to vary from that on the surface for a considerable depth. For this reason a systematic opening-up of the exposures on top by means of a great number of open-cuts should give a good idea as to the possible tonnage and grade. This work, if satisfactory, could be followed by some underground development. With ore exposed on the surface for several thousand feet a large tonnage could easily be expected.

Mining cost should be low. Timber is plentiful on the lower claims and both walls of the vein are good. No timbering in the stopes would be necessary. The water-power situation is also good.

The cost of putting this property on an operating basis would be fairly high, the main expenditures for construction consisting in a fairly long aerial tramway, the erection of a concentrator, the development of some power, and the extension of the existing wagon-road for, say, 2 or 3 miles. In this connection it may be stated that a series of flats extend for 8 or 10 miles back from Seymour arm which permit of very cheap conditions as regards wagon-haul for this distance.

Around Seymour arm there are located about 10,000 acres of very fertile country. A few struggling settlers are now living in this area and the successful development of this enterprise would not only help the people mining, but would be a godsend to the whole community.

At present about 2 miles of new trail to the upper end of the group is needed and repairs are necessary to the balance of the trail now in existence, particularly at its upper end.

The *Complex* vein which is shown on the map was not examined when this **Complex Group** report was made; it, however, according to all reports, has considerable merit.

The ore is stated to be somewhat similar to that of the *Cotton Belt* group and to be in considerable quantity. It would therefore have to be carefully considered in connection with any scheme of development for the camp.

This group is a copper proposition which would also appear to have some merit.

Copper King Group. The *Copper King* vein lies in the mica-schist formation of the district, conforming with its strike and dip (N. 30° W. and about 45° dip to east). A

tunnel 150 feet long shows good ore over a width of 10 or 12 feet, but not to the face, however. The surface exposures were not examined to any extent. The Granby Company did a little drilling on this property during the war. The ore is quartz, carrying chalcopyrite, with very little iron pyrites in sight, and would concentrate very nicely. A specimen selected from the dump as typical ore ran: Gold, trace; silver, 0.6 oz.; copper, 3.2 per cent.

NON-METALLIC SECTION.

GYPSUM.

While it was impossible to personally investigate all the gypsum occurrences in the district, some were seen and in other cases reliable reports were used in compiling the following notes.

The gypsite-deposits mentioned farther on probably result (according to the Geological Survey) from the action of sulphur springs or limestone, the resulting gypsum being carried in solution to the surface and deposited there on the hillsides in a pulverulent state. The resultant deposits, therefore, are in flat zones over the original surface of the ground. Usually the gypsite has only a few feet in thickness.

There is enough gypsite in the country to make it worthy of serious attention. One factor in its favour is that no preliminary crushing is needed.

Salmon River Deposit.—This property was personally examined. It is located on the Salmon river at Falkland, about 25 miles west of Vernon on the Vernon-Kamloops wagon-road. This would appear to be the premier gypsum-deposit of the interior of British Columbia and there is a very large tonnage in sight. It is owned by the Manitoba Gypsum Company, whose intention it was to furnish from this point all the British Columbia demand for this material. Owing to the delay in laying the steel on the graded railway between the Canadian Pacific Railway at Ducks (east of Kamloops) and Vernon, this property continues to stand idle, although developed and equipped and ready to ship on short notice. There is a large deposit here of pure white gypsum (alabaster) in rock form. A typical analysis is as follows:—

	Per Cent.
CaO	32.60
SO ₃	46.87
H ₂ O	20.80
Insol.	0.06
Total	100.33

Charles Mandell and associates, of Vancouver, are, Mr. Mandell informs me, owners of the extension of the Manitoba Gypsum Company's holdings at Falkland.

The Spatsum Deposit.—This deposit occurs on the west bank of the North Thompson river opposite Spatsum, a point on the main line of the Canadian Pacific Railway about 15 miles west of Ashcroft. The main body of the outcrop consists of a badly disintegrated mass of mica-schists, limestones, and shales, with frequent nodular lumps of white gypsum of varying size. In a tunnel driven on the property a 5-foot band of pure white gypsum has been opened up. Not enough work has been done on the property to know whether it has any great extent. Systematic development-work on the property is required. Other pure bands may be encountered. A series of trenches on the surface might disclose more.

The above information on the Spatsum deposit is obtained from a publication entitled "Gypsum in Canada," issued by the Geological Survey of Canada, 1913. (NOTE.—Since then the Canadian National Railway has been constructed across the foot of the bank in which the deposit occurs.)

Basque Deposit.—This deposit occurs on the ranch belonging to W. H. Hammond, known as the "Basque Ranch," and located near Ashcroft. The material is gypsite or the pulverulent variety of gypsum. Mr. Hammond claims 100,000 tons and its distance from the railway 2 miles over a good road. I have not seen this exposure myself.

Merritt Deposit.—Consists of gypsite. Referring to the same publication mentioned above ("Gypsum in Canada"), the following extract is made: "Location of property half a mile from the town of Merritt, on the Canadian Pacific Railway, Nicola branch. The deposit probably covers an area of 1,000 by 1,500 feet. Several prospect-pits have shown a thickness varying from 3 to 8 feet. Although the crude material contains considerable vegetable matter, this fact does not appear to alter its tensile strength. It presents no difficulties as regards calcination and forms a quick-setting, strong, and reliable plaster. Its colour is not white, but a light tone of brown. The owner in 1913 was R. Henderson, of Merritt, B.C."

Louis Creek Deposit.—This is another gypsite-deposit, occurring on the east side of the North Thompson river near Louis creek, about 40 miles north of Kamloops, and practically adjoins the Canadian National Railway. The area of the deposit is not very large and the average depth

of the pure material is only about 3 or 4 feet. Whilst as a producer of big tonnage it cannot be considered very seriously, it is capable of a limited production of very pure material. A typical analysis of the gypsite (sample taken by me) is as follows:—

	Per Cent.
Gypsum (CaSO_4 plus 2 Ag.)	89.7
Insoluble	0.9
Organic matter	0.2
Carbonate lime	9.1
Magnesia	Trace.

Any estimate of tonnage in sight here would be a pure guess until more pits are sunk. All that can be said now is that there are several thousand tons in sight.

The Kelly Lake Gypsum.—This deposit is of the usual gypsite variety, occurring on the shore of Kelly lake, on the Pacific Great Eastern Railway near Clinton. It is supposed to cover a large area. Some shipments have been made, but only two or three car-loads. I understand. Last summer I took a sample from some of the sacked material (ready to ship) lying at an open-cut on the wagon-road. This analysed as follows:—

	Per Cent.
CaSO_4	65.1
CaCO_3	13.0
Insoluble	19.0
Moisture	2.8

They had evidently been digging into the underlying earth when this sacking was done, which would explain the high insoluble contents. Purer material can be obtained than this.

With regard to the Kelly Lake deposit, it was acquired on November 24th, 1922, by the International Gypsum Corporation, of Seattle. A superintendent has been placed on the ground and steps are being taken to produce steadily.

There are persistent reports of other large deposits of gypsite in the neighbourhood of Clinton.

SODIUM SULPHATE.

Hammond Deposit.—This deposit is owned by W. H. Hammond, Basque Ranch, Ashcroft. It is located about half a mile back from Kamloops lake and about opposite Tranquille, on the north side of the lake. The area of the dried-up lake, which constitutes the deposit, is around 9 acres. In every case after boring around 4 feet a semi-liquid was encountered which could not be taken up with the auger, but which no doubt was heavily saturated with the same sodium-sulphate salt. This deposit would appear to be of value, as many thousand tons of the salt are obviously in sight.

Six borings were made at various points on the lake and a composite sample taken which gave the following analysis:—

Average sample—

	Per Cent.
Insoluble	7.4
Sodium sulphate (Na_2SO_4)	41.1
Water of crystallization	51.0
Magnesia	0.4
Iron and alumina	Trace.

One of the six samples taken seemed purer than the others. A separate sample taken from this point gave the following analysis:—

	Per Cent.
Insoluble	3.8
Sodium sulphate (Na_2SO_4)	43.9
Magnesia	0.5
Iron and alumina	Trace.

An aerial tramway half a mile long could be cheaply constructed to drop the salt down to the Canadian Pacific Railway track below.

MAGNESIUM SULPHATE (EPSOM SALTS).

Basque Deposit.—Owned by the Basque Chemical Production Company, of Vancouver. This deposit consists of both magnesium sulphate and sodium sulphate. The upper 3 feet is the

former salt, whilst below it (with a distinct line of cleavage showing) lies the sodium sulphate. During the past season about 1,200 tons of the magnesium sulphate was shipped to Vancouver and there refined, although to eliminate freight costs it would appear a sound policy to do this on the ground.

I was informed when on the property that in the Vancouver plant the raw product is first of all put into solution and cleaned, all the accompanying mud, etc., being thus eliminated. The liquid is then run over a long galvanized-iron table (water-cooled), when the salts crystallize out. This product then goes to a centrifugal dryer and then to a hot-air rotary dryer. As a final process the salts are ground and screened. The perfect crystals are previously separated as a better price is obtained for them, they being used for medicinal purposes. One main use for the general product is in connection with tanning.

There are two lakes owned by this company. The wagon-haul is about 3 miles, down-hill most of the way, to Basque Siding, a point on the Canadian National Railway a short distance below Ashcroft.

Clinton Deposit.—A large and pure-looking deposit of Epsom salts occurs in a dried-up lake about a mile from Clinton on the main road to Ashcroft. One thousand tons of this material was shipped during the war. Nothing, however, was done with the deposit during the year 1922.

HYDROMAGNESITE.

Lac la Hache Deposit.—Campbell Johnson and associates have staked some ground at the north end of this lake.

Exeter Deposit.—Some tentative shipments were made from a magnesite-deposit located near this point, which is a station on the Pacific Great Eastern Railway a short distance west of Lac la Hache.

Meadow Lake Magnesite.—Some extensive magnesite-deposits are reported in the vicinity of this lake, which is about 20 miles west of 70-Mile House, on the Cariboo Road, and Pacific Great Eastern Railway.

Clinton Deposit.—About half a mile east of Clinton occurs a fair-sized deposit of magnesite. A typical analysis ran as follows:—

	Per Cent.
Water	10.0
Insol.	4.0
Fe and Al.	0.5
CaCO ₃	Trace.
MgCO ₃	85.3

The deposit has only been staked recently.

SODA.

Lillooet Soda Co., Ltd., Deposits.—This company controls what appear to be the principal soda-deposits of the district. At the head of the company is C. E. Cartwright, consulting civil engineer, of Vancouver; while F. Silvertown is manager on the ground.

Ten or twelve car-loads of the soda were shipped last fall, weather conditions finally tying up operations about the end of the year. There is about a 20-mile truck-haul from the vicinity of Meadow lake, where the deposits occur, to Chasm, on the Pacific Great Eastern Railway.

So far the shipments have only comprised the crude crystals of soda, which, without any treatment, are sold as washing-soda. As it is necessary to ship 2½ tons of crystals to obtain the equivalent of 1 ton, say, of soda-ash, the handling and freight do not leave much profit. What is badly needed is a plant on the ground. The object of the company is to then produce for shipment: (a) Soda-ash (this is the dried sodium carbonate and the most concentrated form to which the material may be reduced); (b) bicarbonate of soda; (c) caustic soda.

In a long and carefully drawn-up report recently received, Mr. Cartwright indicates the possible markets for this material, and outlines the plant necessary to turn out these products. Costs are gone into very carefully, also the tonnage in sight, and the general impression gained is a very favourable one.

Spences Bridge Soda.—Three miles up the Nicola river from Spences Bridge occurs a small lake heavily impregnated with sodium carbonate which is worthy of investigation. It is owned by Lee Clarke and associates, of Spences Bridge.

OIL.

The Okanagan Coal Oil and Gas Company, with headquarters at Vernon, is, according to its statement, now down 450 feet, with a hole being drilled in the Okanagan Valley near Armstrong. Some oil leases have also been staked in the near vicinity of Clinton.

LILLOOET DISTRICT.

LILLOOET MINING DIVISION.

REPORT BY JOHN DUNLOP, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Lillooet Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—LILLOOET MINING DIVISION.

Free miners' certificates issued	326
Mineral claims recorded	157
Placer claims recorded and rerecorded	4
Placer-mining leases granted	21
Certificates of work recorded (mineral)	147
Certificates of work recorded (placer leases)	59
Transfers and agreements recorded	64

Revenue.

Free miners' certificates	\$1,809 00
Mining receipts (general)	3,965 60
Tax, Crown-granted mineral claims	467 00
Mineral-tax	4 22
Fees, Crown grants, mineral claims	75 00

Total \$6,320 88

CLINTON MINING DIVISION.

REPORT BY G. MILBURN, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Clinton Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—CLINTON MINING DIVISION.

Free miners' certificates	150
Mineral claims recorded	548
Certificates of work	226
Placer claims	9
Creek leases in existence	3
Creek leases issued	1
"Mineral Act," bills of sale, etc.	83
"Placer Act," bills of sale, etc.	8
Certificates of work (placer)	2
Certificates of improvement	3
Crown grants	2

Revenue.

Free miners' certificates	\$ 723 25
Mining receipts (general)	4,545 15

Total \$5,268 40

YALE DISTRICT.

NICOLA MINING DIVISION.

REPORT BY W. H. BOOTHROYD, MINING RECORDER.

I have the honour to submit the office statistics of the Nicola Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—NICOLA MINING DIVISION.

Free miners' certificates (individual)	102
Free miners' certificates (company)	1
Mineral claims recorded	31
Placer claims recorded	10
Certificates of work	82
Bills of sale	10
Powers of attorney	2

VERNON MINING DIVISION.

REPORT BY L. NORRIS, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Vernon Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—VERNON MINING DIVISION.

Free miners' certificates	320
Mineral claims recorded	105
Certificates of work	40
Conveyances	22
Placer leases	11

YALE MINING DIVISION.

REPORT BY H. BEECH, MINING RECORDER.

I have the honour to submit the office statistics of the Yale Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—YALE MINING DIVISION.

Free miners' certificates (ordinary)	212
Free miners' certificates (company)	1
Free miners' certificates (special)	1
Mineral claims recorded	164
Certificates of work (mineral)	142
Certificates of work (placer)	2
Placer leases in existence	8
Powers of attorney recorded	27
Bills of sale recorded	17

ASHCROFT MINING DIVISION.

REPORT BY J. S. ALEXANDER, MINING RECORDER.

I have the honour to submit the office statistics of the Ashcroft Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—ASHCROFT MINING DIVISION.

Free miners' certificates	118
Mineral claims recorded	59
Certificates of work	86
Notices to group	5
Placer claims recorded	6
Rerecords	7
Agreements of sale	6
Bills of sale	3
Powers of attorney	10
Leaves of absence	23
Consolidation of placer claims	1
Leases	13
Leases disallowed	~~1~~
Leases cancelled	~~1~~
Declarations of work and expenditure on placer-mining leases	5

KAMLOOPS MINING DIVISION.

REPORT BY E. FISHER, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Kamloops Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—KAMLOOPS MINING DIVISION.

Free miners' certificates	387
Mineral claims recorded	134
Placer claims recorded	5
Placer leases issued	20
Certificates of work (mineral)	168
Certificates of work (placer)	10
Bills of sale recorded	29
Powers of attorney	21
Permissions to relocate	~~1~~
Mining receipts	\$4,282 50

SOUTHERN DISTRICT (No. 4).

REPORT BY PHILIP B. FREELAND, RESIDENT MINING ENGINEER.

The above district, comprising four Mining Divisions—Grand Forks, Greenwood, Osoyoos, and Similkameen—is situated in the extreme south centre of the Province of British Columbia.

SYNOPSIS OF MINING IN THE DISTRICT.

There is no doubt that a distinct improvement has taken place in the mining situation generally in that part of the Boundary country covered by District No. 4. The influx of new capital creates a competitive interest wholly beneficial to the prospects of the district. As pointed out in previous reports, the facilities for transportation and power are such that much lower-grade ores can be handled than in other parts of the Province not so fortunately situated. If the prospectors would realize that every mile added to the distance of their holdings from transportation necessitates additional higher values in their ore, much lost time might be saved.

For the first time in many years no copper was produced in the district. This fact does not mean that there is no copper ore available, but that operations have been delayed. In the Canada Copper Corporation mines at Copper Mountain, near Princeton, it has been estimated there is 10,000,000 tons of copper ore which has been developed for two years, but, owing to financial difficulties and the lower price of copper, has not been mined. The tonnage and content from this ore-body will probably soon bring the total tonnage of the district up to normal. A letter from the Granby Consolidated Mining and Smelting Company has been issued to its stockholders, an excerpt from which is as follows:—

"The Canada Copper Corporation, Limited, a Dominion of Canada company, is now in the process of reorganization. A new company is to be formed to acquire all of its properties and assets free of all liabilities, and in addition thereto such new company will have \$800,000 cash in its treasury. The mining properties so to be acquired by the new company are situated at Princeton, British Columbia, and are fully equipped. Engineers have estimated that these contain upwards of 10,000,000 tons of developed ore averaging 1.74 per cent. copper. A recent review of diamond-drill and development records and an examination of the workings by our own engineers and geologists conservatively concede 5,625,980 tons of 1.83-per-cent. ore, with values in gold and silver, and probable increased tonnages as operations and developments progress.

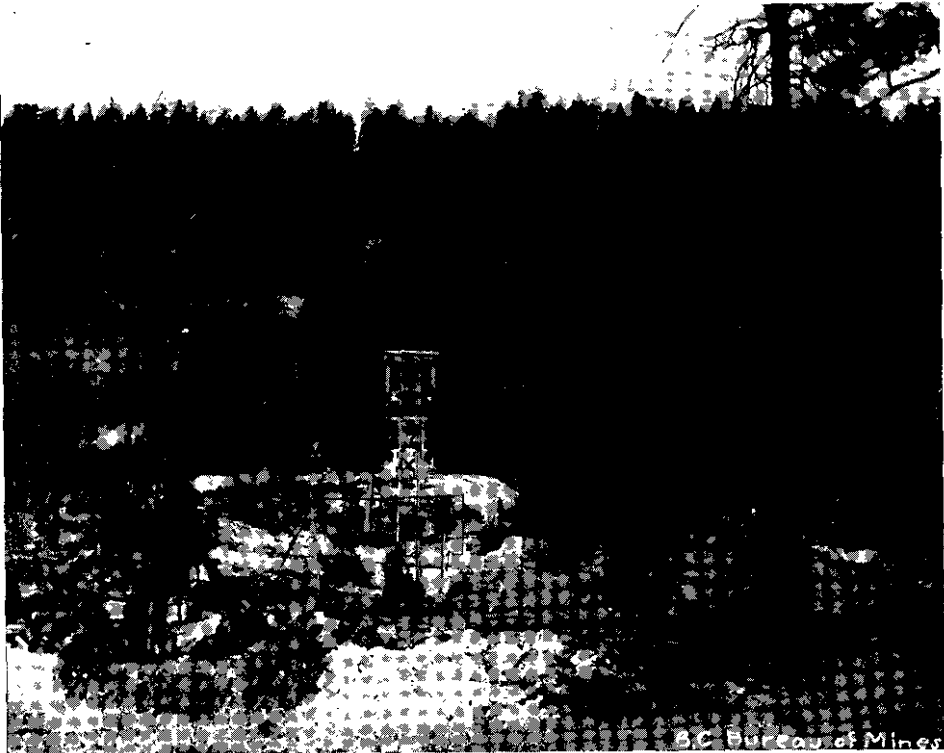
"A concentrating-mill having an estimated capacity of 2,000 tons a day has recently been constructed, and the necessary shops, community facilities, and other additions have been erected at Allenby, British Columbia, 9 miles from the mine on a branch of the Canadian Pacific Railway. While the concentrating-mill is of an up-to-date design and complete in essential equipment, some additions will be necessary to ensure a rated capacity of 2,000 tons a day. The cash fund of \$800,000 above mentioned which the new company will have in its treasury is believed to be ample not only for this purpose, but to supply sufficient working capital pending the receipt of income from operations. Satisfactory arrangements for transportation, power, and the treatment of concentrates have been established."

The cutting of the estimated ore reserves from 10,000,000 tons to 5,635,980 tons is not as serious as it at first appears. In other words, the probabilities for finding more ore in a deposit of this type are just as good as the reverse. The property has not been as thoroughly prospected as it might have been, and when developments progress it is more than likely that additional tonnage will be found.

SUMMARY.

The total tonnage of ore shipped from the district for 1922 is greater than the 1921 production by 4,616 tons.

The output of coal shows a marked increase, due chiefly to the successful operating of the Coalmont Collieries.



Susie Mine, Fairview, Osoyoos M.D.



Basalt Columns near Keremeos, Osoyoos M.D.

The increase in the production of silver and lead is attributable to the high-grade silver-lead properties at Beaverdell. The persistence of these veins and the installation of machinery for development suggests a further increase in tonnage in 1923. A lower production of fluorspar was due to lack of demand, caused by strikes in the steel and coal industry of the United States. The deposit at the *Rock Candy* mine has turned siliceous in the face of the two drifts, but there is still a considerable tonnage at the lower elevations. The high siliceous content hinders successful concentration.

PROSPECTING.

Most of the prospecting was done by those who live and already hold claims in the district; consequently only the areas near at hand were exploited. Much attention was given to the Beaverdell section, where new outcrops of silver-lead were discovered; also in the neighbourhood of Greenwood, where an attempt was made to find new ore-bodies that might supply tonnage for a concentration plant.

Under the head of prospecting might be mentioned placers, because most of the work done was of this nature, on the Tulameen river, Granite creek, Rock creek, and on the lower reaches of Boundary creek.

The results of this prospecting, mostly on the benches, may make a favourable showing next year. Captain Cates's operation, financed by himself, on the Tulameen river was entirely creditable and the non-success of the venture was due to unforeseen circumstances.

The development of the *Susie* group of claims at Fairview by the Federal Mining Company is only in its prospect stage. The veins are wide and low grade and a large tonnage will have to be assured before any plant is built to treat the ores. Work done up to the end of the year was satisfactory.

ADDRESSES.

In the early spring a series of addresses was given by the writer in the different centres throughout the district, touching on general geology, mineralogy, mining, and prospecting. The attendance averaged twenty-five in each place, which was considered fairly good, seeing that mining at that time was quiet and weather conditions unfavourable for travel.

The interest shown by many of the younger mining men, especially in the study of formations likely to contain certain ores, was gratifying, inasmuch that the finding of future ore-bodies in any district only preliminarily prospected lies with those who have a general knowledge of its geology.

TRANSPORTATION.

The building of the Princeton-Hope highway seems to be practically assured. The route believed to be chosen is the extension of the old trans-provincial road following the Similkameen river to its junction with the Roche river; thence up the Roche to Allison pass and across into the Skagit river and down to Hope. The opening up of this area will greatly assist mining development, especially on the Roche river, where there are copper prospects in the schists which may possibly become mines.

To the south of Allison pass there are areas covered with sedimentary rocks, intruded by porphyry dykes, with veins and stringers of silver-lead ores in the fractures of the sedimentaries. This area has never been thoroughly prospected on account of lack of transportation.

TOTAL TONNAGE AND CONTENTS IN MINING DIVISIONS FOR 1922.

Division.	Ore.	Gold.	Silver.	Lead.	Fluorspar.	Coal.	Limestone.
	Tons.	Oz.	Oz.	Lb.	Tons.	Tons.	Tons.
Grand Forks	5	.....	283	4,295	4,219	.....	9,000
Greenwood	764	81	209,315	139,956	.....	.....	.....
Osoyoos	41,280	17,887	2,122	.....	.....	.....	.....
Similkameen .....	.....	.....	.....	.....	.....	142,806	.....
Totals.	42,055	17,918	211,780	144,251	4,219	142,806	9,000

OSOYOOS MINING DIVISION.

SIMILKAMEEN RIVER SECTION.

Hedley Gold Mining Co. This company operated throughout the greater part of the year, commencing when the ice had thawed in the river and closing late in the autumn. The reason for this cessation from work is that the ice formed in the river during the coldest weather seriously interferes with the generation of power at the company's plant. The power supplied is used to drive all the machinery as well as light the town. The closing of the mine and mill works a hardship not only on the company, but on the inhabitants of the town. It seems a pity that some arrangements cannot be made with the South Kootenay Power Company, whose high-power line passes within half a mile of the plant, to supply electric current during the winter months. Development-work has been advanced by means of diamond-drilling and it is probable that this work will be continued throughout the winter. The details of this work are not published, but the general results have been encouraging.

A total of 41,286 tons of ore was mined and treated, making 1,621 tons of concentrates and 511 tons of arsenic, in addition to the gold contents extracted by cyanidation. All the concentrates are treated at the Tacoma smelter.

Olalla Camp.

The situation of this area, close to a wagon-road and within 4 miles of Keremeos, on the Great Northern Railway and the high-power electric line, is worth a good deal to capital contemplating operations. The topography of the valley, steep on the eastern slope and only slightly less so on the west, will also be an advantage, offering cheaper development.

The history of this camp, which embraces both sides of the valley, has been insignificant when based on production, only a few tons having been shipped. This fact in no way belittles the future possibilities of the area, because the geological conditions are such that the deposition of ore seems probable.

Dolphin and Spar Fraction. These claims are situated on the east side of the valley and are owned by C. W. Jordon, of Olalla. Development-work consists of tunnels and open-cuts. The ore-minerals are chiefly chalcopryite and pyrite containing silver. Shipments made averaged 6 per cent. copper and 1.50 oz. in silver to the ton. The lode has been crushed and faulted in the tunnel and the ore-body displaced. Crosscut tunnels were driven, but only small segregations of ore found in the fractures. This property needs capital for exploration. It is attractively situated for mining and transportation.

Over a large area on the eastern side of Olalla the mineral possibilities have been explored by trenching, open-cuts, and shallow shafts. In these workings are evidences of copper carbonates and sulphides of iron and copper, but at the present time none of the ore-bodies discovered appears to be in place.

To the north and east crosscut tunnels have been driven under an oxidized "capping" without results. This form of development at depth is to be condemned in a section where so much faulting is in evidence.

Price Jandell has been doing regular assessment-work on several claims in the camp, amongst which are the *Mica* and *Groundhog*. The ore occurring on these claims is chiefly chalcopryite, with carbonates of copper in the fractures. The same owner also commenced a crosscut tunnel on the *Silver King* claim on the west side of the valley. The ore found in open-cuts above contain values principally in silver.

Golconda. The owners of this claim, Dan and Archie McEachern, of Olalla, continued the lower development-tunnel and commenced a crosscut from the hanging-wall towards the foot-wall. The ore-body developed was narrow and the owners deemed it advisable to crosscut to the foot-wall in the hope that a larger body might be found. In the upper tunnel the ore-minerals are chalcopryite, molybdenite, and pyrite, occurring in lenses and segregations, sometimes on one wall and sometimes on the other. This fact warrants the crosscut on the lower tunnel. The difference in elevation between the upper and lower tunnel is approximately 150 feet (barometric).

About 10 tons of picked ore has been shipped, containing 18.1 per cent. copper to the ton. Another shipment of 4,390 lb. of molybdenite was made to Ottawa in 1918, which carried 17.11 per cent. MoS₂.

The lead has a generally north-westerly and south-easterly strike, dipping nearly perpendicular, and varies from 4 to 10 feet in width, as far as exploration has proved.

This claim adjoins the *Golconda* on the south-east and is owned by R. Northey, of Olalla. Development-work consists of a shaft and several tunnels. The shaft is sunk about 20 feet through a capping of magnetite. In the bottom of this shaft copper sulphides have to a great extent replaced the iron. Below this shaft, to the north and east, tunnels have been driven in the limestone, but not far enough to reach the probable mineralized zone under the shaft. The highly altered limestones, showing epidote and garnetite mineralized with copper and iron sulphides on its contact with the igneous rocks, forms an attractive zone for exploitation.

One of the main drawbacks in any attempts made to prove up the property has been the desire to develop ore at too great a depth. If the present tunnels had been driven higher up the hill, nearer the shaft, something definite might be known of the extent and value of this deposit. As it is, money is not available to continue the present tunnels.

The situation of this claim, on the north and west of the *Copper King*, is attractive from a possible development standpoint. At present the surface mineralization discovered is only slight owing chiefly to a heavy gravel-wash. A tunnel about 100 feet long has been driven on a narrow mineralized fissure in the direction of the *Copper King* shaft. The formations are about the same. Northey & Hagelberg, of Olalla, are owners.

Steve Mangott, of Keremeos, is the owner of this claim. Development-work consists of tunnels and open-cuts, most of which are driven in disintegrated and crushed country-rock, carrying nodules and specks of chalcopyrite and iron pyrite. There is a large area of these rocks which are heavily stained with copper carbonates. It is possible that this stain may be due to a slight mineralization throughout the rock, or it may have been precipitated from a zone higher up the hill. The valley at this point widens into a U shape and a glacial action was probably responsible for the crushing of the rocks. A trace of platinum has been found associated with the copper ores on this claim.

Prince of Wales and Wm. Lee Claims.—These claims lie below and to the east of the *Copper King*. There is a lot of development done on the surface and a good deal of mineralization uncovered. The rocks are fractured and stained with copper carbonates, with occasional lenses and stringers of chalcopyrite.

INDEPENDENCE MOUNTAIN.

These claims are owned by James McNulty, of Hedley. The area in the vicinity of these claims forms a high ridge practically at the summit of Independence mountain, at an elevation over 7,000 feet. The *Nelson* claim is situated on the rim of the Apex basin and most of the recent developments were done in the basin. In a shallow shaft sunk 5 feet at the end of a 35-foot tunnel driven in the winter of 1921-22, some siliceous rock carrying pyrrhotite and arsenopyrite was struck. A sample of this on each side of the shaft assayed: Gold, 3.14 oz.; silver, 0.90 oz.; copper, 0.22 per cent.; and on the other side: Gold, 1.82 oz.; silver, 1 oz.; copper, 0.55 per cent. Other developments consisted of two open-cuts, two shafts 10 feet deep in oxidized material, with some copper sulphides and carbonates.

The country-rock in the neighbourhood of the workings is fractured and crushed and it seems probable that the ore discovered is not in-place. However, more work will have to be done to prove this. There is evidence of copper sulphides in the fractures of the rocks. The chalcopyrite and arsenopyrite appear to carry the gold values, whilst the pyrrhotite is barren. The country-rocks are limestones, quartzites, and argillites highly metamorphosed and disturbed, and have been placed by C. Camsell in the Palaeozoic. These rocks are intruded by dykes of diorite, porphyrite, andesite, and granite porphyry.

There is an extensive mineralization over several areas adjoining the *Nelson* claim and much open-cut work has been done in the past. The low values found in copper and gold caused interest to wane on the mountain, until J. McNulty struck higher-grade ore on the *Nelson* claim.

There is an old wagon-road built from the present Keremeos-Penticton highway up to the Apex basin. This road could be repaired with a reasonably low expense should tonnage be developed on Independence mountain.

Horn Silver Group.

This group is situated about 6 miles from Similkameen Station, on the Great Northern Railway plying between Princeton, B.C., and Oroville, Wash. The group consists of six and a half claims—*Horn Silver Nos. 1, 2, and 3, Anna, Silver Plate, Golden Horn, and Silver Bell*. Crown grants have been given on the *Horn Silver Nos. 1, 2, and 3*. A lien has been placed on the property, not including the *Silver Bell*, by the employees for non-payment of wages, etc., and A. S. Black, solicitor, of Princeton, is now acting for the lien-holders.

In the vicinity of the mine the side-hills are steep. At the camp, situated three-quarters of a mile below, the ground begins a gentle slope down to the Similkameen river, approximately a mile distant. The elevation of the camp is about 900 feet lower than the workings. There is plenty of timber for mining purposes, especially on the *Silver Bell*.

A good spring of water, running all the year, finds an outlet at the camp. With ample storage facilities, there would probably be sufficient for both domestic and reduction purposes. As it is, there is ample for domestic uses.

A good wagon-road is built from the camp to Similkameen Station. The railway passes within $1\frac{1}{2}$ miles of the camp on the opposite side of the Similkameen river.

An aerial tram 4,000 feet in length, consisting of $\frac{1}{2}$ -inch cable, on which are slung 200-lb. wooden buckets and supported by wooden towers, conveys the ore from the mine to a bunker of 30 tons capacity. There is a trail from the mine to the camp.

Two frame dwelling-houses, office and outhouses, a cook-house large enough to accommodate twenty-five men, and a bunk-house have been built at the camp. At the mine are the following: Blacksmith-shop, 12 by 25 feet, fully equipped (October 7th); an engine-room, 25 by 16 feet; also an ore-sorting shed, one 8 by 8 Ingersoll-Rand compressor in good condition, one 40-horse-power Alco engine, one 6- by $2\frac{1}{2}$ -foot air-receiver, three machine-drills, several sets of hand-steel, and all necessary tools for engine, besides rails, hose, and two mine-cars.

The South Kootenay Power Company's electric line passes within 12 miles of the property.

Development consists of the following on the *Horn Silver*: No. 1 tunnel and crosscuts, 574 feet and winze 50 feet deep; No. 2 tunnel and crosscuts, 791 feet and upraises 122 feet; No. 3 tunnel and crosscuts, 73 feet; No. 2 extension crosscut, 112 feet; No. 3 extension crosscut, 150 feet and drift 60 feet in length.

Most of the ore in Nos. 1, 2, and 3 levels has been stoped out, excepting some low grade near the mouths of the tunnels. There is no ore in No. 2 extension crosscut, which was driven probably too high to strike the ore near the surface of the side-hill. An extension of this tunnel may be used later if the ore in No. 3 extension continues its present dip. No. 3 extension crosscut has been driven for about 150 feet, cutting the vein and extending into a crushed and oxidized zone. The vein in the drift is 14 inches wide and shows some oxidization near the crosscut, but gradually tightens and narrows to 3 inches wide at the end of the stope, 90 feet in length. The ore in the stope lies nearly flat, with a slight rise into the hill.

The country-rocks are granite, granodiorite, and olivine diabase. The vein is a true fissure in the granite, carrying argentite, native silver, pyrite, chalcopyrite, containing gold in a quartz gangue. There is probably 600 tons of medium grade ore on the dump that might be mixed with high grade and successfully concentrated.

This claim adjoins the *Horn Silver* mine to the north. The quartz vein, apparently the same as the *Horn Silver*, is traceable for 1,500 feet and has been developed by open-cuts and a tunnel about 180 feet in length. The vein varies from 6 inches to 2 feet and carries values as shown by sampling. There are other claims about and to the east of the *Horn Silver* and *Silver Bell* on which other quartz veins, carrying from 40 to 50 oz. in silver to the ton, have been uncovered.

One of the chief detriments to the future operations of the *Horn Silver* is the lack of knowledge regarding the future ore-bodies. The previous operators have stoped out most of the ore developed and any new operator will have to do some development on the lower levels of the *Horn Silver* and also on the *Silver Bell* before any estimate of tonnage and values can be arrived at. A thorough sampling will also have to be made to obtain some knowledge of the average ores already developed. It seems possible that by blending the high-grade and the low-grade ores an average could be obtained which would permit the expense of a small reduction plant. The price asked, which I believe to be \$45,000, with a small payment down and easy payments for the remainder, seems to be worthy of consideration. Seeing that it would be

possible to lease and bond adjoining claims which would give a required tonnage, I have no hesitation in recommending any one interested to examine these properties, having in mind the ideas laid out by me.

FAIRVIEW CAMP.

This group, consisting of the *Susie*, *Banker*, *Federal*, and *Agricola* claims, is **Susie Group.** situated about 3 miles north of the old Fairview camp and within three-quarters of a mile to the west of the wagon-road between Penticton and Fairview. The Federal Mining Company, under the management of C. E. Wethered, has been exploiting the *Susie* and *Federal* claims, first with a diamond-drill and latterly by means of tunnels and a shaft.

On the *Federal* claim the tunnel has been advanced about 200 feet on the vein. On the surface there are numerous open-cuts and stripping showing the continuation of the lead. Several diamond-drill holes were bored to ascertain the dip and extension of this vein and the tunnel is being driven to prove the results found in the drill holes. Another vein on the *Susie*, lying approximately 1,500 feet to the north-east, is being developed by means of a shaft. A shaft 110 feet deep, sunk several years ago, was unwatered and extended 50 feet in depth. The company intends sinking this shaft to the 200-foot level, when drifts will be driven in both directions along the vein in order to determine the possibilities of the property. The vein on the *Federal* claim is about 15 feet wide and strikes generally north and south (magnetic).

The ore-minerals are galena and pyrite, containing gold and silver in a gangue of quartz. The mineralization, as far as development has gone, appears to be spotty, with a good deal of oxidized iron in the fractures.

On the *Susie* the vein is about 20 feet wide and contains the same mineralization as the *Federal* claim. The lead dips to the east about 30°.

In November the West Kootenay power-line was extended from Oliver to the *Susie* shaft and a 75-horse-power motor and a 320-cubic-foot Ingersoll compressor installed. This plant will greatly facilitate development and within a short period something definite will be known regarding the future possibilities of this group.

WHITE LAKE BASIN.

Southern Okanagan Collieries, Ltd.—This company, having its head office at Penticton, was organized to exploit and operate certain coal areas situated at White lake, near Okanagan Falls. Some difficulty has been experienced in interesting capital, due chiefly to lack of developed tonnage and financial depression.

The area covered by White Lake basin is estimated at 1,280 acres, consisting of sandstones and shales, surrounded by volcanic rocks. (See Geological Survey Report, 1912, by Chas. Camsell.)

Development-work done consists of open-cuts across the coal-measure, exposing six seams from 80 to 160 feet apart. The coal analysed from these cuts contained a high percentage of ash and water, which was a natural contamination so close to the surface. On No. 3 seam a tunnel has been driven about 400 feet and an upraise put through to the surface, 100 feet above. The seam of coal in this development averages 3 feet in width and was used by blacksmiths for steam purposes in Penticton and as tests on different railways. The results, according to the company's secretary, were excellent.

Two samples taken across seam No. 1, about 200 feet from the mouth of the tunnel, and No. 2, 50 feet from the face, analysed as follows:—No. 1: Moisture, 0.3 per cent.; volatile combustible material, 15.3 per cent.; fixed carbon, 70.4 per cent.; ash, 14 per cent. No. 2: Moisture, 0.2 per cent.; volatile combustible matter, 11.3 per cent.; fixed carbon, 54.4 per cent.; ash, 34.1 per cent. The sample marked No. 1 was taken across 2 feet 6 inches of cleau coal, whilst No. 2 was taken across 4 feet 6 inches of coal regardless of foreign matter, which probably accounts for the high percentage of ash.

In the early spring two diamond-drill holes were bored, one near the eastern end of the basin and the other about 500 feet farther west in the basin. Both holes were driven at an angle of 45° across the dip of the coal-seams.

The results from these holes, driven 563 and 437 feet respectively, was as satisfactory as might have been expected, seeing that the bit used cut a $\frac{15}{16}$ -inch core. As far as the location of a coal-seam and its probable width are concerned, the $\frac{15}{16}$ -inch core leaves little to be desired. When an estimate of the quality of the coal and amount of foreign matter are important, the

small cores are useless. It is most important to ascertain the quality of the seams at depth, seeing that the percentage of ash is high and the seams narrow. If they prove to be good clean coal, the future of the field seems assured; if they are not, other seams will have to be developed.

This group includes the *Silver Crown*, located in British Columbia, and the *Silver Crown Submarine* and other claims, located in State of Washington, U.S.; the **Silver Crown Group.** International Boundary-line dividing the claims. This group was examined and reported on in the Minister of Mines' Report for 1921. Since that time an option has been given to the London Exploration Company. The new company is expected to diamond-drill the property thoroughly in 1923, with the idea of developing a more highly mineralized zone than that which has already been exploited. It will be remembered that the vein is large, but it contains low values, except in isolated places.

SIMILKAMEEN MINING DIVISION.

SUMMIT CAMP.

Treasure Mountain.

Silver Chief. William Dornberg *et al.*, owners of this claim, employed seven men late in the autumn in an endeavour to develop the lead in the lower workings. Up to that time a crosscut had been run 568 feet, cutting the main vein at about 484 feet. On this vein drifts were run 25 feet each way, which developed about 4 feet of lode-matter, with intermittent veins on the foot and hanging walls about 4 inches wide, carrying from 70 to 100 oz. in silver to the ton, 40 to 60 per cent. in lead, and a high percentage of zinc. At a point 463 feet from the portal of the tunnel a crosscut was driven 100 feet to the west, and an upraise commenced.

It is the intention of the owners to drift on the vein to the east and west in the hope that the ore may persist and increase in width. This effort on the part of the owners is to be commended, as at the present time the camp is suffering from a lack of developed tonnage, which has been a constant drawback when examined by interested capital.

Transportation consists of a road up the river from Tulameen about 6 miles, and thence by a trail for 19 miles to Summit camp. Should enough tonnage be developed, it would not be difficult to build a wagon-road into the camp so that machinery could be hauled in.

The vein strikes in a north-easterly and south-westerly direction and cuts through a series of quartzites, argillites, and limestones. Other work has been done on this vein. (*See Minister of Mines' Report for 1914.*)

Stevenson Group.—This group consists of *Summit No. 1* and others. A lease was taken on these claims early in the year by Vancouver interests and the old shaft cleaned out. No definite information is to hand, except that these interests abandoned the lease.

There are several other veins carrying high values in silver-lead in different parts of this camp which have never been thoroughly prospected.

Should the *Silver Chief* develop favourably, there is little doubt but that other interests will be attracted to the vicinity.

TULAMEEN RIVER.

The one outstanding feature in the Tulameen River section was a placer lease operated by Captain Cates, of Vancouver. The river was dammed about $4\frac{1}{2}$ miles up from Tulameen village below the first canyon and a flume and riffles erected. A pump was also installed on a raft to facilitate movement to different deep holes. Bunk-houses, dining-room, and a bungalow were built. When the water was pumped out of the river below the dam, the bed-rock was found to be smooth and worn and no values, to speak of, left in the gravels.

Before entering into the scheme, Captain Cates, who was an old-timer on the river, had watched the flow at this point, winter and summer, and decided that, owing to the slow movement of the water in the summer and the gradual breaking-up of the ice in the winter, gold values, if there were any, would not move far after once being deposited in the hole adjacent to the swift waters in the canyon.

The results seemed to prove that the slow movement of the ice, which was crushed and tilted, scoured the rocks at the bottom of the river to such an extent that no riffles were left to hold any gold values.

These operations were watched with great interest, because, had Captain Cates been lucky enough to have found good pay-gravel, many other outside interests would have applied for and worked leases on the river.

Another lease was taken up near Eagle creek by Emmons & Dickinson. A small hydraulic plant was used and an attempt made to wash the gravel benches on the east side of the Tulameen. No definite information is at hand regarding the amount of gold or platinum recovered, but owing to intermittent operation it is understood to be small. One of the owners stated that he intended to renew the lease in 1923, when better results may be hoped for.

Besides these two leases, there were several snipers higher up the river who panned small pockets of auriferous gravel.

Some prospecting was done on leases on the main Tulameen river held by local Princeton people, and good indications found for large-scale operations.

GRANITE CREEK.

Four leases were worked on Granite creek and some gold and platinum taken from the gravels. Most of this work took the form of prospecting and next season will probably show some recovery.

The old Swan placer claim was reworked by American interests and a new drift started from the Granite Creek side. No results had been obtained at the time of examination.

LAW'S CAMP.

Liverpool. This claim, situated at Bear creek, was exploited by Louis Marcotte *et al.*, of Coalmont. In the winter of 1922-23 an inclined shaft was sunk 60 feet deep on the main vein at an angle of about 30°. To facilitate this work a small gasoline-hoist was installed and a siphon to unwater the shaft. The shaft, which was commenced near the mouth of an old tunnel driven about 50 feet across the mineral-zone, cuts through rock heavily mineralized with pyrrhotite near the collar, changing to nearly solid pyrrhotite containing specks and small lenses of chalcopyrite. A general sample from the bottom of the shaft carried a trace in gold, 1.2 oz. in silver to the ton, and 3 per cent. copper.

The rocks in the vicinity are interbedded limestones, chlorite and talcose schists, intruded by granodiorite and cut by dykes of granite porphyry. It seems probable that the granodiorite is responsible for the mineralization of the cover-rocks.

Charles Camsell, of the Geological Survey of Canada, 1913, says: "The ore-deposits are replacement deposits, characterized by minerals formed at a moderate depth, and are undoubtedly genetically connected with the granodiorite intrusion. They lie almost exclusively in the limestone-bands, which they frequently have replaced from wall to wall. The maximum width of the ore-bodies is determined by the thickness of the limestone-beds. The actual width of the bodies varies from 3 feet up to 12 feet."

The ore-minerals are pyrrhotite, pyrite, chalcopyrite, galena, zinc-blende, and some magnetite, with an association of gold and silver in a gangue of calcite and silica.

It seems likely that the possible future tonnage depends upon the thickness and extent of the limestone-beds. This factor can only be determined by prospecting, as the surface is generally covered with loam. The owners report the finding of a similar mineralized zone about 1,500 feet to the south.

A great deal of development-work was done on this group prior to 1912 and to the north of the *Liverpool* claim. This work was generally unsatisfactory and apparently done too far to the west of the ore-zone.

The camp is well supplied with log buildings and a good water-supply.

An old wagon-road about 12 miles in length, built between Tulameen, on the Kettle Valley Railway, and Law's camp, crosses a high summit and then down a steep incline to Bear creek, climbing again to the camp. The elevation of Tulameen is about 2,562 feet above sea-level; the summit of the road about 4,800 feet, the crossing of Bear Creek about 3,440 feet, and Law's camp 4,640 feet. These grades could be considerably improved by curving to the south-west about 2 miles before reaching the summit and circling around a high ridge. The switchbacks built on the approach to Bear creek could be abandoned and longer loops constructed. At the present time the old road is sufficiently good to transport supplies for preliminary exploitation.

In conclusion, it may be said that property is well worth further development, with the idea in mind of the possible discovery of continuous ore-bodies in the cover-rocks, and perhaps a plant to treat the lower-grade ores. The vicinity is well covered with spruce and fir trees good for mining and construction purposes. The present owner is Louis Marcotte, of Coalmont.

A full report of work done prior to 1912 is to be found in Memoir No. 26, "Geology and Mineral Deposits of the Tulameen District," by Charles Camsell, Geological Survey, Ottawa.

RABBIT MOUNTAIN.

The mineral-deposits on Rabbit mountain, situated between the Tulameen river and Otter lake on the south side of Boulder creek, are chiefly of the replacement variety, associated with porphyry and apophyses from what is known as the Boulder granite.

The overlying rocks, mainly chlorite-schists, have been impregnated with pyrite and chalcopryite close to the contact of the porphyry. This porphyry is in places mineralized with pyrite.

The ore occurs in veins through the schist varying from a fraction of an inch to 6 inches in width and traceable for several hundred feet. Development-work consists of a tunnel 300 feet in length, shallow shafts, and a series of open-cuts along the veins.

At the present time the ore exposed is not in sufficient quantities to warrant shipping, but the exposures justify more development in hopes that there may be larger parallel veins in the schist.

BOULDER CREEK.

The ore-deposits in this vicinity are very similar to those on Rabbit mountain, being of a replacement variety occurring in schist. J. Osborne, owner of the *Ottawa* group, has done a lot of surface development and has uncovered several veins carrying pyrite and chalcopryite, with occasional specks of galena. This vicinity is also promising enough to deserve further exploration.

SUMMERS CREEK.

These claims are situated about a mile up Dry creek, a tributary of Summers creek, at an approximate distance of 10 miles from Princeton. Along the south bank of the stream lies a considerable area of altered sedimentaries intruded by granite and granite porphyry. Near the contact, in the fractures of the limestones, a good deal of mineralization has taken place. A crosscut tunnel has been driven into the limestone for 50 feet. Nearly all the ground passed through was broken and crushed and the ore recovered was evidently not in-place, but had broken down from above. The ore-minerals visible in the rock were lead, copper, and zinc sulphides in a gangue of silica and containing values in gold and silver.

The owners of these claims are E. N. Freding, Oscar Petersen, and the Pete Johnston estate, all of Princeton.

Other development consisting of open-cuts and pits had been dug along the supposed strike of the vein and indications of ore found. It seems advisable for the owners to continue the crosscut straight into the hill until the lead is found in-place.

ROCHE RIVER.

The claims on Roche river were not visited this season, but it is understood that development-work on the *Knob Hill* and *Red Star* groups of claims progressed favourably. John Bowman *et al.*, of Princeton, own the *Knob Hill*, and W. Bonnivier *et al.*, also of Princeton, the *Red Star*. The copper-deposits on both these groups occur in schist, and, judging chiefly by surface indications, are worthy of attention.

Canada Copper Corporation, Princeton.—A reorganization of this company took place during the year, but no definite plans of future operations have been made public. At the present time only a few men are employed watching the plant.

Princeton Mining and Development Co., Ltd., Princeton.—This company, composed of British Columbia and Washington stockholders and managed by Fred F. Foster, of Princeton, owns the *Copper Farm* group of claims, situated 4 miles east of Princeton, on the Great Northern Railway.

During 1922 an upraise commenced in the winter of 1921 was driven 135 feet and broke through into No. 2 tunnel above, making a total length of 210 feet. This upraise intersected the

vein exposed in the No. 2 tunnel, 30 feet below the floor. The vein-matter exposed measures about 8 feet between the foot and hanging wall. In this there are three lenses of ore measuring 20, 12, and 3 inches respectively in the widest part. The gangue appears to have specks of chalcopyrite disseminated through it. No. 2 tunnel was extended a few feet and the ore in the face has improved, showing small amounts of tetrahedrite.

On top of the hill, approximately 900 feet higher and 1,200 feet from No. 2 tunnel, a streak of copper ore varying between 1 to 6 inches in width was uncovered. A good deal of grey-copper was found in this vein, samples of which the management had assayed by W. H. Stowall, of Spokane, with the following results: Copper, 12 per cent.; silver, 54 oz.; and gold, 0.07 oz. to the ton. Samples from the same lead 40 feet north sent to Fasset & Company, Spokane, assayed: Copper, 20 per cent.; silver, 65 oz.; and gold, 0.09 oz. to the ton.

These discoveries, though not representing any tonnage blocked out, add greatly to the attractiveness of the property.

Coalmont Collieries, Ltd.—A considerable advance was made in the development of the underground seams of this company's property, situated near Coalmont, on the Tulameen river, also in the amount of tonnage shipped for the year. In 1921 the total tonnage was 63,344 long tons, as against 142,806 tons in 1922.

New buildings were erected for the accommodation of the men at the mine and the cable-line strengthened.

Princeton Coal and Land Co.—The total amount of coal shipped by this company amounted to 19,418 long tons for the year, as against 13,966 tons in 1921.

GRAND FORKS MINING DIVISION.

FRANKLIN CAMP.

Davenport and Don. Since 1921 assessment-work was done on the ore-body discovered at the end of the crosscut on the *Don* claim and the shallow shaft sunk 20 feet farther. The ore, carrying gold, copper, and platinum, occurs in small segregations throughout the pyroxenite formation. Nothing definite can be said regarding the possible size of this ore-body until further development-work has been done. At the present time it is a promising prospect.

Maple Leaf. The Maple Leaf Mines Company employed three men during the greater part of the year on the *Maple Leaf* claim. Work was confined to cleaning out several old open-cuts and two tunnels, also excavating new cuts in an endeavour to trace the mineral-zone. Although there was a marked persistency in mineralization throughout the fractures, the country-rock seemed to be barren.

To the south of the old upper workings, near the cabins, some development was done on a vein of highly siliceous matter containing pyritohedrons of iron. A shaft was sunk about 40 feet and a crosscut driven to the west for about 15 feet into the lead.

Samples taken from the crosscut carried values in gold and silver, but not high enough for shipping purposes. The strike of the lead is in a northerly and southerly direction, with a dip to the west.

Union. The Union Mining and Milling Company has experienced some difficulty in getting the different partnership interests in agreement, so that either stock could be sold or the mine leased and bonded. It is understood that this difficulty may be overcome early in 1923 and something done to promote the further exploitation of the mine. The *Union* is one of the best partially developed low-grade mines in the district, and if carefully managed may make a steady producer.

Before any construction programme is contemplated the ore should be blocked out on three sides, which will give a fair estimate of values to the ton. The topography in the vicinity of the mine is such that development can be carried on cheaply by tunnelling. Results of samples taken and a map of the underground workings are to be found in the Minister of Mines' Report for 1920.

GRANBY RIVER.

Little Bertha. The development of this mine consisted of driving the long crosscut ahead to a point 600 feet from the portal. The tunnel was commenced two years ago and driven about 200 feet below the *Little Bertha* workings in the hope that the vein might be cut to a greater depth. At present no sign of the lead has been discovered,

and it seems probable that it was either formed nearer the surface or has faulted into the hill. In any case, this method of development is to be condemned when so little is known of the condition or depth of the vein at the bottom of the old workings. A few hundred dollars spent in unwatering the old winze and generally exploring the vein would greatly assist in forming a correct plan for future development.

This mine was worked for a short time during the year by the Consolidated
Rock Candy. Mining and Smelting Company, of Trail. The operations at the mine and mill were seriously hindered by forest fires which swept the area. A total of 5,044 tons of fluorspar was shipped to Trail and points in the Eastern States.

This group of claims, situated about 20 miles from Grand Forks, was staked by Lucy Wilson and Margaret Cooper on and near Jones creek, a tributary to Granby river. During the summer a heavy cloudburst passed across Jones creek. The result was that the overburden of gravel and loose rock was in many localities swept away, leaving a clean bed-rock. In the bottom of Jones creek some mineralized fractures were found close to the contact of the granite and remnants of limestone. On the east bank of the stream there is a layer of cemented lime heavily stained with iron and oxides of iron varying in thickness from 2 inches to 2 feet. No doubt this material has its origin higher up the hill, although no evidence of it was found at the time of examination (September 22nd, 1922); the mineralization is not sufficiently large nor the ore a high enough grade to warrant the expenditure of much capital. A few holes blasted in the bed of the creek would probably prove whether the ore was worth further consideration or not. A general sample of ore taken gave a trace in gold and 0.6 oz. in silver to the ton. No doubt picked samples would run higher.

This claim, situated near the Granby river, about 38 miles from Grand Forks,
Copper Cliff. is owned by E. Rice and K. Scheer, of that town. A good deal of development work has been done in the past ten years, consisting of a shaft 10 feet deep, several open-cuts and shallow pits, and a crosscut tunnel 260 feet long. The mineralization on the surface occurs in highly altered volcanic tuffs, quartzites, and limestone pods. These rocks are cut by porphyry dykes and underlain and intruded by granitic and syenite country-rocks. The ore-minerals are chalcopyrite and pyrite carrying values in gold and silver, and are found in the fractures of the rocks. The crosscut tunnel cuts through granite and highly siliceous non-mineralized limestone into the syenite.

CASCADE.

This group of claims, situated on Castle mountain a mile east of Cascade, has
Mastodon Group. not been worked since 1919, when the Stewart-Calvert Company, of Oroville, Washington, shipped several hundred tons of chromite. The location of these claims is near the high-power West Kootenay electric line, on a wagon-road, and three-quarters of a mile from the Canadian Pacific Railway. There is a large area of dunite rocks on this mountain, some of which are entirely changed to serpentine. The chromite appears to lie in lenses and in the fractures of the dunite. Practically all the ore in sight has been shipped and any interests taking hold will have to do some development-work.

PAULSON.

The Molly Gibson (Burnt Basin) Mining Company, with headquarters at
Molly Gibson. Rossland, planned to install some machinery on this property to develop the ore-body. Probably due to inability to procure capital, the scheme did not materialize. At the present time the shaft is sunk about 85 feet, dipping from 20° to 35° and curving to the south-west. All the way down this shaft there are intermittent lenses of ore in the highly siliceous limestone. The ore-minerals are pyrite and pyrrhotite containing gold and a trace of silver. A small vein was opened up in the old upper tunnel.

The Provincial Government cleaned out and repaired the 6-foot trail from Paulson up to the mine, in view of the plans and requests of the company.

The owner of this group is Ed. Terzick, of Rossland. Development-work
Enterprise Group. consisted of sinking the present shaft 15 feet, making a total of about 25 feet from the collar. The ore consists of silver, lead, copper, zinc, and iron sulphides in a gangue of highly altered limestone. The mineralization does not occur generally through the limestone, but in segregations in and near the fractures.

A large part of the limestone is unaltered. The deposit is of the contact-metamorphic variety, due to the intrusion of the granite and greenstone into the sedimentaries. It seems probable that the size of the deposit will be in proportion to the area of sediments remaining.

The old 10-stamp mill, constructed some years ago on the Inland Mining Company's property and adjoining the *Berlin*, was overhauled by Ralph Wolverton and Harvey Griswold, of Cascade, with the intention of reducing some of the *Berlin* ore, already broken and on the dump. When the work on the mill was undertaken the machinery was found to be out of line and the belts in bad condition. These repairs took longer than anticipated and the reduction of the ore rendered impossible owing to the scarcity of water late in the season.

CHRISTINA LAKE SECTION.

These claims were developed and Crown-granted about 1900, and very little work has been done upon them since. An examination of the area was made in September, 1922, and samples taken where any mineralization was in evidence. **Deadwood, Cannon Ball, and Alma.** These samples were taken to represent tonnage and gave too low results for profitable mining. Development consisted of many open-cuts and pits in and near the oxidized iron-capping, also two shafts—one about 50 feet deep, following a stringer of ore carrying some galena and pyrite; the other sunk about 90 feet and approximately 75 feet distant from the first one. A drift was run 70 feet from the deepest shaft, but no ore was discovered. This second shaft was full of water and this information was obtained from a man who had worked in the shaft. The geology in the vicinity consists of remnants of the sedimentary rocks intruded by syenite and gabbro.

Fife Limestone-quarries.—These quarries were worked during the earlier part of the year by the Consolidated Mining and Smelting Company, of Trail. A total of 9,000 tons of lime rock was shipped to the smelter for fluxing purposes.

LIGHTNING PEAK SECTION.

This claim, one of the old *Equinox* group, was leased and bonded by William **West Fork.** Williams, of Edgewood, and a tunnel driven 70 feet on the lead, also a shaft sunk 19 feet in depth and 29 feet from the face of the tunnel. The ore, a silver-lead and zinc sulphides with specks of chalcopryite, occurred in lenses in a 4-foot lead. In the vicinity of the shaft high values in silver and lead were obtained.

Another crosscut was driven about 60 feet below the tunnel. This crosscut encountered some ore near the mouth, evidently broken up and displaced; also a dyke 20 feet thick. About 15 feet beyond the dyke the vein was struck, within it some high-grade ore from 2 to 9 inches thick. The strike of this lead was in a northerly and southerly direction, instead of east and west as is the vein above.

On driving ahead on this lead about 25 feet another dyke was encountered, which appeared to displace the vein entirely. After again crosscutting to the left for 20 feet the lessee decided to drive straight for the winze sunk in the upper tunnel. Altogether, this development-tunnel has been driven 85 feet, with a probable 80 feet farther to run before the bottom of the winze is struck.

Seven and a half tons of the silver-lead ore taken from the lower tunnel is in transit to the Trail smelter and the results will be looked forward to with interest.

A general sample of sorted ore carried 23 oz. in silver, 54 per cent. lead, and 5.5 per cent. zinc to the ton. Samples from the shaft carried 150 oz. in silver, 64 per cent. lead, and 4 per cent. zinc to the ton.

The improvements at the mine consisted of an ore-sorting house and blacksmith-shop combined. Also a stable to accommodate five horses and a trail built $1\frac{1}{2}$ miles to connect the workings with the end of the surveyed wagon-road.

This claim joins the *Lightning Peak* group to the west and is owned by **Killarney.** W. Bunting of Edgewood. Development-work prior to 1922 amounted to two tunnels, 25 feet and 50 feet respectively, driven into the wash and broken ground near the creek. A few tons of silver-lead ore was taken out of this ground, but the vein in-place was not found.

In 1922 some stripping and open-cut work was done higher up the hill and a 3-inch vein of solid galena exposed for 15 feet. This upper vein appeared to be in-place and seems to be the logical point to do future development. Although very little work has been done upon this claim, it has merits which warrant attention. Samples from the lower workings carried 0.02 oz. in gold, 62 oz. in silver, 60 per cent. lead, and 4 per cent. zinc.

GREENWOOD MINING DIVISION.

WALLACE MOUNTAIN.

The greatest activity and interest in mining in the Greenwood Division was centred on Wallace mountain near Beaverdell. The narrow but high-grade silver-lead veins seem to persist in value in depth, which is contrary to the expectations of some of the earlier operators. The location of these claims close to railway transportation makes them attractive to small capital interests.

Bell. This mine, owned by Duncan McIntosh and Pat Crane, of Beaverdell, produced steadily throughout the year. The total of 453 tons, carrying a small percentage of gold, an average of 257 oz. in silver, and about 10 per cent. lead to the ton, was shipped to the Trail smelter. An average of eleven men was employed. Development-work consisted of 947 feet of drifting and crosscutting and 120 feet of upraising. A new two-story bunk-house and office building has been erected, each room to accommodate two men and a general reading-room below. The mine equipment includes one National truck, 1½ tons capacity; one air-compressor, 225 cubic feet; and one Fairbanks-Morse 50-horse-power engine.

All the ore is sorted at the mine and hauled about 4 miles to Beaverdell, on the Kettle Valley Railway. The ore-minerals are argentite, tetrahedrite, polybasite, ruby-silver, free silver, galena, zinc-blende, and pyrite containing gold. The elevation between the upper and lower workings is approximately 300 feet. There appears to be six separate veins, striking north-east.

The property of this syndicate, with headquarters in Penticton, consists of the **Wallace Mountain Mines, Ltd.** *Sally, Rob Roy*, and ten other claims lying to the south. Practically all the work was done on the *Rob Roy*, which adjoins the *Bell* mine. A total of 254 tons of ore was shipped, averaging about 311 oz. of silver and about 8 per cent. lead to the ton. Development-work consisted of 832 feet of drifting, 264 feet of crosscutting, 227 feet of upraising, and 61 feet of sinking. Improvements consisted of a small air-compressor and engine, also a good domestic water system and a dry-house with shower-baths for the men.

Some good ore was developed and the company expect an increased output for 1923. Practically all the work was done by hand in 1922. Ed. Nordman is superintendent of the work at the mine. The ore-minerals are the same as those in the *Bell* mine.

Highland Lass. This claim adjoins the *Bell* on the north, and the owners, I. Hallet *et al.*, of Greenwood, have driven about 100 feet of tunnel on the lead. Some good silver-lead sulphides and carbonates were taken from the vein near the mouth of the drift. At a point 50 feet from the portal the vein faulted and broke, but was again picked up about 10 feet from the break. The ore was considerably lower grade beyond the break, being made up chiefly of pyrite in a siliceous gangue.

Across a ravine another tunnel was run to the south-west about 110 feet in length and a few tons of galena stoped out. The lead faulted at the end of this drift and was not looked for beyond. It seems likely that this is an extension of the lead found on the *Revenge* claim, which will be dealt with later.

About 15 tons of silver-lead ore was shipped from the two tunnels, carrying small values in gold, an average of 338 oz. in silver, and 8 per cent. lead.

Revenge. This mine was leased and bonded to Westbridge interests—E. Granberg, John Burman, and L. Clary—by Geo. Barrett, of Beaverdell. Development-work consisted of producing the upper tunnel, commenced by Barrett, on the lead for 100 feet. The vein, averaging about 6 inches in width, persisted in this drift, with only an occasional fault from 1 to 2 feet. No ore was shipped by the lessees, but Geo. Barrett sent 11.27 tons of ore to the Trail smelter, carrying gold, an average of 200 oz. in silver, and 7 per cent. lead to the ton.

This claim is situated to the north-east of the *Bell* mine and considerably lower in elevation. Prospect-holes on the surface seem to correlate this lead with the ore discovered on the *Highland Lass*.

A sample of the ore taken from the upper tunnel, and before being sorted, assayed a trace in gold, 154 oz. in silver, 14 per cent. lead, and 5 per cent. zinc to the ton. Practically all the ores in this mountain are associated with zinc. Tetrahedrite or grey-copper was generally absent, also pyrrargyrite (ruby-silver).

Standard Fraction. The owner of this claim, W. Rambo, continued the work done by the Nordman Bros. two years ago in the upper and lower tunnels. Most of the ore lay in the fault-planes and was excavated with difficulty. A total of 11.25 tons was shipped to Trail, carrying a trace in gold and high values in silver and lead.

Bounty Fraction. A lease and bond was taken on this fraction by John McKellar and I. Hallet, of Greenwood. Previous work on this claim, done twenty years ago, comprised a crosscut tunnel 200 feet long and two drifts on the lead from this crosscut 50 feet and 60 feet respectively. Two car-loads of silver-lead ore were shipped from this tunnel at that time. The lessees drove 40 feet into a break in a southerly direction and 8 feet in the opposite direction, but failed to pick up the ore. The surface indications are good, but at the present time are low in values.

Nepanee. Another effort to locate the ore in-place was made by the owner, E. G. Cummings, of Beaverdell. Last year slabs of high-grade silver-lead were discovered in the gravel-wash, but no trace of the lead in-place could be found. This year, when driving the drift ahead, the ore was discovered lying on a fault-plane which seems to dip to the east. It also seems probable that the slabs of ore found in the wash are lying on the same fault-plane. With this information to work on, better results may be looked forward to next year. A sample of the ore taken by the owner assayed 0.61 oz. in gold and 239 oz. in silver to the ton, and 23 per cent. lead. The gold values are one of the chief attractions of the ore taken from this claim.

Nodaway. Late in the season a lease was taken on this claim by Joe Cunningham, Mike Belfountain, Ludlow, Neil McLeod, and Ed. Lutner. Development consisted of 120 feet of drifting, 22 feet of crosscutting, and an 8-foot winze. About 8 tons of ore has been taken out, but not shipped. A hand sample of this ore assayed 347 oz. silver and 25 per cent. lead to the ton, and 11 per cent. zinc. This is the first real development-work done on this slope of Wallace mountain.

Wellington.—Jack Morrison *et al.*, of Greenwood, leased this claim. There are no data to hand regarding the work done, and to date no ore has been shipped.

CARMI.

Carmi Gold Mines. A reorganization of this company took place this year, and W. A. Marvin, who is in charge of the mine, reports that the old shaft has been unwatered and three men are employed retimbering the old workings and generally preparing to develop some ore for a mill test. This is good news, and it is to be hoped that sufficient ore will be developed before much more money is spent on the surface plant.

GREENWOOD SECTION.

The citizens of Greenwood spent a good deal of time and money in an endeavour to find a sufficient quantity of ore in some of the old developed mines near the town to permit the building of a reduction plant. Old shafts were unwatered and made safe for examination and practically all the mineral-deposits with any merit were sampled.

Barbara. The high-power electric line was extended half a mile to the collar of the shaft and the water pumped out. The shaft was sunk on the lead for 40 feet at an angle of 47°, when a fault was encountered. The drag of this fault was followed to the east for 49 feet on an incline of about 2°, when the vein was again struck, dipping about 44° to the east. Small faults were encountered on sinking 142 feet farther, with some enrichment at the point of faulting.

At the bottom of the shaft a drift was run on the vein north for 52 feet. For 11 feet from the shaft the vein was about 20 inches wide and well mineralized. Beyond this point for 35 feet it varied in size from 6 to 24 inches, but was generally barren of mineral. The last 6 feet

of the vein in the tunnel was about 8 inches wide and well mineralized. A crosscut was driven from the first point of faulting in a north-easterly direction and some ore said to have been shipped. This crosscut was filled with waste.

Sixteen samples were taken of the vein at intervals where the mineralization appeared to be the heaviest, with the idea in mind that closer sampling could be undertaken should the values warrant it. The results are as follows: Composite sample from samples Nos. 4, 5, 6, 7, and 8, 0.02 oz. in gold, 1.6 oz. silver, 0.23 per cent. copper, 3 per cent. lead, and 1.6 per cent. zinc to the ton; and composite sample from samples A, B, C, D, E, F, G, and H, 0.015 oz. in gold, 1.1 oz. silver, 0.41 per cent. copper, 1.85 per cent. lead, and 0.5 per cent. zinc to the ton. These are composite samples of those taken throughout the shaft.

The ore-minerals are galena, chalcopyrite, zinc-blende, and pyrite carrying gold and silver occurring in a gangue of quartz. The country-rock is granite. The strike of the vein is north and south, dipping to the east, and varies in size from 1 inch to 2 feet. The mineralization was very "spotty" in a white quartz gangue.

The results of the samples taken show without doubt that the best ore is too low grade at the present time to mine and mill profitably in spite of the close proximity of power and transportation. The location of this claim is to the south-east of Greenwood and adjoining the city limits.

A lease was taken on this claim by James Drum, of Greenwood, and the old tunnel extended to a point 110 feet from the portal. The strike of the vein, varying in size from 1 to 18 inches, is north and south, with a dip of about 45° to the east. There is little doubt but that vein is a continuation of the *Barbara* lead.

The ore-minerals are galena, chalcopyrite, and pyrite carrying silver and a trace of gold. The country-rocks are granites overlain by argillites. The vein cuts through both formations. The ore occurs as segregations in the quartz gangue in a very similar manner to that of the *Barbara* mine. Some 2 tons of ore was shipped to the smelter, the metallic content of which was 29.84 oz. in silver and 1,163 lb. of lead.

This claim is located about three-quarters of a mile to the south-east of Greenwood and above the *Barbara* mine. About eighteen years ago the Porter Bros. drove an 800-foot crosscut tunnel, sank several shafts varying from 10 to 100 feet, and put in numerous open-cuts on small badly broken quartz gash-veins and "blow-outs." The tunnel winds about under some of the veins, but failed to find the extension at depth. The best ore, a silver-lead containing some gold, occurred within 10 feet of the surface; beneath that the quartz, though stained with iron oxides, contained only small values as far as development went. Walter McDonnel *et al.*, of Greenwood, leased this property for a few months during the summer. Some of the old workings were cleaned out and new open-cut excavated.

The veins, wherever exposed, were small and generally broken. Values varied very much within a few inches, which caused a good deal of discussion after shipping a small lot to the smelter. In an open-cut the oxidized quartz carried 3.02 oz. in gold to the ton. Unfortunately this character of ore was scarce; 1,328 lb. was shipped, containing a trace of gold and small values in silver.

The upper inclined shaft and tunnels driven from this shaft were sampled. Assay returns gave as high as 1.50 oz. in gold. The vein is generally narrow, with the exception of 10 feet in the north drift, where it widens to 16 inches. The estimate of possible tonnage was too small to warrant the expenditure, at the present time, of developing the property.

This mine is situated about 1½ miles east of Greenwood, adjoining the Skylark camp. One of the old shafts, 100 feet deep, and a drift driven west from the bottom of the shaft 20 feet were unwatered and the vein sampled. It was evident that there had been a good deal of movement since the vein was formed, causing faulting and crushing. Nowhere in the shaft or drift was the lead undisturbed.

A sample taken of the vein in the tunnel and shaft gave only a trace in gold and silver. Other samples taken from the highly siliceous foot-wall rock contained good values in gold. It seems likely that the later igneous intrusion which disturbed the original vein was responsible for these values. The only mineralization evident is iron pyrites. More development-work is

needed to ascertain whether there is a sufficient tonnage of this gold-bearing rock. The strike of the vein is in a south-easterly, north-westerly direction.

This claim is attractively situated for cheap mining, transportation, and power, and should receive consideration. Dan McGillis, of Greenwood, is at present interested.

This claim is owned by M. Christianson, of Boundary Falls. A lease was taken on the property by H. Stramberg, of New Denver, and a tunnel driven 40 feet on the lead. The ore-minerals are galena, chalcopyrite, zinc-blende, and iron pyrites carrying silver and a trace in gold in a gangue of quartz. The vein varies in width from 1 to 10 inches and is persistent, though slightly faulted. The country-rocks are argillites. Although the values are small, the improvement in the amount of mineralization in depth seems to warrant further exploration.

Vendela. The first work done on this claim by the owners, Dick Pascoe and Bombini, of Anaconda, consisted of an open-cut 25 feet long, which uncovered a small mineralized segregation of chalcopyrite, pyrite, and copper carbonates in a gangue of silica and epidote. There were numerous inclusions of black tourmaline, in which some of the copper sulphides were embedded. The country-rock appears to be a greenstone in contact with a serpentinized dolomite. The crosscut tunnel was driven about 15 feet beneath the open-cut this year, but no ore was found. It seems likely that the ore found in the open-cut has slipped from a higher elevation and further prospecting above may uncover a larger body. The extreme hardness of the greenstone makes prospecting difficult and expensive.

About 1,500 feet south of this exposure a large boulder containing the same minerals was found. The extreme angularity of this rock shows that it has not travelled any great distance and exploration above this point might prove profitable.

This group consists of the *Republic*, *Last Chance*, *Non Such*, and *Hidden Republic Group*. *Treasure* claims and is situated about a mile to the north-west of Boundary Falls. Oli Lofstad, of Greenwood, purchased this group from the British Columbia Government at a tax sale. The former company drove two tunnels, one approximately 75 feet higher than the other; the upper one extending 398 feet on the vein and the lower one 226 feet, chiefly on the vein, with a crosscut from this tunnel a distance of 67 feet. An upraise was put in between the upper tunnel and surface 65 feet in height. In the upper tunnel the vein is persistent, but varied from 14 inches to 6 feet in width, and contained iron sulphides carrying gold and silver. The gangue is quartz with oxides of iron in the fractures.

Eight samples were taken in the upper tunnel, where the mineralization was the heaviest, with the following average result: 0.07 oz. in gold and 0.83 oz. in silver to the ton. In the lower tunnel only three samples were taken, averaging in result: 0.04 oz. in gold and 0.40 oz. in silver to the ton. Near the mouth of the upper tunnel a small tonnage of heavily oxidized quartz carried 0.51 oz. in gold and 1.70 oz. in silver to the ton. This sample was not calculated in the above averages because the tonnage was not deemed sufficiently large.

Numerous open-cuts and shallow shafts have been excavated on the same lead higher up the hill on the *Non Such* claim, with about the same results. On the *Last Chance* claim, which adjoins the *Non Such* on the north-west, an inclined shaft was sunk, as far as could be ascertained, about 75 feet on the extension of the *Non Such* vein. The water was hoisted out of the shaft for about 50 feet and the vein in the drifts sampled.

About 25 feet below the collar of the shaft the lead was split in three veins interbedded in the slate. The vein on the hanging-wall is 8 inches wide, the one in the centre 1 foot 6 inches, and on the foot-wall 2 feet 2 inches wide. The ore-minerals are galena, chalcopyrite, and iron pyrites in a gangue of quartz.

The vein on the hanging-wall contains 0.18 oz. in gold, 12.8 oz. in silver, 0.59 per cent. copper, and 1.7 per cent. lead. The other two veins average 0.03 oz. in gold, 1.10 oz. in silver, 0.27 per cent. copper, and 0.9 per cent. lead.

Another drift had been run about 20 feet below the upper one to the west and the two drifts connected by a raise. At the end of the lower tunnel the vein had faulted to the south and had not been found again. The vein in this tunnel measures 30 inches across in the widest part and is well mineralized in galena, chalcopyrite, and pyrite containing gold and silver. Two samples were taken across this vein in the most heavily mineralized part. The results are as follows: A trace in gold, 8.50 oz. in silver, 0.80 per cent. copper, 11.5 per cent. lead, and 4 per cent.

zinc, and the other sample carried a trace in gold, 5 oz. in silver, 1 per cent. copper, and 15.5 per cent. lead. All these samples were cut with a moil.

The size and persistence of this vein, traceable through the *Non Such* and part of the *Last Chance*, warranted the work done by the former company. The results obtained from the sampling of such heavy mineralization were disappointing. The country rocks in the vicinity are greenstones and a highly serpentinized dolomite, overlain by slates and other metamorphosed sedimentary rocks. To the west about half a mile lies the granite batholith, which is probably responsible for the mineralized fissures in these sedimentaries.

The *Non Such* and *Republic* claims were staked under the old mining law and are 600 feet wide by 1,500 feet long. The *Last Chance* is a large fraction, staked 1,500 by 1,500 feet.

Combination.—The Eholt Mining Company, with Mr. Bartholomew, of Spokane, in charge, commenced operations on this claim. A tunnel has been driven 9 feet, and with the assistance of a newly installed 3-drill air-compressor and engine favourable progress is expected in 1923.

DEADWOOD CAMP.

The development of this property continued during the early part of the year **Tam O'Shanter.** and 208 feet of tunnels was driven, including crosscuts, also a 25-foot upraise on the lead. The vein was discovered a short distance to the south of the point where the lower crosscut tunnel turned to the west. After the crosscut tunnel was driven in 1921 and connected with the upper shaft, the owners discovered a fault dipping to the south, just below the bottom of the shaft. Had this knowledge been available before, a great deal of dead-work could have been avoided. The presence of the vein lying to the north near the mouth of the tunnel, plus the indications of the vein in the old lower shaft, led them to believe that the ore had faulted to the north. The new work consisted of a short crosscut tunnel which tapped the lead, and a drift on the vein to the east and west and an upraise from the east drift.

The lead in this drift consisted mainly of soft gangue and crushed country-rock, containing lenses of ore. It seems probable that, after faulting, the vein was subjected to a considerable amount of grinding between the walls, causing a disintegration of the vein and part of the country-rock. The breaking-down of the ore probably extends in elevation to a point of faulting, and it seems advisable to sink rather than raise on the vein.

The lenses and pebbles of ore found in the lead consisted of galena, chalcopyrite, and iron pyrites carrying gold and silver in a gangue of quartz. The ore from the stope assayed 0.18 oz. in gold, 72.8 oz. in silver, and 4.3 per cent. copper. The mixed sample across the lead in the stope assayed 0.04 oz. in gold, 8 oz. in silver, and 1.5 per cent. copper. The sorted ore from different parts of the mine assayed 0.20 oz. in gold, 104 oz. in silver, and 3.3 per cent. copper, with a negligible quantity of lead and zinc. A small shipment of about 3 tons was shipped to the Trail smelter, averaging 0.40 oz. in gold, 66 oz. in silver, and a small quantity of lead.

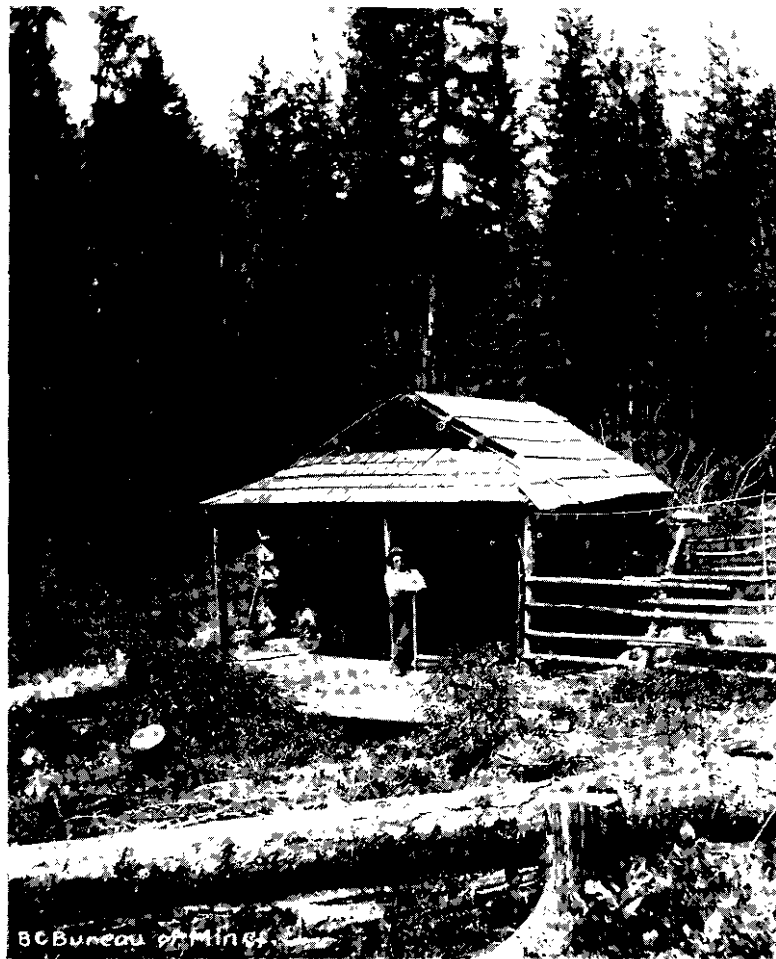
This property is still quite attractive, being well located for transportation, etc.

LONG LAKE CAMP.

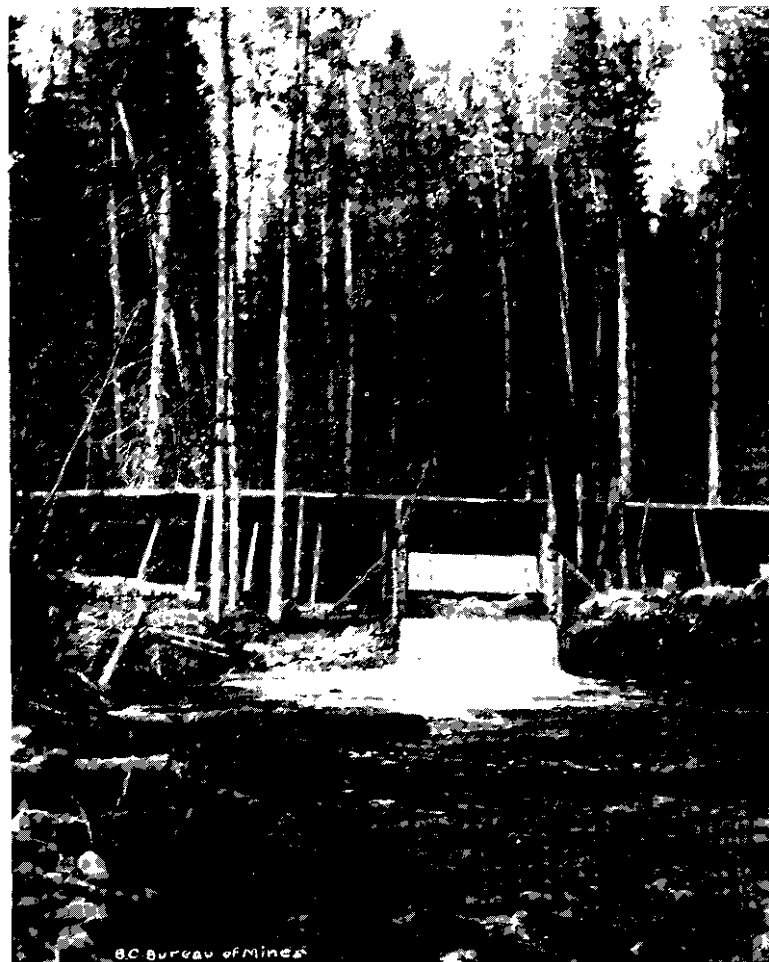
J. Duhamel, of Greenwood, was unable to proceed with his development plans owing to ill-health. A thorough examination was made of this property and **Ethiopia, Enter-prise, and Anchor.** samples taken of the lower open-cuts. These samples averaged 0.34 oz. in gold and 70 oz. in silver to the ton. The vein is without doubt a continuation of the lead on the *Jewel*, *Enterprise*, and *Anchor* claims and can be easily traced over the surface trenches and open-cuts. The *Jewel* mine was operated successfully for many years and the ore treated with cyanide.

The *Enterprise* and *Anchor* claims have been exploited by shafts, trenches, and open-cuts and only a few tons of ore shipped. The vein on these two claims varies from 6 inches to 4 feet and, though low grade in places, carries segregations of high-grade ore that might, when mixed with the low grade, make an average high enough to treat profitably.

On the *Ethiopia* there appears to be a split in the vein beyond an intrusion of pulaskite porphyry which cuts diagonally across the claim. The mineralized portion of the vein in both leads varies from 2 inches to 1 foot and contains galena, chalcopyrite, iron pyrites, carrying values in gold and silver. The gangue is quartz. Copper sulphides are very much in the minority and need not be reckoned with.



Rock Creek—Prospector's Cabin on.



Rock Creek Placer Mine, Greenwood M.D.

Development-work on the *Ethiopia* consists of a crosscut tunnel 242 feet long, a drift on the vein for 30 feet, and a drift on a fault 33 feet and 21 feet. The vein in the first drift strikes about N. 20° W. (mag.) and dips 42° to the north-east, and is considerably disturbed and crushed. The second lead has not been reached by the crosscut tunnel. On the surface there are numerous open-cuts and shafts exposing the ore, 150 feet beyond the tunnel, for 50 feet in length.

Although the vein is small on the *Ethiopia*, yet its position at the lowest extension of the lead which traverses the area makes it attractive from a development standpoint. If the group could be acquired it would probably pay to develop from this end, where tunnels could be driven.

On the *Enterprise* and *Anchor* claims any ore found would have to be hoisted unless a long crosscut tunnel was driven from the lake. Eleven tons of ore was shipped from the *Ethiopia*, containing 3.389 oz. in gold, 690.56 oz. in silver, and 21 lb. lead.

**Oliver and
Bowser.**

Dan McGillis and Al. Morrison, of Greenwood, discovered a small vein containing galena and iron pyrites beside the road which runs between Greenwood and the *Jewel* mine, at a point about 1½ miles from its junction with the Boundary Creek wagon-road. A tunnel was driven about 20 feet on the vein, but ore pinched out and nothing further was done. The vein averaged only 2 inches near the surface, and a sample of this assayed 0.42 oz. in gold, 40 oz. in silver, and 26 per cent. lead.

CENTRAL CAMP.

Clement Vacher and other interests from Kelowna have taken over the above group of claims, situated about 5 miles in a south-easterly direction from Greenwood. The location of these claims places them practically on the divide between the Grand Forks and Greenwood Mining Divisions. The easiest transportation route lies from Greenwood via Boundary Falls up through the No. 7 mining property. A continuation of this road passes through Danville, in Washington, and through to Grand Forks, B.C. About twenty years ago this camp was extremely active and a great deal of development was done on the *Lexington* and *City of Paris* mines. The latter adjoins the *City of Denver* on the east and has shipped 2,000 tons of ore. The companies at that time could only handle ore of a high enough grade to ship, and were not particularly interested in concentration. The idea of the present interests is to further develop the lower-grade ores in this camp and, if the tonnage and values warrant it, to build a small reduction plant.

The country-rocks are of interest, being argillites, quartzites, and limestone intruded by large masses of serpentine, which is in turn invaded by diorite, andesite, and stocks of granodiorite and occasional porphyry dykes. The ores consist of galena, zinc-blende, chalcopyrite, and pyrite and in the *City of Paris* tetrahedrite was found.

Nearly all the higher-grade ore-bodies have been discovered in shoots in the serpentine. What seems to be of special interest is the possibility of finding platinum in some of these ores, especially those in which the copper sulphides occur. To the south of this group in Washington, where the formations are very similar, the presence of platinum has been detected up to 0.50 oz. to the ton of copper sulphides. The present owners would do well to remember this and have the ore tested occasionally for this metal.

The mineralized zone on the *Lexington* strikes in a north-easterly direction, dipping according to the shearing and fracturing of the serpentine rocks.

ROCK CREEK PLACERS.

Several attempts were made to test the gravels on bed-rock in this creek, especially on the higher reaches. J. Bennett and two partners built a dam across the creek about 2 miles up from the lower wagon-road crossing and endeavoured to reach bed-rock. At the time of examination this had not been achieved, on account of the illness of Mr. Bennett. Another attempt will be made next year.

JOLLY JACK CREEK.

This creek is a tributary to Rock creek and flows into it about 3 miles above the road crossing. In 1860 the gravels on this creek were worked extensively and a considerable amount of gold taken out. Since that time leases have been taken at various intervals, most of which produced some gold. James Grant operated a lease this year, sinking a shaft 20 feet to bed-rock.

About the time he had constructed a water-wheel and sunk this distance, the flow of water in the creek was insufficient to keep his pumps working and the lease was abandoned.

The values found in the Jolly Jack creek appear to be the result of a reconcentration of gold deposited in an old channel running diagonally across the creek. Above this point practically no values were found, whilst directly below the pay-gravel was good.

FISH LAKE.

Fish lake is situated about 6 miles in a westerly direction from West-bridge, on the main Kettle river, at an elevation of approximately 3,700 feet (barometric) above sea-level. The lake can be reached by trail from a point about 4 miles above Westbridge or by wagon-road from Rock Creek crossing. About 3½ miles from the north end of the lake (3 miles long) the *Bonanza* claim is situated at an elevation of 4,000 feet above sea-level. Tim Sullivan, of Rock Creek, owns this claim and has carried on exploration-work for many years. The country-rocks are diorite, alkali syenite, and remnants of limestone.

A good deal of mineralization occurs on or near the contact of the alkali syenite and the limestone, and in this zone much development-work has been done. The shaft, said to be 10 feet deep, but filled with water at the time of examination, was sunk at the end of a 50-foot tunnel driven to the contact of the limestone and syenite. At the collar of the shaft small pockets and lenses of chalcopyrite, pyrite, and copper carbonates were in evidence, also a heavy mineralization in the fractures.

A crosscut tunnel was driven 238 feet in length and about 175 feet vertically lower down the hill. No ore had been discovered in this tunnel at the time of examination (May 30th). Probably another 50 feet of tunnel will have to be driven before the end of the crosscut lies under the mineral-zone found above.

A great deal of exploratory work had been done in an area of 1 mile square adjoining this claim, consisting of shallow shafts, trenches, and open-cuts, but these failed to develop much mineral. The rock formations are generally considered good in this region for the deposition of copper ores, and it is to be hoped that the present owner will meet with success.

MAIN KETTLE RIVER.

On September 13th a trip was made to Christian valley, a distance of 35 miles from West-bridge, on the Kettle Valley Railway. There is a good though narrow wagon-road up this river for 38 miles, which can be traversed by automobile.

Copper creek, flowing from the west, joins the Kettle river about a mile beyond the end of the wagon-road. Four miles up the creek several claims were staked about ten years ago and a series of development-pits and a tunnel driven under the outcropping. Advice from some of the former owners stated that these pits and tunnel did not develop any ore and a trip was made by the writer to examine the prospects.

Unfortunately, no one who was familiar with the location of this group could be found to act as guide, and owing to the numerous trails and thick underbrush the workings were not examined. The outcropping, according to reliable authority, consisted of oxidized iron and copper carbonates, changing into pyrite, chalcopyrite, and bornite beneath.

On the west side of the Kettle river, about a mile beyond the mouth of Copper creek, there are three separate springs flowing within an area of 200 square feet. The water from the springs is always cold and evidently charged with some form of gas, causing the water to bubble. In the winter season the springs never freeze. The only rocks in the immediate vicinity are alkali syenite porphyry. This dyke extends for several miles up and down the west side of the Kettle river and measures from a half to three-quarters of a mile in thickness where it is exposed in the Copper Creek canyon. An analysis of this water has never been made, but it tastes strongly of soda.

LIGHTNING PEAK.

Waterloo and Potosi.—Only assessment-work was done on these two claims during the year. On the *Waterloo* further exploration of the lower tunnel developed more lower-grade ore than was found near the surface. No further ore developments were made on the *Potosi*.

BOUNDARY DISTRICT.

GREENWOOD MINING DIVISION.

REPORT BY P. H. MCCURRACH, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Greenwood Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—GREENWOOD MINING DIVISION.

Free miners' certificates	132
Locations (quartz)	47
Locations (placer)	3
Rerecords (placer)	7
Placer leases	2
Certificates of work	129
Leases of reverted claims 2	12
Bills of sale 3	10
Fillings 7	18
Miscellaneous 7	16

GRAND FORKS MINING DIVISION.

REPORT BY CHARLES MUDGE, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Grand Forks Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—GRAND FORKS MINING DIVISION.

Free miners' certificates	92
Locations	29
Certificates of work	52
Bills of sale 3	12
Fillings	5
Leases of reverted claims 2	4

OSOYOOS MINING DIVISION.

REPORT BY W. R. DEWDNEY, GOLD COMMISSIONER, FAIRVIEW.

I have the honour to submit the office statistics of the Osoyoos Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—OSOYOOS MINING DIVISION.

Locations (quartz)	60
Certificates of work	107
Conveyances	11
Free miners' certificates issued	183
Fillings 7	21
Certificates of improvement	3
Forfeited claims leased	~~2~~

SIMILKAMEEN MINING DIVISION.**REPORT BY HUGH HUNTER, GOLD COMMISSIONER.**

I have the honour to submit the office statistics of the Similkameen Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—SIMILKAMEEN MINING DIVISION.

Free miners' certificates	184
Location records	65
Certificates of work	63
Bills of sale	14
Certificates of improvements	1
Record of placer claims	12
Certificates of work (placer claims)	6
Powers of attorney	17
Bills of sale (placer)	8
Leases of placer claims	16

EASTERN DISTRICT (No. 5).

REPORT BY A. G. LANGLEY, RESIDENT MINING ENGINEER.

(Reports marked * are by B. T. O'Grady, Assistant.)

District No. 5, or the Eastern Mineral Survey District, covers East Kootenay, comprised of the Golden, Windermere, and Fort Steele Mining Divisions, and West Kootenay, which includes the Ainsworth, Slocan, Slocan City, Nelson, Arrow Lake, Trail Creek, Lardeau, Trout Lake, and Revelstoke Mining Divisions. The headquarters office of the district is in the city of Revelstoke.

INTRODUCTORY REMARKS.

The better prices prevailing throughout the year, the improved smelter rates which were introduced last year, and the acceptance of zinc ores and concentrates by the Trail smelter have all had a very beneficial effect on the silver-lead-zinc mining activity in the district. Among the outstanding features of the year have been the commencement of erection of a 1,500-ton concentrator by the Consolidated Mining and Smelting Company at Kimberley for the *Sullivan* ores and the completion and successful operation of the *Silversmith* concentrator at Sandon.

Lastly, but not of least importance, was the announcement by the Consolidated Mining and Smelting Company in June that the custom plant for zinc ores was completed and that they were prepared to accept zinc ore and concentrates, paying for the zinc and silver values.

In West Kootenay, Sandon has been the centre around which much new mining and development has taken place, resulting in increased production. It is gratifying to note, and at the same time a significant fact, that the old *Slocan Star*, under the management of the Silversmith Mines, Limited, has after a period of comparative inactivity again been established as the leading producer in the Slocan. The output of the mining companies has been supplemented by that of leasers, who have been unusually active. That ore can be mined profitably by leasers with small capital who rely on their shipments to pay good wages after deducting all expenses, including a royalty of 15 or 20 per cent., is a noteworthy fact which speaks well for either the richness of the ores or favourable mining conditions.

Mining activities in the northerly part of the district, including Revelstoke, Trout Lake, and the Lardeau Divisions, have been rather quiet, but indications point to a betterment of conditions next year.

There has been a marked increase in minor operations in the Windermere Mining Division and it is fully expected that some new names will be added to the shipping-list.

An International Mining Convention was held in Nelson at the beginning of July, at which some interesting and instructive papers were read on the treatment of the Slocan and Rossland ores by the oil-flotation process, also one on the lead-smelting practice at Trail. The meetings were well attended and the hospitality of the people of Nelson added greatly to the enjoyment of the occasion. Among the distinguished guests present were His Honour the Lieutenant-Governor; the Honourable William Sloan, Minister of Mines; and S. G. Blaylock, general manager of the Consolidated Mining and Smelting Company.

The number of mines on the shipping-list of the district totals sixty-six, which is significant of the widespread activity of mining.

Work was carried on by the Geological Survey in the Revelstoke and Lardeau Mining Divisions under M. F. Bancroft and in the Windermere and Fort Steele Divisions under Mr. Walker in the field.

Lectures to prospectors were given to well-attended meetings at different points in the district.

In concluding, the writer wishes to acknowledge the courtesy and co-operation of the mine-owners and prospectors, and at the same time to predict increased activity during the coming year, providing nothing unforeseen happens.

EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

The usual amount of prospecting has been carried on during the year, but there have not been enough men in the hills of this vast area to enable much headway being made, either in the direction of new discoveries or of the development of the known mineral-deposits. The *Monarch*, at Field, which shipped 239 tons, is the only property on the shipping-list.

Perhaps the most important work of an exploratory nature is that being done at the *Alpha* group, under the supervision of H. G. Nichols, and of which the following is a brief description:—

Situated at the headwaters of the Middle fork of the Spillimacheen river at **Alpha Group.** an approximate elevation of 7,500 feet and at a distance of 30 miles by trail from the Columbia river. The claims are located on and cover the summit of the divide between the Duncan river and the Spillimacheen. The Alpha Mines Syndicate, Limited, in which, it is understood, English capital is invested, is responsible for financing the project.

The formation, which is clearly defined in the bluffs and ridges of the summit, has been folded to form a large anticline. The rocks mostly in evidence are schists and impure quartzites. The schists are of a greenish-grey colour and are mineralized in varying degrees with iron pyrites, which imparts a rusty colour upon oxidation. In places cubes of iron pyrites and their casts are a distinct feature of the formation.

Cutting this formation there is a series of strong, well-defined quartz veins running north and south, which are intersected by another series running about N. 60° W. Enrichment has taken place at the intersection of these two vein systems and only at and near these points are the values said to be sufficiently high to constitute ore.

These veins which are freely exposed in the bluffs above the camp, have been laid bare on the glaciated bench above and can easily be traced for a considerable distance across the summit towards the Duncan river. Time did not allow an examination of the showings on the Duncan River slope, but Mr. Nichols stated that the largest and most important showings occurred on this side. These spectacular showings attracted the prospector in early days, for a considerable amount of prospecting had been done by means of shallow shafts and short tunnels. Until recently the property has remained idle for many years.

The character of the ore varies somewhat at different places on the property, which is hardly to be wondered at, for the claims cover a large area of rugged mountain country over which prospecting-work is widely scattered. The principal values are in gold. Some of the ore more closely resembles a silver-lead than a gold ore on account of the presence of a high percentage of galena.

The geological conditions appealed to Mr. Nichols, who has made a careful study of the area, as presenting possibilities for the development of important ore-bodies and as being worthy of certain exploratory work.

With this object in view a long tunnel, driven some years ago, is being continued to crosscut at depth a sheared zone in which the strong surface showings are exposed on the Duncan slope. The portal of this tunnel is situated on the easterly side of the summit. On the Duncan River side natural conditions do not lend themselves to mining operations, while the most feasible outlet of the property seems to be down the valley of the Spillimacheen.

Should ore be developed in quantity, it will do a lot towards helping to revive mining and prospecting in this part of the country. Work was started in the fall and is being continued through the winter by a crew of seven or eight men.

WINDERMERE MINING DIVISION.

In the Windermere Division there has been a marked increase in the mining activities as compared to last year. On No. 3 creek several new companies have been actively engaged at mining and development work, while the country surrounding the head of McDonald and Boulder creeks has received more attention from the prospector and small operator. During the season work of the Geological Survey, started by Dr. S. J. Schofield, was continued under the direction of Mr. Walker.

Paradise. This mine, which for many years has proved itself to be the steadiest producer and the most important property in the Division, was visited by the writer in June, when a trip through the mine-workings was made with R. McDonald, the mine manager. A considerable tonnage of ore was exposed on the No. 3 level and between this and the No. 2 level. The ore consists of soft sand carbonates and has a ratio of about 1 oz. in silver to the unit of lead, which is remarkably persistent. Several samples taken indicated that the mine-run would average about 42.5 oz. in silver and about 44 per cent. lead. The output has been derived from the Nos. 2, 3, and 4 levels. Sulphide ore is being mined for the first time below the No. 4 level.

The mine was operated continuously during the season with a small crew of men, and nearly 700 tons of ore was hauled to the railway, nearly 50 per cent. of which was by a 5-ton White truck. The distance by the new Toby Creek road is about 18 miles. Average cost of motor-truck haulage, including depreciation, was 55 cents a ton-mile.

This property, comprising two claims—*Steele No. 1* and *Steele No. 2*—**Steele Group.** located on the rugged summit between two small tributaries of No. 3 creek, was acquired by the Alice Arm Holdings Company, of Vancouver. Access is gained by wagon-road from Brisco, on the Kootenay Central Railway. This road gradually climbs up the valley of No. Three creek until at a distance of about 18 miles an elevation of 6,000 feet is attained. From this point a good rawhide trail leads up to the mine camp, which is situated at an elevation of 8,150 feet.

During the latter part of the summer a small crew of men was put to work under the mine manager, A. J. Hughes, and no time was lost in building a good cook-house and bunk-house, the first preparations which were necessary for operating the property. The present accommodation is for about eight men.

This camp is situated on the bench some 500 feet below the workings, which is a distinct drawback for winter work, and to overcome this it is understood that a small cabin has been erected on an excavated space in the steep side-hill near the tunnel, so that the men will not have to travel between the mine and the camp when the weather conditions are bad.

The ore is brought down to the bench below by a light aerial tram about 1,200 feet long, from the lower terminal of which it will be hauled over the rawhide trail for a distance of about 2 miles to the wagon-road.

In the vicinity of the workings the rugged ridge of bluffs has been deeply scarred by the action of erosion, leaving a big pile of talus extending from the tunnel-site to the bench below. The strata exhibit uniformity in dip and strike. The formation consists of calcareous schists, quartzites, and argillites, having a north-westerly strike and dipping to the south-west.

The vein, striking about N. 60° W. and dipping into the hill at an angle of 70°, occupies a fault-fissure apparently conforming in strike and dip to that of the formation. It can be easily traced for a considerable distance towards the summit of the ridge and is thought to be the continuation of the *Lead Queen* vein, which is located on the other side of the summit and upon which considerable work has been done. Unfortunately snow prevented an examination of the surface showings on and around the other side of the summit.

Some years ago a little surface-prospecting work was done and a crosscut 47 feet in length was driven which tapped the vein at a point about 30 feet vertically below the outcrop, but no drifting was done. The present company has uncovered the vein for a distance of about 65 feet along the strike by a deep open-cut, showing an average width of about 2 feet of ore, consisting of steel-grained galena associated with disseminated iron pyrites in a highly siliceous gangue. A sample taken across 2 feet gave the following returns: Gold, 0.01 oz.; silver, 18.1 oz.; lead, 23.3 per cent.; zinc, 2.4 per cent.

Below this surface exposure drifting is being continued from the old crosscut tunnel already referred to and a raise was driven to the southerly end of the open-cut. At the time of examination the drift was only 13 feet long. While the southerly continuation of this drift will gain good backs, the northerly will gain very little depth, but will be useful for prospecting the vein under the heavy slide material which covers the surface at this point. A sample taken across 2 feet at the southerly face of the drift ran: Gold, 0.01 oz.; silver, 29.8 oz.; lead, 71.8 per cent.; zinc, 0.9 per cent.; and one across 3 feet at the northerly face ran: Gold, 0.01 oz.; silver, 17 oz.; lead, 26.5 per cent.; zinc, 7.6 per cent.

It is evident that there has been extensive movement along the line of fissuring, for the country-rock on the foot-wall side has a schistose structure and might be classified as a silicified lime-schist; lying between this and the ore there is a streak of black gouge. The true hanging-wall was not clearly exposed in the drift, but apparently was of similar character as the foot-wall.

Carbonate ore is exposed in places along the foot-wall side in the open-cut, a sample of which ran: Gold, 0.01 oz.; silver, 13.3 oz.; lead, 27.6 per cent.; zinc, 2.3 per cent. In the writer's opinion not much importance can be attached to this, as it is due to surficial oxidation and is not likely to continue with depth. A grab sample from about 12 tons of ore on the dump, which had been extracted from the tunnel, ran: Gold, 0.02 oz.; silver, 21.4 oz.; lead, 29.8 per cent.; zinc, 8.3 per cent.

For the amount of work done the showings were encouraging and gave promise of the development of a nice shoot of ore, but it is not high grade, and unless better values are obtained, owing to the distance from transportation, a margin of profit can only be shown under the most favourable conditions—namely, good management with a minimum of overhead expense and a sufficient width of ore to ensure economic mining.

This property, consisting of the *Isaac* (Crown-granted), *Isaac No. 1*, *Isaac Isaac Group*.* *No. 2*, *Isaac No. 3*, and *Isaac Extension* claims, owned by James Rutherford and associates, of Vancouver, is situated near the head of Isaac creek, 3 miles by trail from the *Lead Queen* wagon-road. The elevation of the cabin is about 6,500 feet and the lowest working is at about 7,200 feet. As the old workings were described in the Annual Report of the Minister of Mines for 1916, page 100, a brief description of the new work only will be given here.

At a distance of several hundred feet south-easterly from and a little below the old incline shaft a new incline shaft has been sunk 56 feet on the vein, which is about 4 feet wide and contains disseminations, bunches, and stringers of galena. At 35 feet down the shaft there is a 15-foot south-easterly drift on the vein, which maintains the same width and character of mineralization. The vein here is much oxidized. At the bottom of the shaft there is a 15-foot drift run north-westerly on the vein. There was no ore in the face of this tunnel, but in the hanging-wall there was a wide showing of oxidized ore.

Shipments recorded are 125 tons in 1916 and 1917, 28 tons in 1918, and 62 tons in 1920. The sorted ore will assay from 30 to 35 oz. silver and from 55 to 70 per cent. lead. A grab sample from a pile of ore sacked for shipment gave as follows: Gold, 0.2 oz.; silver, 28.8 oz.; lead, 54.6 per cent.; zinc, 3 per cent. At the time of the writer's visit in July there were four men employed at the property.

This property was again visited during the latter part of September. At the time of examination in 1920, it was being operated by a syndicate under the terms of a lease and bond from the owners, W. D. McMillan and V. Sontag, of Seattle. This syndicate abandoned the property in 1921. The only shipment made by them was a few tons. This year the Interprovincial Mines Development Company acquired the property on bond and work was started during the summer under the management of T. H. Kerruish, who is one of the principal owners. As the property has already been described in the Annual Report for 1920, repetition will be avoided as much as possible.

During the earlier part of the season Mr. Kerruish and a small crew of men devoted their time to surface prospecting and taking out ore from a rather inaccessible showing high up in the peak above the mine-workings. About a car-load was extracted, sacked, and dropped down by a light aerial tram to a point alongside the trail in the basin below. A sample taken at random from a few sacks ran as follows: Gold, 0.01 oz.; silver, 63.8 oz.; lead, 35.1 per cent.; zinc, 0.8 per cent. This ore consists principally of galena in a gangue of lime and quartz, the associated minerals being iron pyrites and a little zinc-blende.♦

Surface prospecting was attended by encouraging results, the most interesting discovery being made in the slide-rock below the old tunnels, where a little digging disclosed some carbonate ore. This would indicate the downward continuation of the vein on which work has been done in the short tunnels above, or the presence of a parallel vein. However, not enough work had been done in the way of uncovering this material to form a definite conclusion as to what might be expected with further development. A sample of this carbonate ore taken across a width of

2 feet, exposed in a shallow digging, ran: Gold, 0.04 oz.; silver, 23.1 oz.; lead, 21.3 per cent.; zinc, 0.8 per cent.

Mr. Kerruish informed the writer that he intends to drive a lower tunnel at this point during the winter. Other showings have been uncovered above and beyond the upper tunnel which indicate the continuity of the vein for a considerable distance, but these could not be examined on account of snow.

In the upper tunnel the vein shows a pay-streak of about 10 inches wide of oxidized ore in the roof; a sample across this gave: Gold, 0.03 oz.; silver, 49.1 oz.; lead, 20.7 per cent.; zinc, 1.1 per cent.

The elevation of the workings—namely, about 9,000 feet above sea-level—and the long haul of about 28 miles to the railway are factors which seriously handicap mining operations, but should sufficient ore be developed to warrant the erection of an aerial tram over the rough bit of country between the mine and the end of the wagon-road, the costs of operating and transportation could be greatly reduced.

During the year very little work has been done at the property and at the time of the writer's visit in June no one was employed. Since last year no new developments of striking importance had been made. As the property has been reported on in the last two Annual Reports, no further description will be given. No further depth has been gained by the underground workings, and presumably the time during last year was chiefly occupied by gouging out the richest ore from the surface showings; cobbing, sorting, and sacking it for shipment. There were 25 or 30 tons of this sacked and neatly stacked on an excavated space near the open-cut.

A grab sample from twelve sacks selected at random from the different parts of the pile ran: Gold, 0.02 oz.; silver, 42.9 oz.; lead, 40.9 per cent.; zinc, 13.8 per cent. This can be taken to represent the highest-grade ore that could be maintained for shipment in a car-load lot. Whether another car-load of this grade could be won from the surface diggings is, in the writer's opinion, doubtful. In any event this is not good mining practice and would not pay at this distance from transportation. Besides this lot of ore, there were a few sacks lying by the trail below the cabin, a grab sample from which ran: Gold, 0.02 oz.; silver, 10.5 oz.; lead, 30.6 per cent.; zinc, 26.1 per cent.

It is quite evident, from the number of samples taken at different times, that the ore is essentially a milling-ore and mining cannot be carried on at a profit without the installation of a concentrator. Therefore systematic development should be undertaken to prove definitely the existence of sufficient ore to warrant the large expenditure entailed by mill-construction, power plant, tramway, etc.

Owing to the somewhat complex geological conditions surrounding the deposit, it is not possible with the small amount of work done to estimate ore tonnage with any degree of accuracy, or to even form anything but a vague idea of the possibilities.

In the opinion of the writer, scarcely enough ore has been developed to justify heavy expenditures on plant of any kind, but a little more crosscutting and drifting could be done to good advantage by a small crew of men, which, if intelligently and systematically carried out, would be of valuable assistance in determining future plans of development.

The only other work reported on Toby creek was that done by Murdoch McLeod on his claims on Copper creek.

On Slade creek there was considerably more activity in the area north-west of the *Paradise* mine, where John Burman put in a season at the *Bald Eagle*. A. Nelson, at his property across the creek from the latter, and R. McNeil at the *Relief* were busy. Further work was also done at the *White Cap*, in which J. C. Pitts, of Invermere, is one of the principal owners. It is reported that a nice showing of galena was uncovered at this property.

A piece of new trail was built up the creek from the *Trojan* camp and all these properties are now more easily accessible from the Horsethief Creek road.

No further work was done at the *Bunyan* this year. Neither the 300-foot crosscut nor the 80-foot raise driven from near the end of it developed any ore. It is regrettable that this work was ever done, as the ore-showings in the upper workings did not justify such an expense. There is some very nice clean-looking barite at the portal of the upper tunnel, and should there be a market for this material it is possible that quite a tonnage could be developed at different places on this property, but it would first be necessary to do quite a little exploratory work.

FORT STEELE MINING DIVISION.

Concentrator.—The new concentrator now being built by the Consolidated Sullivan Mining and Smelting Company for the treatment of the *Sullivan* ores is situated on the hillside at a distance of $3\frac{1}{2}$ miles from the mine. The many factors governing the choice of site have had most careful consideration. It is as near the mine as natural conditions would allow. The water-supply is taken from Mark creek at a point near the mine power-house, where the difference in elevation allows sufficient head at the mill for all requirements. There is ample room below the plant for the accumulation of tailings, while the contour of the hill lends itself to the requirements of modern mill-construction.

The mill building, which will cover an area of about 112 by 700 feet, is to be constructed of concrete and steel with gunite walls. Some very heavy excavation-work in the glacial drift, which covers the hillside to a considerable depth, has been necessary for the floor areas and the foundations of the heavier machinery.

The plan has been made to conform with the flow-sheet now in use at the Trail plant, which consists chiefly of differential flotation, preceded with fine crushing, made necessary by the character of the ore, which is a finely crystalline mixture of lead, iron, and zinc sulphides.

The coarse-crushing plant will be located near the portal of the long adit on Mark creek. Here 7-ton cars will dump into a 1,000-ton bin, from which the ore will be fed to one 36- by 42-inch Buchanan jaw-crusher set to 8-mesh. The product will pass to a stationary fan grizzly with 4-inch spacing. The oversize will go to a sorting-belt for picking off waste. From the sorting-belt the ore, together with the grizzly undersize, will go to two No. 8 Gates crushers set $2\frac{1}{2}$ or 3 inches. The product of these will go by conveyor to a 2,500-ton ore-bin. From this bin the ore will be transferred by standard ore-cars over the Canadian Pacific Railway tracks, and after passing over a 150-ton track-scale will be dumped into a 1,000-ton bin excavated in the solid rock at a point immediately above the fine-crushing plant at the mill. It will then be fed by pulley feeders to conveyors and thence over a stationary Simplex screen to one set of 72- by 20-inch rolls. The product will be fed over a secondary Simplex screen to another set of 72- by 20-inch rolls.

The product, with screen undersize, which is expected to be minus $\frac{1}{2}$ inch, will be delivered by conveyors through a sample-mill to a 2,500-ton fine-ore bin. Bedding will be effected in this, as also in the 2,500-ton bin at the crushing plant, by shuttle conveyor or travelling tripper. Pulley feeders will deliver the ore from the fine-ore bin to conveyors. These will pass through weightmeter to two primary grinding-mills which will be 8-foot by 48-inch Hardinge ball-mills. The discharge will go, after single pass, to mechanical distributors and to ten 6- by 25-foot Model D Dorr classifiers, from which the sands will go to four regrinding-mills, which will be 8-foot by 48-inch Hardinge ball-mills. The product will be returned by Wilfley sand-pumps to the distributor. The classifier overflow will be delivered to two bowl classifiers, from which the overflow will go to a surge-tank. The sand will be returned to the secondary mills. Flotation follows in modified standard-type M.S. machines, which will be used throughout.

A brief outline of the process is as follows: From the surge-tank the pulp goes to the lead-roughers, from which the lead concentrate goes to the cleaner-cells, making a lead product which, after being treated by American filters, passes to the bins or cars for shipment. The tails from the cleaner-cells go back into circuit. The tails from the lead-roughers go to the zinc-roughers, where a zinc concentrate is made, which, after passing over Plato tables, goes through American filters to the cars or bins. The tails from the zinc-roughers go to the cleaner-cells, making tails which go to waste and heads which go over Plato tables. Here a zinc concentrate is made and a middlings carrying iron and lead, which are retreated by a M.S. machine, making a lead concentrate and an iron tailings. The flotation iron tailings contain about 80 per cent. of the iron, the flotation lead concentrates contain about 80 per cent. of the lead, and the zinc concentrates about 80 per cent. of the zinc.

Direct-connected motors will be used throughout the mill wherever feasible. Power for the mill and crushing plant will be supplied by the East Kootenay power plant at Bull river. Between 5,000 and 6,000 horse-power will be used by the mine and mill together.

All circulation of pulp and solutions will be effected by Wilfley pumps. The Genter thickener, which is something entirely new and has been largely developed at the Trail plant, will be used for thickening the flotation concentrates. It combines the functions of a thickener

and filter to a certain extent. It is compact and occupies much less floor-space than a Dorr tank. The concentrates, after being loaded into steel cars of special design, will pass over 150-ton track-scales.

The voltage used in the mill will be 575 3-phase 60-cycle. At the side of the upper portion of the mill building there will be a machine-shop having ground-floor dimensions of 45 by 150 feet. There will also be a large warehouse, in which all mill supplies will be kept. Ample provision has been made for trackage facilities for delivery of ore, supplies, and the shipment of concentrates.

The boiler plant, which will be used for heating the building and solutions, will be situated at the lower extremity of the mill building, beside which a long concrete tunnel run on an incline from the boiler-house to the top of the building will enclose all piping, while its roof will be used as a skipway for hoisting supplies from the lower track.

The design of this plant has been accomplished by the officials of the company and the installation is being carried out under their direct supervision. Construction-work started in the spring and it is anticipated that the mill will be ready for operation early next summer. Between 400 and 500 men have been steadily employed.

Mine.—At the *Sullivan* mine the long adit from Mark creek is now in about 10,000 feet. Near the end of this tunnel the downward continuation of the northerly ore-body developed in the upper workings has been encountered. At the time of the writer's visit the true width had not been exposed, but there was about 30 feet of ore said to carry as high as 30 per cent. lead, which is considerably higher than the average run of ore so far developed in the southerly stope on this level.

Preparations were being made to start stoping, and with this object in view a crosscut was being run due west in the foot-wall side. Raises will then be driven to this ore-body. The rock encountered in this crosscut is extremely hard; it is presumably a highly altered quartzite resembling a chert. The output from this level has been between 700 and 800 tons a day.

The total number of men employed at the actual mining of this tonnage is about forty. The upper workings have contributed the balance of the output, making a total of between 1,100 and 1,200 tons a day, which has been maintained by a force not exceeding 300 men.

The output will be increased as soon as the new mill is available. In view of this, additional facilities have been provided for mining and underground transportation, including the widening of the mine-track to 30-inch gauge and the installation of two direct-connected 3,000-cubic-foot air-compressors near the portal of the tunnel.

Brenda. This claim, belonging to Colonel C. H. Pollen, of Cranbrook, was acquired by the Globe Mining Company in the fall of last year, when development-work was started with a small crew of men under the supervision of D. McIntosh.

It is situated on a small tributary of Skookumchuck creek called Copper creek, and is reached by a trail which leads over the summit of a divide and then descends to the valley of Copper creek, making a total distance of about 6 miles from Torrent Station, on the Kootenay Central Railway.

The principal workings are situated along and near the bottom of a low narrow ridge which forms the easterly side of a shallow gulch. The country-rock forming this ridge is a grey schist which has been broken and crushed, possibly by glacial action, which no doubt accounts for the somewhat curious topographical features.

At the northerly extremity of this ridge there is a strong outcrop of material composed of barytes, siderite, and quartz, the two former minerals predominating. At the surface this outcrop carries a heavy iron-stain, while the presence of small quantities of copper are indicated by the characteristic stains in places.

The oxidation is confined to the surface and does not continue with depth. Freshly broken surfaces show that this partly oxidized material is sparsely mineralized with disseminated specks of grey-copper, which has also been deposited in thin coatings along the cracks and partings in the barytes and siderite, more particularly in the latter. It is therefore evidently of secondary origin.

As no appreciable depth could be obtained by crosscutting, an incline shaft was sunk at an angle of 28° and in the apparent direction of the strike—namely, S. 25° W. The length of the shaft was 86 feet. The material encountered was principally barytes and siderite, in which irregular patches of sparsely disseminated grey-copper occur, but nowhere had the mineralization been sufficiently concentrated to form ore-bodies of economic importance.

Near the bottom of the shaft a sample was chipped at random from a small showing of the best grade of material; this ran as follows: Gold, 0.02 oz.; silver, 2.3 oz.; copper, 1.27 per cent. A picked sample from some of the highest-grade material from the shaft ran: Gold, 0.03 oz.; silver, 2.7 oz.; copper, 1.63 per cent.

It is proposed to sink the shaft another 50 feet and drift in a south-westerly direction under other surface exposures, and in order to facilitate this work the installation of a compressor, boiler, and machine-drills is contemplated, while it will also be necessary to increase the pumping capacity.

Unless ore can be uncovered at or near the surface which will pay to ship, further underground work, in the opinion of the writer, is not advisable and should only be undertaken after a more thorough exploration of the surface showings has been made.

At about 450 feet southerly from the shaft an old tunnel had been driven for a distance of about 80 feet into the ridge and below a shallow surface digging, from which, it is understood, some good ore was extracted, but neither this tunnel nor subsequent underground work was successful in developing the downward continuation of the ore. Upon further digging at the surface it was found to pinch out a few feet down. Recent work on the westerly side of the gulch has been done, where a number of shallow diggings show the presence of vein-matter, but no ore of importance has yet been encountered.

The present mine equipment consists of a 6-horse-power Fairbanks gasoline-engine connected to a small pump, which is used for dewatering the shaft. Hoisting was done by a horse-whim. A well-built 16- by 20-foot log cabin affords accommodation for six or eight men.

No work was being done at the property when visited in October, as the crew was engaged in widening the present trail for a sleigh-road.

Other mining activities in the Division have not shown any marked increase over those of last year; the same men have been out in the hills again, developing their properties.*

The Evans Bros. did further work at the *Achilles* group on Whitefish creek, W. van Arsdalen put in a season at the *Yellow Metal* group on Perry creek, and James Angus is reported to have uncovered some good ore on Hellroaring creek.

At the *Homestake* on Perry creek further surface prospecting was done by George Carr, who has been interested in the property for a number of years. At the end of the season he brought down some nice-looking samples of gold quartz from some of the new diggings.

It is reported that the low tunnel at the *Victor* near Fort Steele is being continued under contract.

The *Society Girl* mine near Moyie was visited by the writer with J. F. Huchcroft; the object being to determine the ore available for shipment and possibilities of winning more from the upper workings.

Upon examination it was found that practically all the ore from this portion of the mine had been stoped to the surface and the indications for the development of further tonnage did not appear to be very encouraging. In the blacksmith-shop there were about forty sacks of carbonate ore which has been extracted from this part of the mine. A grab sample gave the following returns: Silver, 10.3 oz.; lead, 53.2 per cent.; zinc, 0.2 per cent.

Near the lower camp there were a number of sacks lying alongside the trail, containing ore which at some previous period had been extracted from the lower part of the mine-workings. On account of the high percentage of zinc associated with the galena this lot did not constitute shipping-ore, although possibly some fairly clean lead ore could be sorted out.

The time afforded for the trip was unfortunately insufficient to allow an inspection of all the mine-workings; hence no report will be attempted until the writer has had an opportunity of making a more thorough examination. Further references may be seen in the Annual Report of the Minister of Mines, 1911, page 162, and Geological Survey Memoir 76, page 127.

Placer-mining activities have been principally confined to Wildhorse and Perry creeks.

On Wildhorse creek work on the Gamble Mining Company's property was continued under the direction of E. Watson. A lot of preliminary work was necessary before the water could be turned on at the monitor, and by the time everything was in readiness the supply gave out. However, arrangements were made for further water rights sufficient to ensure continuous operations throughout the season. Unfortunately the old flume through which this water had to be conveyed broke away before any useful work could be accomplished, and as the repairs involved a considerable expenditure work was discontinued for the time being.

The Wild Horse Dredging Company, which acquired a number of leases on Wildhorse creek in 1918, has made spasmodic attempts at recovering gold from the creek-gravels. Before making any serious efforts to test the depth and value of the gravels, the first attempt consisted of erecting a boom dam across the creek with the idea of sluicing the gravel from the creek-bed and recovering any gold there might be left on the bed-rock. The boom dam was not quite completed before the high water came and washed it out. So ended the first attempt.

Following this, a drag-scraper was installed above the dam-site, with which it was intended to gradually excavate down to bed-rock, sluicing the gravels in the process. No success has been obtained so far.

Upon making inquiries it would appear as if it has been simply a stock-jobbing proposition from start to finish; in any event, there has been much dissatisfaction among the shareholders and the company at the present time is without funds. The company was incorporated under the laws of the State of Washington and the subscribers to the stock are American citizens.

The operations of this company are no criterion of the possibilities for placer-mining on this creek.

On Perry creek the Wild Horse Gold Mining Company operated its monitor on the high gravel-bank just below the falls during the early part of the season. Unfortunately the creek has not sufficient grade to take care of the tailings and operations at this point could not be carried on successfully.

To add to its troubles the bank caved and buried a long section of the sluice-box. A. J. Palmquist, the manager, is now seriously considering the construction of a dam at a point about 1,500 feet up the creek from the canyon; the idea being to hydraulic the gravel into the main channel and sluice it down the creek by suddenly releasing large volumes of water from the dam by means of automatic gates. The material would then pass through sluice-boxes and a large undercurrent, in which it is hoped to catch the values.

WEST KOOTENAY DISTRICT.

AINSWORTH MINING DIVISION.

AINSWORTH CAMP.

Although the production from this camp and vicinity has been very small as compared to that of previous years, owing to the inactivity of some of the well-known mines, there has been the usual number of minor activities, some of which give promise of greater production in the future.

Florence. When this property was visited in the fall development-work was being done on the Nos. 4 and 5 levels, where wide showings of milling-ore had been opened up. During the latter part of the year this was being put through the mill as mined. The property has been seriously handicapped by lack of sufficient water-power during several months. Twelve men are employed.

The Lakeshore Mining Company, under the management of E. J. Edwards, is reported to have struck the vein at the end of 700-foot crosscut, where there is a width of 8 feet of good milling-ore. Drifting is now being proceeded with in either direction.

The *Silver Hoard* is being worked under the terms of a lease by Logan McPhee and two partners. There is said to be a good showing, from which about 800 sacks of ore has been extracted.

The *Krao* is leased by Clarence Harmon and two partners. A car-load of ore is now ready for shipment.

The *Spokane-Trinket* is being worked under a lease by Billy Sherman and George McPherson. There is a showing of 2 feet of ore and they expect to soon be in a position to ship a car-load.

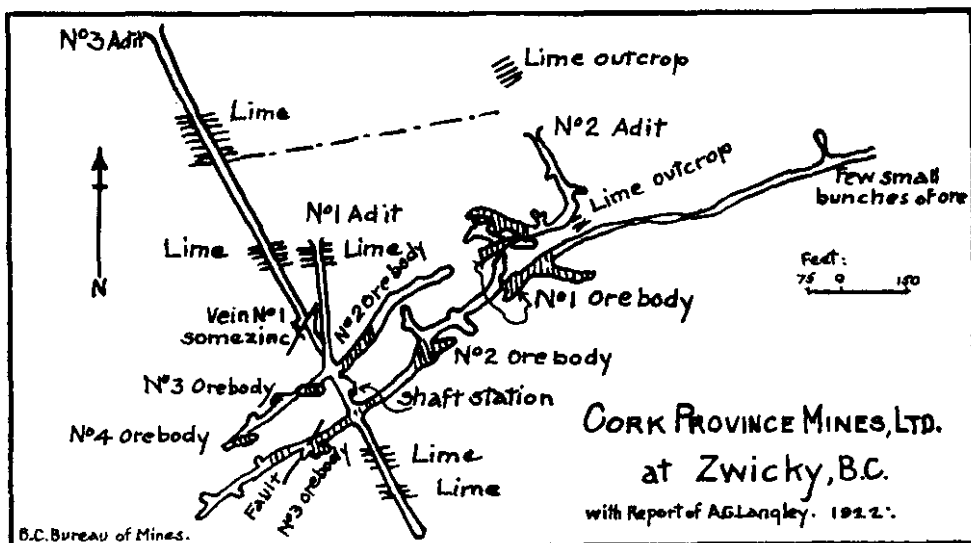
At the *Kirby* group near Riondel the long tunnel which was being driven from the lake-shore to tap the vein was advanced 217 feet during the year, making a total length of 507 feet. Work was temporarily suspended on November 4th.

KASLO.

Whitewater. At this mine the principal tonnage, consisting of silver-lead and silver-zinc ore, was produced by leasers. The company now has a small crew of men at work and it is expected that the production will be materially increased during the coming year. This mine has the record of being one of the steadiest producers in the district. It was discovered in 1892.

The following notes regarding production have been submitted by W. H. Burgess, the manager: "It is interesting to note that this mine has produced steadily since 1896, and has a production record of: 34,477 tons of shipping lead ore having a net value of \$1,579,213, 16,086 tons of shipping zinc ore having a net value of \$209,595, making a total of \$1,788,808. From this production a profit of \$622,515 was divided; but if the record of the old English company is deducted from the rest—namely, profit of \$30,000 on a production of \$406,700—it leaves a profit of \$592,515 from \$1,382,108 smelter returns, or 43 per cent. of smelter returns, and was after the return of all expenditures, capital or otherwise. The record of the English company was due more to wholesale milling of the vein-filling, instead of selecting profitable areas and hand-sorting before milling residues, than to lack of ore. This record is a sample of the results obtained by a Slocan ore-body, and it is anticipated that this mine will have years of life ahead of it yet, as the ore has been taken from a comparatively small area of ground."

This property, situated on the South fork of Kaslo creek, embraces thirteen claims and is owned by the Cork-Province Mines, Limited, of Kaslo. The capitalization of the company is \$1,500,000. Par value of shares is \$1. W. E. Zwicky is president and manager; W. H. Burgess, secretary-treasurer. During the year more capital was realized by the sale of an 8-per-cent. debenture issue. The additional capital



was needed to carry on more extensive development, which included the sinking of a shaft in order to win the ore below the lowest level of the mine—namely, the No. 3 adit.

It is the intention of the company to carry on future development along the lines recommended by R. H. Stewart, who made a careful examination of the property in 1919. Work was started at the mine in June, under the superintendence of W. Y. Williams, after a shut-down of two and a half years.

No sooner were things in shape to start mining when a forest fire broke out in the vicinity of the property and many of the mine crew were taken to fight the fires, which lasted for about six weeks. Handicapped by these discouraging conditions, it was impossible to make as rapid progress as was first anticipated.

Upon W. Y. Williams's resignation, W. E. Zwicky took charge in October. Shortly after starting work on the shaft it was found that the compressor would not handle the pumping, sinking, and hoisting, so a new one was ordered and has just recently been installed. The small amount of other work done in the mine is said to have been satisfactory and to have opened up some nice ore-showings. It is anticipated that the mill will be started up next spring.

This property comprises a group of ten claims on and near Paddy's peak, which derives its name from "Paddy" McCue, the original locator. A good road leading up the valley of 12-Mile creek connects the mine-workings with the railway at Adamant Siding, the distance being about 5 miles. For many years the ownership of the property has been vested in the Utica Mines, Limited.

The complete records of shipments are not available at the time of writing, but the mine has been responsible for a considerable production of high-grade ore. For instance, between 1913 and 1920, 5,058 tons was shipped, the receipts of which show an average value of \$83.44 a ton after deducting freight and treatment charges. During 1919 and 1920 the property was worked by leasers, who struck a rich pocket of ore in the old workings and made substantial profits. In 1921 O. C. Thompson acquired the property under the terms of a five-year lease.

During the latter part of this year negotiations were entered into by Major H. H. Armstead for the purchase of the property, and according to reports a deal has been consummated.

The formation of Paddy's peak consists of rocks of the Slocan series, which have been greatly disturbed by near-by intrusions of granite. The country-rock in which the vein has been formed resembles a slate, but a more correct classification is chistolite schist, in which the needle-like crystals of this mineral can plainly be seen.

The vein which has been formed along a fault-fissure, conforms in dip and strike to the schist. The strike is N. 35° E. and dip 70° to the south-west. In the vicinity of the main ore-shoot the vein-filling principally consists of calcite, quartz, and a little siderite, with inclusions of thin layers of crushed schist.

No ore was exposed in the mine-workings, so the character of its occurrence could not be observed. The ore carries high values in silver, which is associated with galena and zinc-blende. Of the two classes of ore that have been shipped—namely, silver-lead and silver-zinc—the latter has been found to carry almost as high values in silver as the lead. The zinc content is high, often exceeding that of the lead. Recent shipments averaged about: Silver, 150 oz.; lead, 12 per cent.; zinc, 22 per cent.

In the early history of the mine, work was confined to developing the vein below the outcrop, high up in the bluffs of Paddy's peak, where three levels were driven. At the base of the peak the hillside is covered by talus. The No. 4 level, which latterly has been the main working of the mine, develops the vein under the talus-covered slope and well on under the peak at an additional depth of 220 feet. The total length of drifting on the west vein in this level is about 1,300 feet, above which the vein has been stoped to a width of about 5 feet for a length approximating 750 feet.

The ore continues below this level and has been sunk upon to a depth of 50 or 60 feet, but no attempt has been made at underhand stoping on a large scale, due to the necessity of pumping and high cost of winning the ore by this method. Besides this, almost an equal amount of drifting has been done on a parallel vein which lies about 90 feet to the east and is known as the east vein, but so far has not been proved to be as economically important as the west vein.

In order to develop the ore-shoot at an additional depth of 350 feet a crosscut tunnel was driven for 2,000 feet in about 1917. The elevation of the portal of this tunnel is 6,150 feet. It has been driven in a direction of N. 86° W. and intersects the projected strike of the vein at a point about 1,000 feet to the north-east of the No. 4 level. However, the vein was not encountered, and O. C. Thompson started driving from a point near the end of the crosscut in a southerly direction in order to get under the ground already explored by the upper workings. At the beginning of August this tunnel was in 270 feet and had about 700 feet to go.

The power plant, which is situated at a short distance from this tunnel, consists of a 3-drill single-cylinder air-compressor of English manufacture, driven by a Pelton wheel under a head of 300 feet. There is also a 100-horse-power oil-engine installed. The water-power at present developed is insufficient during the dry season for the requirements of the mine. More power is available on the main creek below, which might be utilized to advantage as soon as conditions are found to justify the expenditure of additional installation. The camp buildings, situated at a convenient distance from the lower tunnel, afford good accommodation for the mine crew.

The recent work being done would appear to be the logical way of developing the vein at depth—namely, driving straight for a point below the proven part of the vein where its downward continuation may be expected. The development of the extremities of the vein could well be undertaken later.

This claim is situated on Long creek at a distance of about 3 miles from the South fork of Kaslo creek. At an elevation of 5,850 feet, or about 2,250 feet above the South fork, prospecting has been done on a small vein in granite. The strike of the vein is N. 35° W. and it dips into the hill at an angle of about 65°. The work

consists of a short tunnel and a number of small shallow open-cuts, which latter demonstrate that it is persistent in strike for a considerable distance.

At the best surface showing two small stringers of ore were exposed, consisting of iron sulphides carrying small gold and silver values, the latter probably being in the form of antimonial sulphides. A sample of picked ore from this place ran: Gold, 0.14 oz.; silver, 10.3 oz. to the ton. In the opinion of the writer, more prospecting along the outcrop would be advisable.

This group, consisting of the *Humbolt*, *Sailor Boy*, and *Fraction* Crown-granted **Humbolt Group.*** claims leased by G. Foulkes, of Kaslo, is situated at an elevation of about 4,600 feet near the head of Crawford creek, 13 miles by road and trail from the Crawford Bay wharf, which is the nearest shipping-point. The property is reached by a trail 4 miles in length which starts from the end of the wagon-road at the lower terminal of the aerial tram of the *Silver Hill* mine, which has been shut down for many years. The old road, long disused, is now in bad shape for wagon traffic, though pack-horses can still be taken over it.

The ore is chiefly argentiferous galena occurring in streaks, bunches, and small masses in a flat-lying quartz vein, 4 to 6 feet wide, conforming to the stratification of the enclosing limestone. In places small amounts of zinc-blende and pyrite are associated with the galena, but can be easily separated from it. The galena also separates easily from the gangue, making a very clean shipping product.

The old workings, consisting of two short tunnels and some open-cuts, trace the vein for a length of several hundred feet along the outcrop, which follows the contour of the hill in a northerly direction.

At the southerly end of the section of the outcrop developed by these workings two open-cuts and a slightly inclined tunnel develop an ore-shoot of an apparent length of 80 feet. The tunnel is in the centre of the ore-shoot, with an open-cut on each side. The ore extends down the inclined tunnel for 30 feet.

About 100 feet northerly from these workings and a little below the outcrop there is a crosscut tunnel 108 feet long which failed to intersect the vein, but a short raise 60 feet in from the portal of the tunnel (which was inaccessible) must have struck the vein, judging from the dump outside the tunnel, which contained some ore and quartz.

Some 70 feet farther north along the outcrop an open-cut shows the vein, which contains a 4-inch streak of solid galena along the hanging-wall. A grab sample from a pile of a few tons of ore sorted for shipment gave: Gold, 0.02 oz.; silver, 61.2 oz.; lead, 75.5 per cent.; zinc, 5.4 per cent.

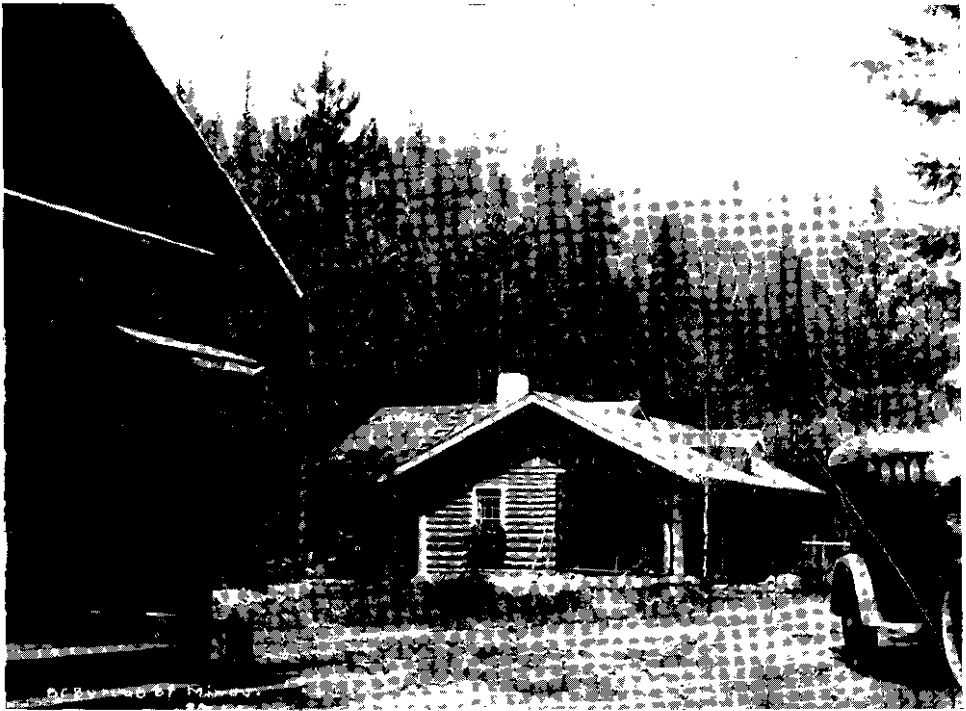
**St. Patrick
Group.***

This property, consisting of the *Regina*, *Flora*, *St. Patrick*, and *Marie* claims, owned by J. Brochier and A. LeBlanc, of Kaslo, is situated on the northern side of Hamill creek at an elevation of 3,880 feet (lower tunnel), being connected to the old Hamill Creek wagon-road by a good rawhide trail $1\frac{1}{2}$ miles in length. From Argenta, the nearest shipping-point, the total distance to the property is about 6 miles. At present a trip to the *St. Patrick* can only be made with difficulty, owing to the dangerous condition of the numerous bridges along the canyon on the old Hamill Creek wagon-road, and it was following an application for Government assistance towards repairing these bridges that the writer visited the property, which, with the exception of annual assessment-work, has been idle since the British Alberta Mining Company relinquished its bond in 1919. This company did considerable work, including the erection of substantial buildings.

In the canyon the rock-exposures consist of limestone and black argillites with interbanded aplite sheets. Some of the lime-bands attain great thickness. The strike of the rocks is northerly (approximately at right angles to the creek), with low easterly dip, the attitude of the beds becoming more steeply inclined a short distance up the creek.

The *St. Patrick* vein conforms to the stratification of the enclosing rocks, which are mica-schist on the hanging-wall and limestone on the foot-wall, the strike of the vein being N. 32° W. (up the mountain) and dip about 55° to the north-east.

The ore is chiefly argentiferous galena occurring in bunches, stringers, and disseminations throughout the gangue of altered country-rock, which is highly siliceous and calcareous and considerably decomposed by oxidation. In some places, however, kidneys of clean zinc ore occur. The vein is well defined and has been traced for over 1,000 feet by a tunnel, a shaft,



Capt. Cates's Camp, Tulameen River, Similkameen M.D.



Capt. Cates's Placer Claim, Tulameen River, Similkameen M.D.

and a number of open-cuts. The upper workings are on a bench which extends for some distance towards the north.

The principal showings are as follows: At an elevation of about 4,045 feet an incline shaft has been sunk 88 feet on the vein, which is here from 4 to 5 feet wide. The upper 75 feet of the shaft is in ore throughout (the lower 13 feet of the shaft was full of water), the mineralization consisting of disseminated galena and lead carbonates, with some bunches and stringers of clean galena over a width varying from 7 inches at the top to 33 inches at the 45-foot level, where a drift was run 20 feet south-easterly on the vein. In this drift the ore is the same as in the shaft for a width of from 30 to 33 inches. In the shaft below the 45-foot level there is a streak of from 2 to 4 inches of solid galena. Samples from the shaft and drift gave the following results:—

Description.	Gold.	Silver.	Lead.	Zinc.
	Oz.	Oz.	Per Cent.	Per Cent.
Across 33 inches at the 45-foot level	0 02	32.0	34.5	4.2
Across 30 inches in face of drift at the 45-foot level	0.01	11.9	19.1	9.1
Across 7 inches at top of shaft	0.02	25.9	38.4	0.7

A little below the collar of the shaft and 136 feet south-easterly along the outcrop a glory-hole exposes 5 feet of oxidized ledge-matter containing stringers and bunches of galena. At 165 feet vertically below the collar of the shaft, and 400 or 500 feet south-easterly from it, a crosscut tunnel 350 feet in length taps the vein, which was drifted on for about 190 feet north-westerly. In this tunnel there are patches of milling-ore, with, in places, bunches and stringers of clean ore occurring in distinct bands of galena and zinc-blende.

On casual inspection the work done on this level appears somewhat indefinite, a survey and plan being required to properly explain the situation. It would appear, however, that the vein was faulted, but has been picked up again towards the face of the drift, which is supposed to be 35 feet short of a point below the bottom of the shaft (77 feet above the level). The strike of the vein near the face is similar to the strike of the vein in the shaft. A specimen of zinc ore from the face of this drift gave: Gold, 0.1 oz.; silver, 9.3 oz.; lead, 2.6 per cent; zinc, 55.5 per cent.

In the crosscut 36 feet short of the above drift a mineralized zone parallel to the vein was encountered, from which 22 tons of ore was shipped in 1919. This shipment consisted of one lot of 11 tons of lead ore said to have assayed 57.5 oz. silver and 75.4 per cent. lead, and one lot of 11 tons of zinc ore said to have assayed 54 per cent. zinc. In the floor of the tunnel at this point there is a width of 43 inches of zinc ore which assayed 2.1 oz. silver and 54.3 per cent. zinc.

Future possibilities of the *St. Patrick* would seem to depend on the developing of a sufficient tonnage of ore to justify installation of milling plant, though a limited amount of crude ore could be sorted out for shipment. Transportation charges for rawhiding and hauling the ore to Argenta were \$7.50 a ton. A little more work on the tunnel-level to complete connection with the shaft should give considerable information and afford a clue to the further development of the property. The *St. Patrick* has many natural advantages, the topography lending itself to deep tunnelling operations. If justified by further development, a comparatively short aerial tram could be built to connect with a mill-site on Hamill creek, which is said to have a grade of 200 feet to the mile through the canyon. There is a plentiful supply of timber for mining purposes on the property and good accommodation for a small crew is afforded by the substantial buildings erected by the above-mentioned company.

POPLAR AND VICINITY.

Mining activities during the season may be summarized as follows: A few men have been employed on development-work at the *Bullock* mine, which is reported to have closed down recently. John Ulvin and Charles Petersen have been working their placer claim on the Lardeau river opposite Gold Hill. Panning gave good results and some sluice-boxes were installed. Eric Strand and Ben Larsen have been developing their property on Tenderfoot creek and are reported to have good showings of high-grade silver ore.

Among others who have been mining and prospecting around the district are: John McDonald, who owns the *Buck* group near Gold Hill; 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; P. Kelly, who owns the *Telluride* group near Poplar; and Osten Foss, who has properties up the Duncan river.

LIST OF PRODUCING MINES, SHOWING APPROXIMATE TONNAGE SHIPPED.

Mine.	Locality.	Weight.	Character of Shipment.
		Tons.	
Florence.....	Ainsworth	351.0	Silver-lead concentrates.
Whitewater	Retallack	410.0	{ Silver-lead ore. Silver-zinc ore.
Utica	Adamant.	150.0	Silver-lead ore.
Highland.....	Ainsworth	157.0	"
Bluebell	Riondel.	66.0	"
No. 1	Ainsworth	75.0	"
Spokane-Trinket.....	"	43.0	"
Silver Hoard	"	80.0	"
Lincoln.....	Blaylock.....	23.0	"
G. Peterson (Tariff).....	Ainsworth	23.0	Silver ore.
Neosho.....	"	11.0	"
Black Bear	South fork, Kaslo Creek..	5.0	Silver-lead ore.
Caledonia.....	Adamant.....	2.0	"

SLOCAN MINING DIVISION.

Free from labour troubles, with a market for zinc and good metal prices, the Slocan operators have had an incentive to renew their mining activities with increased vigour, and they have taken advantage of the opportunity.

The Silversmith Mines, Limited, heads the list of producers with a large tonnage of silver-lead and zinc concentrates, followed by the Rosebery-Surprise Mining Company, the *Rambler-Cariboo*, and Clarence Cunningham.

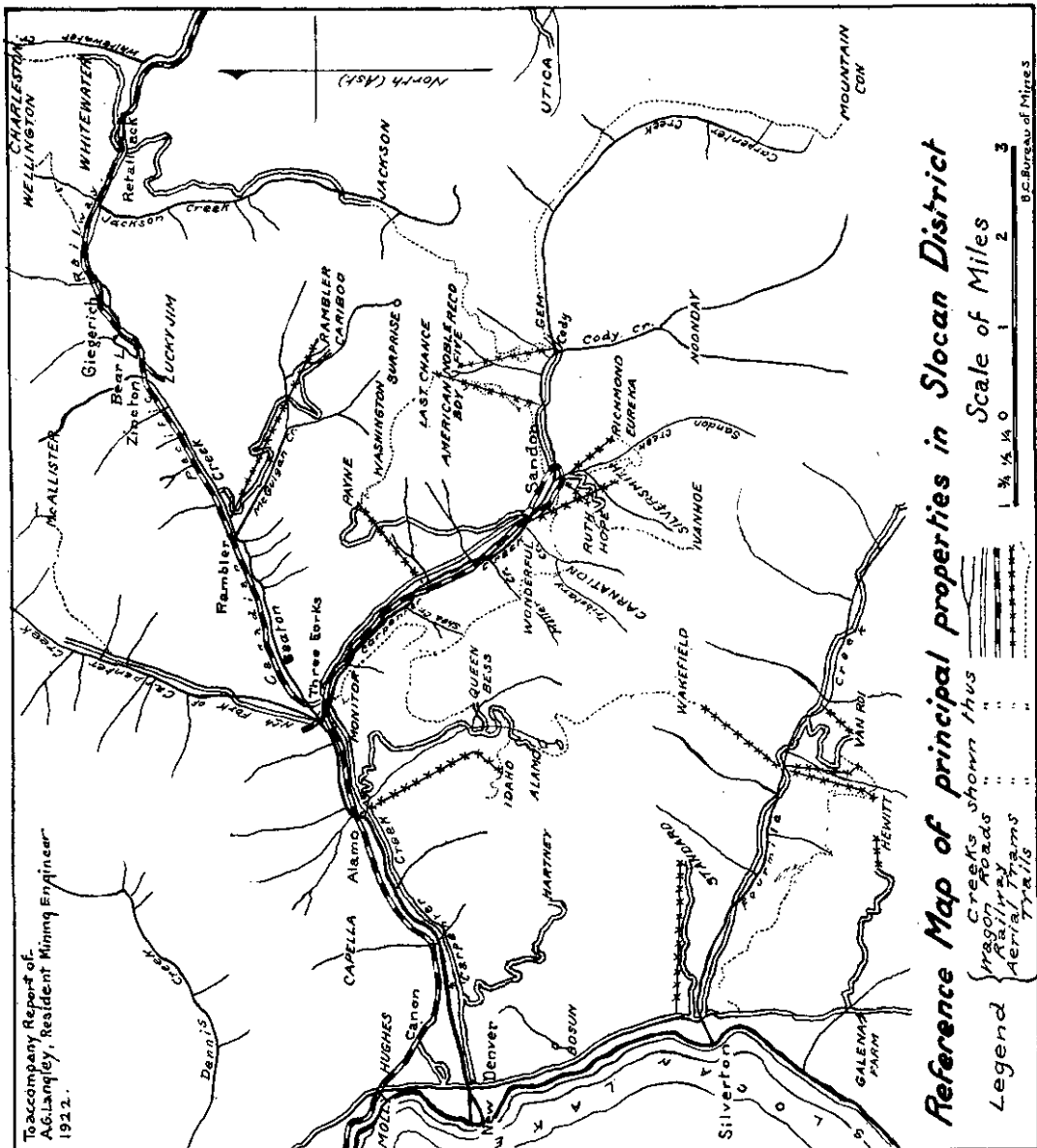
Besides these major operations, the production has been supplemented by the activities of leasers and individual owners of claims. The shipping-list of this division includes the names of twenty-eight properties.

This mine, owned by the Silversmith Mines, Limited, and now generally referred to as the *Silversmith*, is situated at a distance of about half a mile from Sandon. The property, comprising a group of fourteen claims, covers a length of 2,700 feet along the strike of the vein. The mine has the record of being one of the earliest and steadiest producers in the Slocan. It was staked in 1891 by the late Bruce White. John B. White, of Spokane, is president and treasurer of the company; Roy C. Lammers, secretary; Oscar V. White, superintendent.

The following information is derived partly from personal observation and partly from the official report published by the president and that of the mining engineer for the company, Clyde B. White. The normal output was attained about June 1st, from which time till the end of September the production was 214 tons crude silver-lead ore, 1,972 tons of silver-lead concentrates, and 2,040 tons (approximately) of zinc concentrates. The main vein, known as the *Slocan Star* vein, has a general trend of north-east and south-west, dipping to the south-east at an angle of about 47°. Its width varies from 5 to 80 feet, with an average of over 10 feet. It lies in a slate formation in close proximity to a porphyry dyke. The vein-filling consists of crushed slate, siderite, and quartz, with occasional fragments of partially decomposed porphyry.

The vein has been developed by six adits—Nos. 1, 2, 3, 4, 5, and 10. The main working-level is the No. 10. This consists of a crosscut 2,100 feet in length, at which distance the vein is intersected at a depth of 1,200 feet on the dip. In drifting to the west the new *Silversmith* ore-shoot was encountered, from which the present production is being derived. The drift is now being extended in an easterly direction and is said to be in promising ground, which gives rise to the expectation that ore may be opened up shortly.

The new Silversmith shoot has been well explored by levels 5, 8, and 10, and is partially developed by levels 9 and 11. Its length varies from 350 to 450 feet; its width from 2 feet to 35 feet, and is partially developed for a height of 685 feet. The total production from this shoot from October 1st, 1918, to August 1st, 1922, was 57,123 tons of mill-feed and 1,006 tons of clean ore. The average assay of the former was 20.5 oz. silver to the ton, 9.3 per cent. lead, and 9.1 per cent. zinc; while the clean ore averaged 115 oz. silver and 60 per cent. lead. It is estimated that there is still about 175,000 tons of ore left in this shoot.



The mine-workings consist of 16,000 feet of drifts, 8,300 feet of crosscuts, and 5,600 feet of raises, making a total of 29,900 feet. The mine is equipped with a 746-cubic-feet-a-minute air-compressor delivering air at 100 lb. pressure. Light water-hammer drills are used for mining and a heavier type for hard ground. Wet stoper drills are used for raising. Air-hoists are used throughout the mine.

Surface improvements include a new blacksmith-shop equipped with a drill-sharpener and a crude-oil forge. There is also a well-equipped machine-shop and carpenter-shop. A new two-story building, 30 by 60 feet ground dimensions, answers the dual purpose of a cook-house and club-house, while a dry-house of the most modern type further adds to the welfare of the men. About sixty-five men are employed at the mine.

Silversmith Concentrator.—The *Ivanhoe* mill previously used by the Rosebery-Surprise Mining Company for the treatment of the *Surprise* ore was bought by the Silversmith Mines, Limited, last year; since when it has been completely transformed by extensive additions and improvements, until now it represents the latest thing in modern mill design for the treatment of silver-lead-zinc ores by gravity and oil-flotation processes. The excellent flow-sheet and successful operation of the mill reflects credit on E. O. White, of Sandon, who is responsible for its design and construction.

The principal object aimed at was to remove the greatest possible amount of lead by jigs and tables with the least possible amount of grinding; no attention being paid to the zinc during this stage of concentration, for the principal reason that a clean zinc concentrate could not be made by gravity methods on account of the high percentage of spathic iron, which has a similar specific gravity to that of zinc-blende. To accomplish this the ore is ground and reground, and at each successive regrind it is sized and distributed to jigs and tables, from which a lead concentrate is taken off and conveyed to the shipping-bins, until the ore finally is reduced to a fineness (minus 80-mesh) suitable for treatment by the oil-flotation process.

The flotation plant is of the Callow pneumatic type, and consists of two lead-rougher cells of 12 square feet of canvas area each, one lead-cleaner 12 square feet in area, two zinc-rougher cells of 16 square feet each and a second zinc-cleaner cell of 12 square feet area. Lead concentrate made at the first rougher-cells goes to the lead-cleaner cell, where a high-grade silver-lead concentrate is made; the tailings are returned to the rougher. The tailings from the lead-rougher go to the zinc-roughers, where tailings are made which go to waste and a zinc concentrate which is retreated in the first zinc-cleaner; the concentrate from this machine goes to a second zinc-cleaner, where a high-grade zinc concentrate is made. Tailings from the first and second zinc-cleaners are returned to the zinc-rougher. The zinc concentrate being made carries about 48 per cent. zinc.

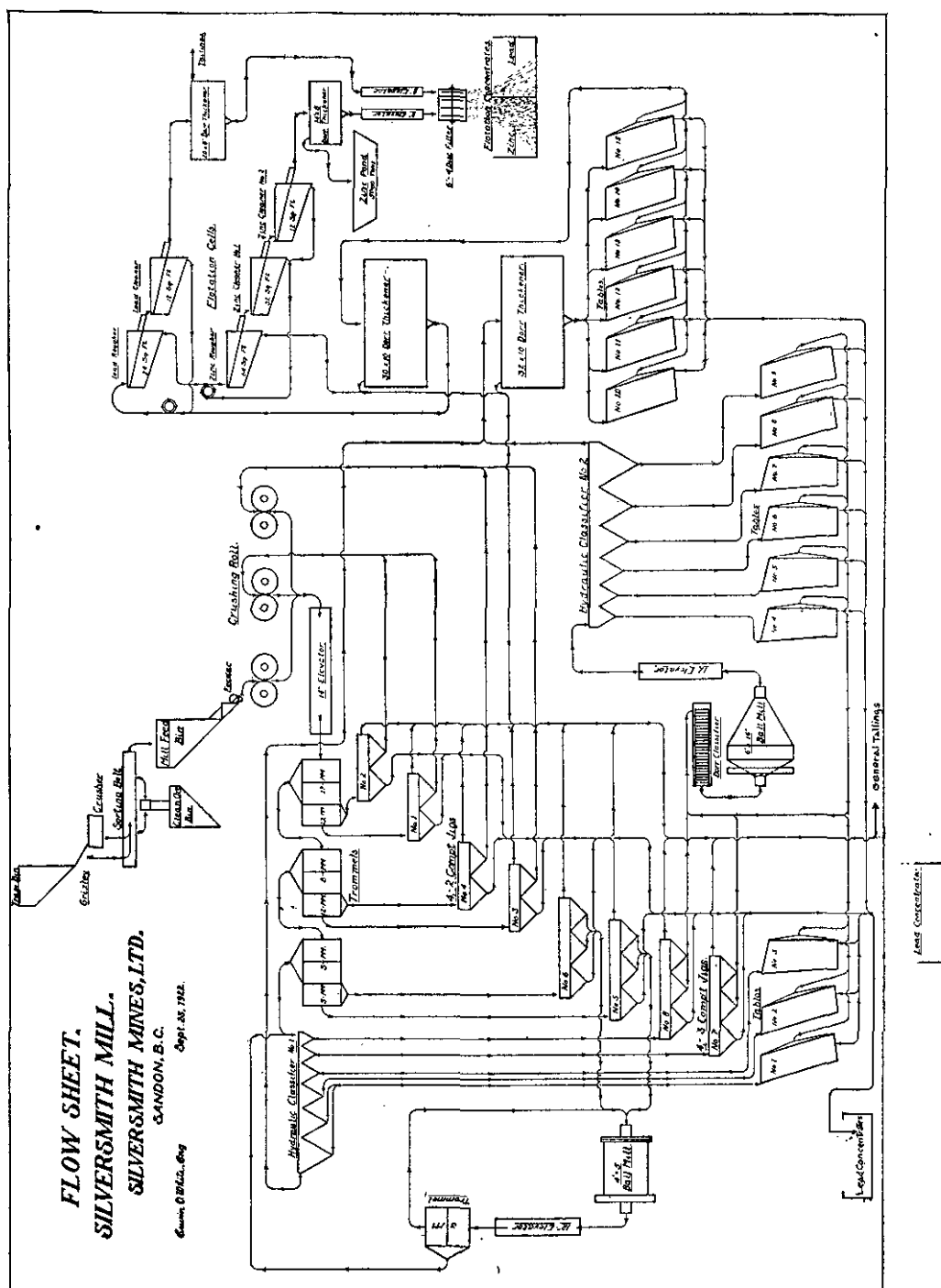
The following gives an idea of the character of the ore milled over a period of four months: In June, 3,149 tons were milled, assaying 21.75 oz. in silver, 8.6 per cent. lead, and 6.2 per cent. zinc; in July, 2,923 tons, assaying 26.24 oz. in silver, 10.07 per cent. lead, and 6.93 per cent. zinc; in August, 3,169 tons, assaying 24.43 oz. in silver, 8.97 per cent. lead, and 7.17 per cent. zinc; in September, 2,179 tons, assaying 27.5 oz. in silver, 9.6 per cent. lead, and 8.05 per cent. zinc. The profit accruing to the company over this period was \$83,350.57.

The ore is supplied to the mill by a 4,600-foot Riblet automatic aerial tramway equipped with twenty 10-cubic-foot buckets. The mine-bin has a capacity of 250 tons and is situated near the portal of the No. 10 level. The receiving-bin at the mill has a capacity of 75 tons, from which the ore is fed to a 10- by 20-inch Blake crusher; it is then fed by conveyor-belt, which is also used as a sorting-belt, to the mill-feed bin, this bin having a capacity of 200 tons. The mill has a rated capacity of 125 tons a day.

Lack of vibration and simplicity in design are features which at once impress the visitor on a walk through the building. The method of handling the lead concentrates from the jigs and tables is an innovation to the Slocan. These concentrates are all fed to the boot of a drag classifier, which delivers the coarse and sand lead practically free from water to a distributing-conveyor mounted on a track above the ore-platform. This latter is of cement and has a sloping bottom, which affords good drainage for the concentrates before shipment. The overflow from the drag classifier goes back into the circuit. Loading the concentrates into box cars is accomplished by means of a scoop-car having a capacity of 14 cubic feet.

There are fifteen tables used in the mill, the majority of which are Diester-Overstrom, the balance being Wilfleys. Dorr settling-tanks are used for thickening the flotation feed and American disk filters for dewatering the lead and zinc concentrates. Fine grinding is accomplished by a 6- by 16-foot Hardinge ball-mill.

Water-power is derived at the mill from the overflow of that developed at the company's central power plant at Sandon, as well as from Miller creek. In addition to this, electrical power is transmitted at 2,200 volts from the Sandon plant. This current is used without trans-



formation on the large motors and is stepped down to 220 and 110 volts for the small motors and lighting. The installation at the central plant consists of a Canadian Westinghouse 200-kw. 3-phase a.c. generator at 2,200 volts and 60 cycles. This is driven by a 400-horse-power Pelton-Doble tangential wheel, as is also a 746-cubic-foot Canadian Ingersoll-Rand compressor, which latter delivers power to the mine in the form of compressed air at 100 lb. pressure. On account

of water shortage during the winter months a 200-horse-power semi-Diesel type of crude-oil engine has recently been installed.

Throughout the season the company has given steady employment to about 100 men between the mine and mill.

The *Rambler-Cariboo* mine was successfully operated by W. A. Cameron and associates under a lease during the greater part of the season. The *Rambler-Cariboo* Mines, Limited, which owns the property, resumed operations on October 15th.

The *Rosebery-Surprise* Mining Company derived its output from the *Bosun* mine near New Denver. Other properties belonging to this company—namely the *Surprise* and *Monitor*—were worked by leasers.

Of the properties operated by Clarence Cunningham, an average number of nine men were employed at the *Van Roi*, about four at the *Queen Bess*, and twenty-one between the *Wonderful* and *Sovereign*.

The large mill at Alamo was operated one shift from August 1st until the end of the year, with the exception of one week, due to extremely cold weather.

Wonderful. Situated near Sandon. Ore was encountered in the continuation of B level to the west. After drifting on this for about 150 feet a fault was struck and the vein lost. However, drifting was continued along the strike of the fault and the vein was picked up again in a distance of 160 feet. Here the vein, striking east and west and dipping at an angle of about 70° to the south, shows a width of about 8 feet of low-grade milling-ore. The ore, consisting of galena and zinc-blende with a quartz gangue, is irregularly distributed through the vein in streaks and small bunches. It is reported that the values are gradually improving as development proceeds. At the beginning of August this ore-shoot had been drifted on for about 150 feet; stoping was commenced and the ore shipped to the concentrator at Alamo.

The early history of this mine is somewhat unusual. Galena float was first found to be freely distributed through the surface wash covering the hillside, and in 1895 the property was worked, not as a lode mine, but as a placer-deposit, when 400 tons of high-grade silver-lead ore was recovered by ground-sluicing methods. Hopes were always entertained of finding the vein in-place and a lot of underground work was done in an endeavour to pick it up, but without any marked success. It was not until recent years that Clarence Cunningham located it on B level at a considerable distance farther into the hill and to the west of the old workings.

Ruth. During the early part of the summer this property was worked by leasers and in the fall was acquired by R. H. Stewart, R. S. Lennie, and associates, of Vancouver. A considerable tonnage had been won by the leasers from the old workings below the No. 2 and No. 3 levels. The work done by them just below the No. 2 level disclosed ore which had been missed when the mine had been operated many years ago; the reason being that the vein had been faulted by an almost flat fault, which displaced it about 30 feet.

At one time this mine ranked among the principal producers of the Sandon camp, but has been lying idle for many years. Credit is due to the leasers who opened up the No. 3 tunnel last year and disclosed some good showings of ore, which no doubt added to the attractiveness of the property and had a certain influence on the making of the above-mentioned deal. The underground workings are extensive, the mine being opened by five levels, the lowest of which is 600 feet below the outcrop.

The records available show that the production stands at about 17,410 tons of silver-lead ore, 15,000 tons of which was hand-sorted. The silver-lead ore averaged: Silver, 85 oz.; lead, 65 per cent. The mine is credited with the payment of \$165,000 in dividends.

Systematic development-work based on a careful study and knowledge of the structural conditions surrounding the deposit should result in opening up further ore-bodies. It is reported that a new surface showing was discovered late in the year, from which some high-grade ore is now being extracted. A crew of twelve or fifteen men is being employed at the property.

McAllister. At this mine, situated on the North fork of Carpenter creek, some very important and interesting development-work is being done under the management of R. A. Grimes. The development-work on the lowest or No. 3 level includes a total length of drifting of 1,350 feet. In this distance there has been a considerable tonnage of good mill-feed developed, carrying average values of about 29 oz. in silver to the ton.

Unfortunately these workings do not gain sufficient depth on the vein to allow a tonnage being mined which would justify the erection of a concentrator, tramway, power plant, etc.; so it was either a question of sinking or running a 1,600-foot crosscut. The latter course was decided on, and with the help of the Standard Silver Lead Mining Company, which acquired an interest in the property preparations were proceeded with for the driving of this crosscut.

After the completion of the road early in the year work was rushed on the installation of a compressor plant, which consists of a compound Ingersoll-Rand compressor, 734 cubic feet of air a minute. This is driven by a 72-inch Pelton wheel under a head of 700 feet. The water-power is derived principally from two small creeks, from which it is conveyed through 2,054 feet of 12-inch diameter wood-stave pipe to the penstock, and then through 1,350 feet of 10-inch diameter pipe to the valve near the wheel, where it is reduced to 4 inches. The length of the air-line to the tunnel-site is about 5,000 feet, 3,000 feet of which is 4-inch diameter and the balance 3-inch.

In order to ensure the safety of the men during the winter it was necessary to build a snow-shed 600 feet in length along the side-hill. The dimensions of the new tunnel are 8 feet high by 6 feet wide. According to report received at the end of the year, it was in 637 feet. About twenty men were employed during the season.

Situated on Reco mountain at a short distance from Sandon and owned by the **American Boy.** American Boy Mining Company, of Spokane, of which N. E. McColl is secretary, which company was organized some twenty-five years ago. The property has been lying idle for about the last fifteen years. During the time that it was operated it had the record of being a small but steady producer of high-grade silver-lead ore. There is said to be a considerable amount of zincy ore left in the old workings which could not be mined profitably in the old days. With a view to winning this ore the company had a few men at work at cleaning out the No. 5 level, which was badly caved. This and other work will be continued through the winter months.

The vein is a strong well-defined fissure in a slate formation. It has a strike of N. 30° E. and dips at 50° to the south-east. Its width varies, in places swelling to 7 feet. It is opened up by seven levels in a depth of 950 feet. Certain of the levels connect with those of the *Last Chance*, which adjoins the property to the north and is located on the same vein.

This group, comprising the *Daniel*, *Donnelly*, and *Elvira*, is located on Payne **Daniel Group.** mountain at a short distance from Sandon and about opposite the *Wonderful*.

George Gormley, of Sandon, is the principal owner. The property has been lying idle for a number of years and is not being worked at the present time. Exploratory work consisting of about 500 feet of tunnelling has been done in broken and crushed ground in close proximity to an acidic dyke. In the lower or No. 2 level a small pocket of ore was encountered near the dyke, from which a car-load was shipped in 1906, which ran as follows: Silver, 8.9 oz.; lead, 8 per cent.; zinc, 39 per cent.

It would appear that the striking of this ore was more due to luck than to good judgment, for there is nothing to indicate as to where it might lie. It is suggested that, should further work be contemplated, following the mineralized ground near the dyke would be good prospecting and might open up more ore.

This group, comprising two claims, is located on the Carpenter Creek slope of **Victor Group.** Queen Bess mountain and at a distance of about 3 miles from Three Forks, the nearest shipping-point. The property is owned by George Petty, of Sandon.

The area probably covers the north-easterly extension of the *Queen Bess* zone of fissuring. As the surface of the hillside is covered to a depth of 6 or 8 feet with wash it is difficult and expensive ground to prospect. However, George Petty, recognizing the possibilities, decided to uncover the bed-rock in the most likely locality. This he did with the aid of water. The water was conducted along the hillside by a small ditch for a distance of about 1 mile to the claims. From this main ditch trenches were dug down the hill in a V-shaped pattern; water was then diverted through these trenches and the gravel sluiced down the hill, leaving the bed-rock exposed.

After persistent work in this direction, extending over quite a long period, he was rewarded this summer by uncovering a nice showing of ore. Along the bottom of a deep and narrow trench it shows a length of about 12 feet and a width of 6 to 8 inches of solid galena. A sample chipped at random along the length of this showing gave the following returns: Gold, 0.03 oz.; silver, 387.6 oz.; lead, 76.9 per cent.; zinc, 0.7 per cent.

The vein, striking N. 38° E. and dipping about vertically, cuts a slate formation which has a strike of N. 30° W. The trench being very narrow, it was not possible to determine whether the true width of vein was exposed or not. By further trenching the vein was traced down the hill and a tunnel was started at a vertical distance of about 50 feet below the showing. At the time of examination in August the tunnel was only in a few feet and had not penetrated the crushed and decomposed material lying along the outcrop. However, a 3-inch streak of high-grade carbonate ore marked the continuation of the vein. Although the showing is not large, it can be mined profitably and may develop into an ore-shoot of considerable dimensions.

This property is situated on the north side of Carpenter creek at an elevation of about 4,750 feet and at a short distance from Cody. The large quantity of high-grade galena float found in the gravels of Carpenter creek on the *Gem* claim, which at one time was undoubtedly brought down by a big slide, has been an incentive to thoroughly prospect the hillside above in an endeavour to find its source of origin. Ore found on the *Chambers* has led to the belief among some that the float came from the lead on this property, but the fact yet remains to be established. During the season development-work was carried on by W. G. Clark, of Sandon.

Recent work has consisted of prospecting the vein at a point above the *Gem*. Here a crosscut driven into the steep side-hill intersected the vein at a distance of 56 feet, from which point drifting has been continued in a north-easterly direction for a distance of 128 feet. Pockets of ore and small stringers were encountered along this drift, but continuity is lacking, due to faulting and shearing movements, which leave doubt as to the true direction of the vein, while the mineralized sheared ground through which the drift passes suggests that a little crosscutting might be done to advantage along the direction of the cross-fracturing. The face of the drift, which is heading for a point under the *Gem* slide, showed patches and sprinklings of galena in limestone. It will be interesting to observe the results of development in this direction. The ore consists of galena and zinc-blende, some of which is similar in character to that at the *Gem*.

Other work done many years ago on the south-westerly end of the claim has no connection with the above described. It consists of tunnelling and a small stope, from which it is claimed some high-grade ore was extracted.

The *Noble Five* was inactive, with the exception of shipping some zinc concentrates which had accumulated during the first run of the mill a year or so ago.

At the *Reco* a small crew of men was busily engaged in doing exploratory work to find the downward continuation of the vein. It is understood that encouraging results were obtained. The property is owned by J. M. Harris, of Sandon, and has the record of having produced a large tonnage of high-grade silver-lead ore during the earlier history of the camp.

At the *Carnation* a small crew of men was employed at development-work under the supervision of W. G. Clark, who reports that conditions appeared very promising. Work was temporarily discontinued late in the year.

M. Byrne continued work on his lead-placer deposit in the bed of Carpenter creek and shipped about 12 tons of silver-lead ore, the average assay of which ran: Silver, 86.7 oz.; lead, 72.15 per cent.; zinc, 2.6 per cent. to the ton. The property is known as the *Gem*.

Activities were also reported at the *Last Chance*, *No. One*, *Noonday*, *Washington*, *Black Colt*, and *Mountain Chief*.

On the North fork of Carpenter creek work was resumed at the *Jo-Jo*, *Milton*, and *Black Grouse*.

The *Standard* mine near Silverton was worked by a number of leasers, who were responsible for the production of a considerable tonnage of zinc ore, together with about 200 tons of lead ore.

The *Hewitt*, on 4-Mile creek, was also worked by leasers. According to recent reports the results obtained have been satisfactory and it is expected that the property will soon appear on the shipping-list again.

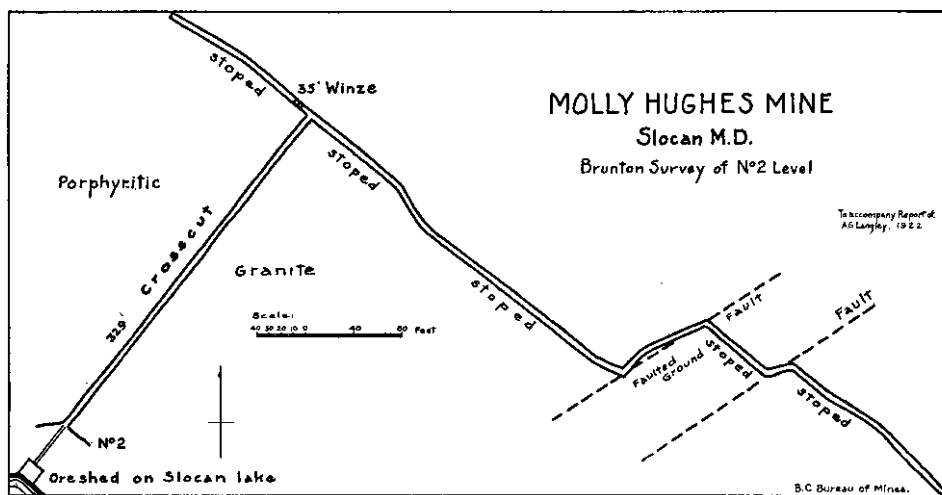
This property is situated within a short distance of New Denver on the edge of Slocan lake. It is owned by H. Clever, of New Denver, and is now being worked under the terms of a two-year lease by F. McDonnell, H. Dimmock, and James A. Greer. Records show that the property was first worked in about 1898 and that the bulk of ore was produced over a period extending from 1906 to the present time. It has

never been worked except by a small crew of men and has been a remarkably steady but small producer of high-grade silver ore, with which is associated small gold values.

To date it has yielded approximately 123,000 oz. of silver, 290 oz. of gold, and about 5,000 lb. of lead. A total of 4 tons shipped during the year averaged the following values: Gold, 10 oz.; silver, 1,884 oz. to the ton.

The vein is a quartz-filled fissure in a porphyritic granite. It has a strike of N. 50° W. and dips at an angle of 60° to the north-east. Its strike almost parallels the shore of the lake. At the No. 2 or lower level the vein has been approached by a crosscut driven from the edge of the lake and at about 15 feet above the high-water mark. This intersects the vein at a distance of 329 feet, from which point the vein has been drifted on in a south-easterly direction for 339 feet, and for almost this entire distance it has been stoped out above the level; the amount of underhand stoping is insignificant. At the end of this straight length of drift a fault was encountered, which was followed and the vein picked up again in a distance of 80 feet to the north-east and drifted on for 66 feet, when another fault threw it a further 23 feet to the north-east; from this latter fault the vein has been drifted on for 165 feet. Small stringers of quartz are showing in the face of this drift.

This latter part of the vein from the first fault has also been stoped out above the level to within short distance from the face. Good values have been obtained from that section of the vein between the two faults and a little underhand stoping has been attempted, at the edge of



which about 6 inches of good ore is visible. In places the stoping has been carried to a width of about 10 feet above the drift, but the best grade of ore is apparently confined to a streak of quartz about 10 inches wide which lies next to the hanging-wall.

The vein has also been drifted on for 159 feet in a north-westerly direction from the crosscut and has been stoped out above the greater part of this distance. At this northerly end of the workings the vein swings slightly to the west and near the face cuts a highly siliceous material resembling aplitic dyke-rock. At this point the quartz does not carry the values it does in other parts of the mine.

It will be seen from the above that the vein shows remarkable continuity, the total amount of drifting being about 700 feet. The best values occur in shoots and evidently more ground was stoped than was necessary during the early history of the mine. According to records, the tonnage shipped was small compared to that which has been stoped. As practically all the ore has been mined above the No. 2 level to the surface, a distance of about 150 feet in depth on the vein, it is now a question of sinking and pumping to win the ore from below this level.

The present leasers have installed a 25-horse-power Deisel-type engine, a 2-drill Ingersoll-Rand compressor, and a pump. It is understood that a 35-foot shaft located near the intersection of the crosscut and drift will be unwatered and mining will be started on a rich shoot of ore encountered in the shaft and showing in the bottom of the drift. The ore principally consists

of massive quartz, through which is disseminated finely crystalline silver-sulphide minerals, associated with a little iron pyrites.

This group, comprising five claims—the *Monarch*, *Manmoth*, *Moose*, *High Ore*, *Monarch Group*, and *Hercules*—is situated on the northerly side of 4-Mile Creek valley and at a distance of approximately 5 miles from Silverton. The principal owners are H. V. Dewis and S. Wetterhuus. The claims are located along a steep side-hill, scored by snow-slide gulches, with narrow rocky ridges intervening. The camp-site is on one of these ridges and a gulch separates it from the workings, which are on another. The vein strikes easterly and westerly, cutting a slate formation.

Open-cuts across the top of a ridge expose a small vein, carrying a streak of a few inches of galena and zinc-blende, in decomposed vein-matter heavily stained with oxide of iron. A sample taken across 12 inches on the westerly side of the ridge ran as follows: Gold, 0.02 oz.; silver, 18.8 oz.; lead, 4.9 per cent.; zinc, 8.5 per cent.

On the easterly side of the ridge at an elevation of 5,700 feet, a crosscut tunnel 33 feet in length has been driven, from the end of which the vein has been drifted on for 34 feet. This tunnel gains a depth of about 75 feet below the highest surface showing on the ridge, but has not been driven far enough to explore the ground under the best showings, and, as yet, not much importance can be attached to this work. A sample taken from a small pile of sorted ore which had been taken from this tunnel ran: Gold, 0.02 oz.; silver, 106.6 oz.; lead, 6.6 per cent.; zinc, 28.8 per cent.

So far not enough work has been done to determine the possibilities of the property, but such an occurrence in a well-mineralized area is worthy of further exploitation.

The Standard Silver-Lead Mining Company, of Silverton, has taken a bond on it and intends to spend a little money upon further exploration-work next season. In anticipation of this a new trail was built from the *Buffalo* to the camp-site and a cabin erected near the workings, so that everything will be in readiness to start work as soon as the snow goes.

The *Galena Farm* is reported to have been bonded to Roy Ainslie, of New Denver.

LIST OF PRODUCING MINES, SHOWING TONNAGE SHIPPED.

Mine.	Locality.	Weight.	Character of Shipment.
		Tons.	
Silversmith	Sandon.....	564	Silver-lead ore.
Surprise	"	35,680	Zinc ore.
Standard.....	Silverton.....	70	Silver-lead ore.
Bosun	New Denver.....	3,944	Silver-lead and zinc.
Rambler	Cariboo basin.....	1,512	{ Silver ore.
Van Roi	Silverton.....	398	{ Zinc ore.
Wonderful.....	Sandon.....	691	Silver-lead-zinc ore.
Queen Bess	Alamo	2,000	Silver ore.
Noble Five	Sandon.....	26	Silver-lead-zinc ore.
Mountain Chief.....	New Denver.....	38	"
Ruth.....	Sandon.....	382	Zinc ore.
Molly Hughes.....	New Denver.....	32	Silver-lead ore.
Metallic	Silverton.....	33	"
McAllister.....	Three Forks.....	4	Silver ore.
No. One	Sandon.....	39	Silver-lead ore.
Noonday	"	29	"
Last Chance.....	"	27	"
Gem	"	25	"
Galena Farm	Silverton.....	13	"
Black Colt	Three Forks.....	11	"
Monitor.....	"	12	"
Payne	Sandon.....	3	"
Mountain Con.	"	1	"
Majestic and Unexpected	"	2	"
Carnation	"	5	"
Alamo	Alamo.....	3	"
Sovereign	"	642	Silver-lead-zinc ore.
Ore Bin	Sandon.....	26	Silver-lead ore.
		1	"

SLOCAN CITY MINING DIVISION.

Ottawa. The *Ottawa* mill on Springer creek, which was designed and built to treat the low grade ore in the large dumps from the mine and had been operating steadily since the fall of last year, was completely destroyed by fire, just at a time when arrangements had been made for handling the material in the No. 4 dump, which was thought to carry better values than that which the mill had been previously treating. It is reported that P. McGuire has taken a lease on this dump.

The *Black Prince* was worked by leasers and a small shipment made. This property was worked steadily during previous years by the late J. T. Tipping, who died during the summer. He was one of the pioneers of the district and his loss will be greatly felt by the community.

W. Creelman and associates packed a small Ross mill in to the *Gold Reef* property near El Oro, on Lemon creek. It is understood that their operations were not successful owing to lack of proper amalgamation, possibly due to inexperience in operating the mill.

Work was again started at the *Meteor* by W. B. Buchanan, and according to last reports very satisfactory results have been obtained.

Ed. Shannon continued development-work at the *Neepawa* on Enterprise creek during the summer.

D. B. O'Neill put in a season at his property, the *L.T.*, and K. Zimmerman at the *Anna*.

Hampton. Situated in the granite area surrounding the headwaters of Springer creek at an elevation of 6,150 feet. A good trail $2\frac{1}{2}$ miles in length leads to the property from the end of the *Arlington* mine road, making a total distance from Slocan City of about 9 miles. The camp buildings consist of a good cabin having accommodation for six to eight men, an old assay office, and stable. The property was being worked under lease by John Wafer, R. Barbour, and T. Maurer, who made a shipment of 22 tons in the fall.

The vein, which has been formed along a fault-fracture, is narrow, but carries high values in silver. It has a strike of N. 40° E. and dips vertically. It has been developed by four tunnels, which gain a total depth of a little over 100 feet below the outcrop. From the uppermost or No. 1 tunnel the ore has been stoped out to the surface, the No. 2 and No. 3 tunnels gain little additional depth and evidently did not succeed in developing much ore, as the ground is faulted and the strike of the vein changes to a north-easterly direction, whereas in the No. 1 it strikes almost due north. In the lowest or No. 4 level, which is about 80 feet lower than the No. 3, the vein has a strike of N. 40° E. and has been drifted on for 110 feet, and consists of a narrow streak of crushed and decomposed granite, in which a stringer of high-grade ore lies next to a massive wall. The ore has a width varying from 1 to 6 inches; the occasional swellings always giving rise to expectation of greater width. The mineralization consists of finely crystalline galena and silver-sulphide minerals associated with quartz and calcite. A sample of the sorted ore for shipment ran: Gold, 0.01 oz.; silver, 505.3 oz.; lead, 10.9 per cent.; zinc, 1.2 per cent.

Other work on this level to prospect what is considered a large vein running in an easterly and westerly direction had not been successful in developing ore in any quantity.

King Jack Group. This group, comprising the *Jack* and *King George* claims on the First North fork of Lemon creek, was acquired by the King Jack Mining Company, incorporated under the laws of the State of Washington, and of which W. F. van Vactor is secretary-treasurer. The outlet to the property is by trail for about 2 miles to the old *Chapleau* mill and thence by road for five miles to the Canadian Pacific Railway tracks at Lemon Creek Siding.

The *King Jack* claim is situated on the north side and near the headwaters of the First North fork. The area is underlain by granite, in which the vein on the *King Jack* strikes in an easterly and westerly direction, dipping at an angle of about 30° to the north. It has been traced by small open-cuts and shallow workings for nearly 2,000 feet. The principal work done consists of an adit run in an easterly direction along the strike of the vein for 242 feet. Here the vein shows a width of about 12 inches of iron-stained quartz carrying specks and small streaks of silver-sulphide minerals. The best values are found where the quartz shows a banded structure and where there is evidence of cross-fracturing.

A small shoot of ore has been stoped to a height of about 50 feet on the dip. At the face of this stope the ore had a tendency to pinch out and did not represent a good mining width, the

average width of the vein being 12 inches. A sample knocked down at frequent intervals along the vein over a length of 21 feet assayed as follows: Gold, 0.42 oz.; silver, 35.4 oz. This was taken opposite the stoped ground and probably is representative of the best grade of ore at this point.

It is the intention of the company to continue this drift with the object of intersecting the downward continuation of an ore-shoot said to be developed by a short tunnel and shaft at a point considerably higher up the hill. These workings being in a caved condition could not be examined.

Other showings which are possibly on the same vein may be seen at the *Duplex* claim belonging to R. Cooper, of Slocan City. Here the vein shows a width of about 2 feet of iron-stained quartz. It has been drifted on for about 168 feet. A composite sample from three separate channel cuts across a width of 2 feet at the end of this drift ran: Gold, 0.06 oz.; silver, 3.7 oz. Several other samples taken along this drift gave similar values. The vein is persistent in strike and well defined and would appear to justify more development, as better values might come in at any time.

A sample of crushed quartz taken from a 20-foot tunnel driven into the bank of the creek some distance below the *King Jack* workings gave the following values: Gold, 1.66 oz.; silver, 18.3 oz. to the ton.

This tunnel is in badly broken ground and gains little depth. An interesting feature was the appearance of a basic dyke in the face. More prospecting is necessary at this point before an opinion can be formed as to the possibilities.

The summer's work consisted mostly of packing in supplies over the summit from Springer creek and building a cabin in preparation for the winter. Time was also spent on road and trail repairs to the Lemon Creek route. According to latest reports they are now operating a 2-stamp mill, which was installed during the latter part of the year. About nine men were employed.

The operations of this company will be observed with interest, for if successful they will have an important bearing on near-by claims and will help to stimulate mining in the Lemon Creek area.

This mine is situated on the First North fork of Lemon creek and is owned by R. Cooper, of Slocan City. The trail leads from the road at a short distance from the bridge across Cameronian creek. At an elevation of 5,350 feet a large iron-stained outcrop occurs along the hillside and can be traced for a considerable distance in a westerly direction. It appears to lie along the contact of an intrusive mass of granite and a slate formation. This iron-stained material on being broken was found to consist, in places, of an intimate mixture of iron, lead, and zinc sulphides, a sample of which, chipped from the surface, ran: Gold, 0.01 oz.; silver, 6.4 oz.; lead, 6.9 per cent.; zinc, 21.9 per cent.

Several short tunnels have been driven which do not throw much light on the character of the deposit. All that can be said at present is that it is a strong and well-mineralized surface showing worthy of careful study and investigation with a view to doing more exploratory work. The property has been lying idle for a number of years and no work is being done at the present time.

LIST OF PRODUCING MINES, SHOWING APPROXIMATE TONNAGE SHIPPED.

Mine.	Locality.	Weight.	Character of Shipment.
		Tons.	
Ottawa.....	Slocan City.....	144	Silver concentrates.
Hampton.....	".....	22	Silver-lead ore.
Anna.....	".....	15	Silver ore.
Arlington.....	".....	13	"
Meteor.....	".....	11	"
Black Prince.....	".....	8	Silver-lead ore.
L.T.....	".....	7	"
Lilly B.....	".....	8	Silver ore.

NELSON MINING DIVISION.

During the year mining activities have been more pronounced in the Sheep Creek area and surrounding country than elsewhere in this Division, although important work was also being done in other parts. Indications point to there being considerably more activity during the coming year.

Nugget Gold Mines. Milling operations this year continued from July to November, the bulk of the ore coming from stopes in the old *Motherlode* workings. A 625-foot raise connecting the upper and lower *Nugget* workings on the *Nugget* vein was completed in December. An entire change in the operation of the *Nugget* mine will now result. The camp is being moved from the *Motherlode* around to the other side of the mountain, adjacent to the old *Nugget* workings; the old workings will be stoped out, the ore being sent down the raise and handled through the *Motherlode* workings to the mill. When the old *Nugget* workings are stoped out mining on the *Nugget* vein at depth will be resumed.

The mill was shut down in November and milling will be resumed next summer, when sufficient ore will have been accumulated to ensure a continuous supply to the mill. The company also intends to continue exploration to the eastward from the face of No. 4 level in the upper workings in the hope of opening up an ore-shoot in the *Nugget* vein correlative with the west ore-body of the *Motherlode*. Development will also be carried on in the *Calhoun* vein, which is parallel to and 40 feet distant from the *Nugget* vein on No. 4 level.

Rumours were current during the latter part of the year that negotiations had been entered into for the amalgamation of the *Nugget-Motherlode*, *Golden Belle*, and *Kootenay Belle* mines; this to be effected by the Sheep Creek Syndicate (1922), Limited, which was formed by heavy shareholders of the *Nugget Gold Mines, Limited*, to consider the principal properties of the Sheep Creek camp. Should this merger be consummated, transfer of the various properties will be made to a new company called the *Selkirks Gold Mining Company*.

During the season a prospecting crew engaged by the syndicate and under the supervision of Arthur Lakes thoroughly prospected an area on the easterly side of the creek, with the result that four veins are reported to have been located. This work was undertaken on the assumption that the prolongation of the present known veins would be found in the formations of the Sheep Creek camp, which repeated themselves in this area. It is the intention of the syndicate to further explore these veins next summer.

Queen. This mine and adjoining properties, including the *Yellowstone* and *Alexandra*, together with twelve claims, have been acquired by the *Yellowstone Mining Company, Limited*, of Victoria. The capital of the company is \$600,000, divided into 60,000 shares of \$10 each. C. W. Irvine, of Independence, Oregon, is president; Fred C. Elliott, of Victoria, secretary-treasurer; and Charles H. Cassill, of Spokane, manager. The *Queen* mine, which has been lying idle since 1916, has the record of being the leading producer of Sheep Creek camp during the period of greatest productive activity in this area. The records show that it produced steadily from 1902 to 1916 and was credited with a total yield of well over \$1,000,000.

Since the present company took hold it has been busily engaged in putting the mill in shape and in unwatering the shaft, preparatory to starting work on the lower levels. At the time of writing it is not known what progress has been made.

Reno Group. This property is situated on Fawn creek at a distance of approximately 4 miles from Sheep creek. It has been referred to in previous Annual Reports; hence only a few notes appertaining to the work being done will be submitted. The *Reno* vein, striking at N. 80° E., runs almost straight up the hillside, which has a slope of about 30°. The surface being covered to a depth of 4 or 5 feet with overburden, a lot of trenching was necessary in order to trace the vein; this having been done, it now remains to prove the continuity of the vein at depth, and this work is now being undertaken. The slope of the hill fortunately allows good backs being obtained to every foot of advance in adit-tunnels.

Some few years ago work was started on an adit driven in the direction of the strike of the vein at an elevation of 6,250 feet. When the vein was said to have been encountered and drifted on for a short distance work was discontinued to do other exploratory work. This tunnel, which is known as the No. 1, was badly caved and could not be examined.

The No. 2 tunnel has been driven at an altitude of 6,400 feet, or at 150 feet vertically above the No. 1 (by aneroid). Recent work on this level struck the vein at a distance of 98 feet from the portal. According to a survey the tunnel lies to the south of the vein for this distance.

At the time of examination in July the vein was exposed along the last 18 feet of this tunnel. At the west end it showed a width of 43 inches, across which a sample was taken giving the following returns: Gold, 2.04 oz.; silver, 1.4 oz. to the ton. Another sample across a width of 2 feet near the face gave: Gold, 4.72 oz.; silver, 1.9 oz. Near the portal of this tunnel there was a pile of 8 to 10 tons of good-looking gold quartz; in a number of pieces of this picked up at random native gold was visible.

Another drift was being run at a considerable distance up the hill and at an elevation of 6,700 feet. It had only been driven for a distance of 24 feet along a streak of decomposed material heavily stained with oxide of iron and said to carry about \$50 a ton in values, but not enough work had been done at this point to enable a definite opinion being formed regarding this occurrence.

It is the intention of the company to clean out the No. 1 tunnel and advance it to develop the ore exposed in the No. 2, and according to recent reports work was being done in this level at the end of the year. It is understood that the No. 2 will also be advanced. Four or five men were employed at the property in July.

The values are encouraging and justify an active programme of development; of which the work now being done is a start in the right direction.

Situated at the head of Kokanee creek at a distance of 10 miles from the West arm of Kootenay lake. The property is owned by the Consolidated Mining and Smelting Company, which acquired it from the La Plata Mines Company in 1910. It has been a steady producer of silver-lead-zinc ore for a number of years, the records showing that shipments were made as early as 1890. In 1921 the lower tram, which is about 4 miles long, was partially destroyed by fire. Incidentally this tram boasted of one of the longest spans in the world, the distance between towers being nearly 1 mile. As the necessary repairs, including the building of twelve new towers and the replacing of long lengths of cable, involved a big expenditure, no attempt was made to undertake them, and the property was leased to W. A. Cameron, of New Denver, who started work at the mine early in June of this year.

The mine camp is situated at an elevation of 7,200 feet, and the mill at 2,200 feet below, in the valley of Kokanee creek. The upper tram connecting the mine with the mill is approximately 8,000 feet long. From the mill the ore was previously transported by the long lower tram to 5-Mile point on the road and then hauled the remaining distance by motor-truck to the landing on Kootenay lake; it is now necessary to haul it the entire distance of 10 miles. Some little delay was caused in starting up owing to the fact that the upper bull-wheel of the mine-tram, which is situated in a wide tunnel and is completely underground, was encased in a solid block of ice, due to seepage from the tunnel above; the air-line from the compressor to the mine also gave a little trouble.

When the property was visited in June the mine had promising ore-showings between the two lowest—namely, the fifth and sixth levels; the most important showing being in an intermediate drift, 100 feet below the fifth level, where a block of ground was exposed which would probably yield between 1,500 and 2,000 tons of good-grade milling-ore. The ore varied in grade and width; in some places it was high in zinc and in others the galena predominated. The width varied from about 6 to 36 inches, the average being about 18 inches. A sample taken across the centre of the stope assayed: Silver, 30.7 oz.; lead, 15.9 per cent.; zinc, 10.2 per cent.

The vein is a well-defined fissure in granite. It is persistent in dip and strike, having been drifted on for over 1,500 feet and developed to a depth of about 1,000 feet below the outcrop. It strikes in a north-westerly direction and dips at an angle 75° to the south-west. In places the walls of the vein are composed of disintegrated granite, which makes it impossible to break down the ore without bringing down a lot of waste with it; these conditions do not, however, prevail throughout the mine. Besides the main vein there is a smaller parallel vein, upon which considerable work has been done.

The concentrator, having a capacity of 100 tons, is well equipped with jigs and tables for gravity concentration. A long picking-belt is a notable feature, as is also a Cascade oil-flotation machine.

During the year ten men were employed at the mine and five at the mill. Some 150 tons of concentrates and 24 tons of crude ore were shipped. Work ceased for the winter on December 14th and will be resumed in the spring. The road was greatly improved during the summer, but there still remains a lot to be done before it will be in good condition for motor-haulage.

Situated near Beasley. This property was visited during the early part of **Monarch Group.** July, at which time three or four men were employed under the direction of C. M. Mohr. Since the property was visited in 1917 1.4 miles of road has been built towards the property from the main road; it is reported that the building of the remaining 1½ miles has been undertaken. A lot of trenching and some tunnelling had been done since the previous examination.

Although this work had not revealed the existence of any further ore-body of commercial importance, more knowledge has been gained regarding the character and possible extent of the deposit. Work at the time was being confined to the driving of a tunnel in a due-easterly direction at a vertical depth of 250 feet below the surface exposure, known as the "glory-hole," and at a distance of about 1,000 feet down the slope of the hill in a south-westerly direction.

This tunnel had been driven for a distance of 100 feet; "garnet rock" and dark basic intrusive rock were encountered in this length, in which chalcopyrite and iron pyrites were sparsely disseminated. In the latter, segregations of chalcopyrite occurred to form patches of good-grade ore. A sample from a small pile of this ore collected near the portal of the tunnel ran as follows: Gold, 0.02 oz.; silver, 1.4 oz.; copper, 6.26 per cent. This probably represents the best grade of ore that could be sorted out.

In places the "garnet rock" is freely stained with epidote, while a narrow band of magnetite was noticed near the contact of the dyke-rock. The mineralization evidently occurs along the zone of contact between an intrusive mass of the Nelson batholith and a band of limestone belonging to a remnant of a sedimentary series, which is exposed in the vicinity of the "glory-hole" workings.

This zone, apparently of considerable width, is defined by the presence of the "garnet rock" and has a north-easterly direction. It has been intruded by basic dyke-rocks, which may be found to have an important bearing on the ore-deposition. The deposit is a contact-metamorphic deposit; hence the occurrence of ore-bodies may be expected to be irregular and the tenor of the ore to vary.

This property, comprising a group of five claims, is situated at a distance of **Porto Rico.** 7 miles by road from Porto Rico Siding on the Great Northern Railway. As an exhaustive report on this property by the late Dr. C. W. Drysdale can be seen in Memoir No. 94 of the Geological Survey, only a brief description of the mine will be given. The buildings at the mine and mill, judging by the remnants, afforded ample accommodation for all requirements. These are now in a state of dilapidation beyond repair, with the possible exception of the office building. The mill building is minus a roof and all the equipment, except the two 5-stamp batteries, two partially wrecked Frue vanners, and a small Blake crusher, has been removed. The tram is also dismantled, while stacks of cordwood adorning the hillside above the mill indicate that operations ceased prematurely.

The vein is a quartz-filled fissure dipping at about 42° to the north-west and striking N. 50° E. towards the summit of the ridge. It occurs (quoting Drysdale) "in augite feldspar porphyrite along the contact of an augite kersantite dyke, which forms the hanging-wall." The average width of the vein is 2 feet. The values are in gold and silver. In 1898-99, when worked by the Canadian Pacific Exploration Company, it yielded \$56,511, representing \$17.21 a ton crushed. In 1903 it was worked by under-lease by G. H. Barnhardt and yielded \$16,000, representing a value of about \$17 or \$18 a ton. In 1915 about \$1,000 in values was extracted by Smith Curtis, which is the last record of any work being done.

The vein has been developed by three adit tunnels driven along the strike of the vein. The No. 1 level is about 300 feet below the summit of the ridge, where the apex of the vein is exposed by shallow open-cuts. The No. 2 level was driven 90 feet below the No. 1 and the No. 3 87 feet below the No. 2. The No. 3 level was the main adit, above which the ore has been stoped out for a distance of about 400 feet, while along the bottom of the drift underhand stoping has been done in places. There is still another level, the No. 4, which is driven at a vertical depth of 85 feet below the No. 3 for a distance of 358 feet along the direction of the strike of the vein. Doubt has been expressed as to whether this drift is on the vein.

Vein-matter was encountered in the drift along a length of about 90 feet, consisting of small bunches and streaks of quartz and calcite. In the face there was about a 2-inch streak of quartz. According to a hurried Brunton survey, it had not been advanced far enough to get under that part of the vein in the No. 3 level which had been underhand-stopped. As apparently some of the best ore had been dug out below the No. 3, and as these holes were all filled with waste, not much information could be gained. Therefore, before doing further development from the No. 4, it might be advisable to clean out some of the underhand stopes and thoroughly examine the vein in the bottom of the level.

All trace of the vein is lost on the surface and in the underground workings at the south-west end, where a schist formation is encountered; beyond this, near the apex of the ridge, its continuation on the summit is indicated by showings exposed in several open-cuts, but the values were disappointing. A sample taken at one of the showings across a width of 30 inches gave the following returns: Gold, 0.02 oz.; silver, 0.3 oz.; this material consists of partially oxidized iron sulphides in a quartz gangue. Another sample taken at one of the other cuts at a short distance to the south-west gave similar returns.

As the geological conditions are similar here to those surrounding the productive part of the vein, more surface prospecting might be done to advantage, and if satisfactory results were obtained the upper levels could be extended to tap this ground. Dr. Drysdale in his report speaks encouragingly of the possibilities of finding extensions of ore-shoots as well as new shoots.

This property, comprising nine claims, is owned by Terzian Bros., of Hall, and **Golden Age.** is situated on the westerly side of the Nelson-Ymir road at a short distance from Wylie Siding. Gold-quartz float found on the lower slopes of the hill has led to intensive prospecting in the heavy overburden in an effort to find the lead. Deep trenching to bed-rock has been extensively carried on and several short tunnels driven.

The result has been the uncovering of a section of vein having an approximate strike of due north. At one place ore was exposed in the bottom of a deep trench, but beyond a length of about 15 feet its extent could not be determined on account of the loose dirt which had fallen in. A sample across a width of 14 inches of earthy oxidized material at the bottom of the trench ran: Gold, 0.18 oz.; silver, 0.7 oz. A grab sample from a small pile of sulphide ore extracted from a near-by place in this trench ran: Gold, 1.20 oz.; silver, 6.2 oz. to the ton. This ore is heavy in iron pyrites, associated with which is a little chalcopyrite.

Whether this section of vein is in-place or not yet remains to be determined by more work. The owners intended driving a short crosscut to mine this ore and to further explore its occurrence. Little knowledge could be gained by examining the few rock-exposures on the lower slopes of the hill. At the top of the ridge, some 1,200 feet above the workings, there are indications of vein-matter and more prospecting at this point would seem advisable.

The formation underlying the area consists of a green schist of the Rossland volcanic series which has been intruded by occasional narrow basic dykes. It strikes to the north-west and dips at 70° to the south-west. According to recent reports the owners have built a short stretch of road to connect with the railway. They certainly deserve credit for their energetic and persistent prospecting.

This group, comprising three claims—*Allouez, Copper King, and Wolverine*—**Allouez Group.** is owned by E. Ballinger and E. C. Smith, of Salmo. The property is situated on the summit of the ridge forming the westerly side of Salmon River valley and is reached by trail from Salmo, the distance being about 6 miles. There is no cabin, shelter being provided by a lean-to.

At an elevation of 4,100 feet a deep open-cut 30 feet in length has been driven across a sheared zone. This sheared material shows copper indications in places and includes a seam of chalcopyrite and quartz a few inches wide. A sample of the ore from this seam ran: Gold, 0.08 oz.; silver, 12.4 oz. to the ton; copper, 6.10 per cent.

The line of shearing has a strike of N. 27° E. and can be traced along the ridge for a considerable distance. At its lower extremity (elevation 3,850 feet) a tunnel is being driven along the strike to further explore the ground under the strongest surface exposure. In the soft decomposed material in which the tunnel has been driven occasional small pockets of ore have been encountered. As yet the tunnel has not been advanced far enough to get under the most promising surface showing.



Sullivan Mine, Kimberley, Fort Steele M.D.—New Concentrator under Construction.



Alpha Group, Golden M.D.

At the *Bayonne* mine work was carried on continuously at driving the long tunnel to develop the vein at depth. The results obtained have not been reported.

At the *Iva Fern*, on Cultus creek, driving the crosscut was continued by the Standard Silver Lead Mining Company, of Silverton, with Jack Mulholland in charge of the work.

The Laib Bros. put in a busy season on trail-construction from their property, the *Spokane* group, to Cultus creek. About 5 miles of the trail is reported to be graded and the balance slashed. The Department of Mines is giving assistance towards the construction of this trail, which, when completed, will benefit properties in the area tributary to Canyon creek by affording an outlet to Kootenay lake.

It is learned that a very promising showing has been uncovered at the *Goodenough*, which is situated near the *Ymir* mine, within about 3 miles of the town of Ymir. It is said that the ore is typical of that which has been mined in the better-known properties of the camp. Work has been suspended for the winter months on account of the heavy fall of snow, which seriously interferes with carrying on further prospecting. The property is owned by O. A. Lovell, A. McDonald, and two other partners.

The *California*, which has been operated by the California Mining Company during recent years, reverted to the owner, W. Moore, of Nelson, upon failure of the above-mentioned company to make their final payment on the purchase price. According to recent reports it has been acquired under option by Seattle interests.

The *Humming Bird* group, situated at the head of 5-Mile creek and belonging to R. Qua and R. G. Joy, of Nelson, according to recent information has been bonded to R. A. Grimes and associates. Construction on a new trail from Apex, on the Great Northern, was started this year.

LIST OF PRODUCING MINES, SHOWING TONNAGE SHIPPED.

Mine.	Locality.	Weight.	Character of Shipment.
		Tons.	
Molly Gibson.....	Kitto.....	62	Silver-lead ore and concentrates.
California.....	Nelson.....	31	Gold concentrates.
Silver Dollar.....	Salmo.....	31	Not known.
United Verde.....	".....	13	Silver-lead ore.
Goldhill.....	Nelson.....	9	Gold-copper ore.
Emerald.....	Salmo.....	119	Lead ore.
Granite Poorman.....	Nelson.....	6	Gold ore.
Nugget.....	Salmo.....	5,645	Gold concentrates.

TRAIL CREEK MINING DIVISION.

ROSSLAND CAMP.

Owing to the closing-down of the Consolidated Mining and Smelting Company's mines in April and the suspension of operations at the *Le Roi No. 2* in January, Rossland has experienced a period of temporary depression. This, however, is alleviated by the announcement by the company that operations will be resumed on a large scale after the completion of the Kimberley concentrator, when the concentration plant at Trail will be available for the treatment of the Rossland ores. So better times may be expected next year in this famous camp.

The *Le Roi No. 2*, Limited, decided not to resume operations at the property after closing down on January 30th, but to enter into negotiations for the sale of its holdings. During the latter part of the year the property was under option, but whether a sale has been consummated is not known. As regards the milling operations of the company since the new plant was installed last year, Douglas Lay, the resident manager, has kindly supplied the following excerpt from the annual report:—

"From the technical standpoint the results were satisfactory, and the proportion of the valuable contents extracted was as large as the economic limit permitted. Greater extraction could have been made, but the additional cost of the increased saving would not have been justified even under improved general conditions. In spite of the important improvements which ameliorated operations towards the end of the campaign, we could not foresee the possibility of

profitable milling under the prevailing conditions and we were obliged to recommend its discontinuance at the end of last January."

The above remarks apply to milling low-grade dump material of a gross value of about \$4 a ton.

I.X.L. This property, situated within $2\frac{1}{2}$ miles of Rossland on the Northport road, has been worked under lease by R. B. Shelledy, J. J. Hawkins, and associates.

It belongs to John S. Baker, of Tacoma. Very rich gold ore has been extracted from the upper part of the vein since recent work was started in 1921. The ore has been shipped to the Bunker Hill and Sullivan smelter at Kellogg, Idaho.

The vein is a small quartz-filled fissure in serpentine. It strikes in an easterly and westerly direction and dips at about 40° . The vein is exposed along the drift for about 50 feet, but with the exception of a small shoot of ore is barren. The ore occurs where the vein has been faulted, which action has caused a displacement of about 3 feet. The gold-bearing quartz has been fractured, which gives it a slightly banded structure. Native gold occurring as flakes along seams in the quartz is plainly visible to the naked eye. Associated minerals are siderite, iron, and copper sulphides.

The last shipment of about 3 tons of sorted ore is said to have yielded nearly 300 oz. in gold to the ton. The shoot from which this was mined is about 16 feet in length and about 8 inches wide. Sinking was being continued on this ore and further exploratory work was under consideration at the time of examination in June. Further reference to this property may be seen in Memoir No. 77 of the Canadian Geological Survey.

This mine, situated near Renata, on the Lower Arrow lake, was worked by **Mountain Chief.** M. McDaniel and a small crew of men during the summer. Since the property was visited in 1918 and during the time it was in the possession of the Mountain Chief Mining Company an aerial tramway some 2,000 feet in length was installed and ore-bins constructed alongside the road at the lower terminals. Good buildings were also erected providing accommodation for about twelve men.

The shaft, which has been sunk to a depth of 100 feet at the southerly end of the long open-cut, is in an extremely hard siliceous limestone and did not develop ore of any consequence; at least, in the first 50 feet, below which it was full of water. On the 50-foot a drift 36 feet in length has been driven due north from the shaft. At the end of this drift an incline raise was being driven to tap the ore exposed at the northerly end of the open-cut. The ground encountered in this raise was a soft, earthy, oxidized material containing stringers of coarsely crystalline calcite.

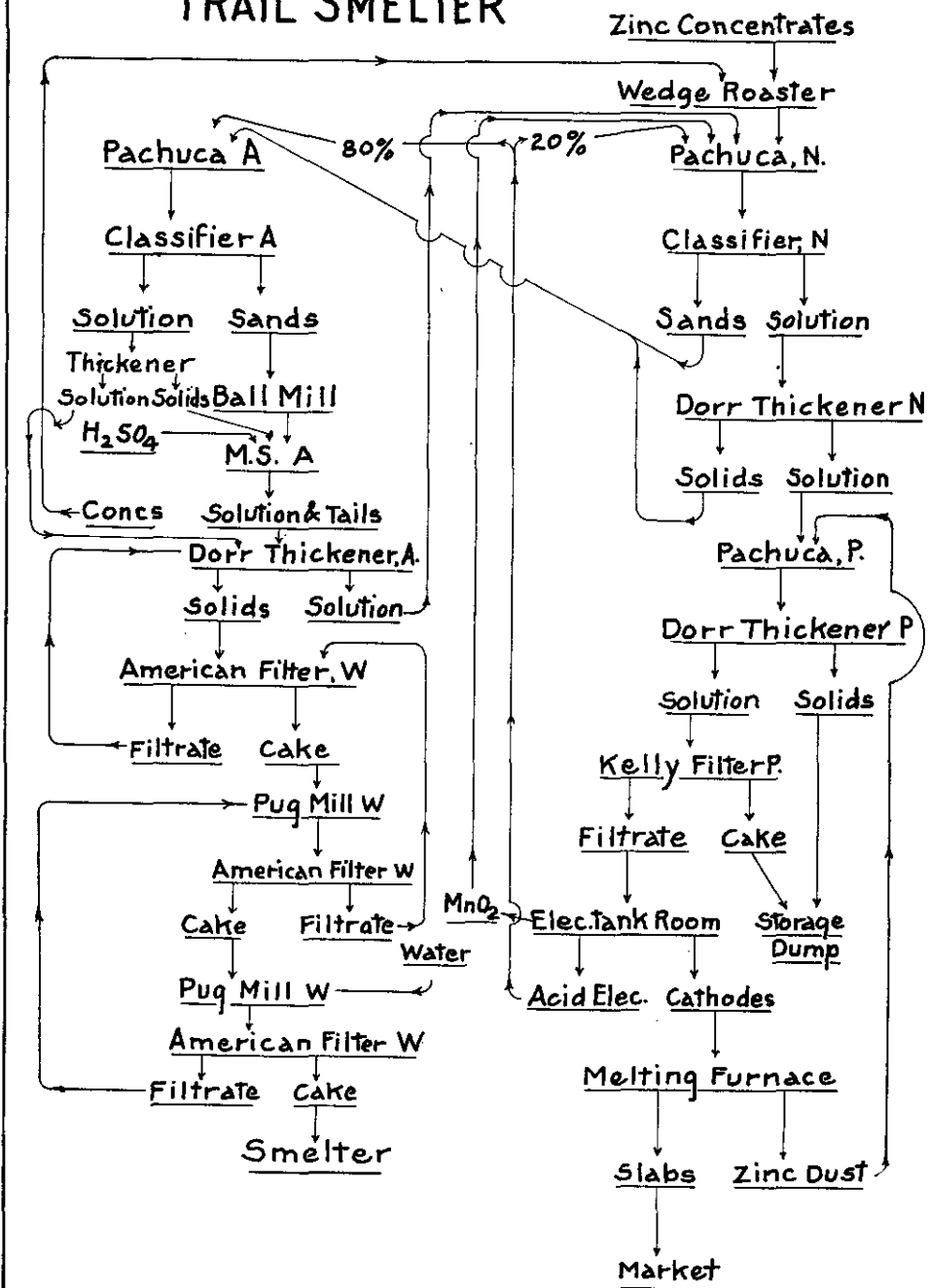
The surface exposure was encouraging; the ore, here presenting a good workable width, apparently had a trend to the south-east and a dip of about 60° to the north-east or away from the underground workings. From this locality M. McDaniels made a shipment of 244 tons, but small-scale operations on a copper-deposit where hand-sorting is necessary did not allow much margin of profit at the prevailing price of copper, and the property was closed down during the latter part of the year. Altogether about 1,000 tons of ore has been shipped from shallow diggings on this property, which have been confined to a small area; this alone suggests that the property has possibilities and is worthy of more thorough and systematic development.

Ore receipts at the smelting plant of the Consolidated Mining and Smelting **Trail Smelter.** Company at once indicate the mining activities of this district, which supplies the large bulk of the ore, every bit of which now finds its way to this smelter, whereas a few years back a considerable tonnage was shipped to American smelters. The principal causes for the change have been due to the introduction of more favourable smelting rates and the acceptance of zinc ores and concentrates, the latter marking a new era in the history of this great plant.

The tonnage received by the smelter this year approximates 411,727 tons, exceeding by a few tons the record established last year. Of this amount, 381,393 tons was supplied by the company's own mines, principally from the *Sullivan*. This output is a little less than last year, as the Rossland mines have been inactive pending the completion of the new concentrator at Kimberley.

However, the decrease in shipments received from the company's own mines has been more than balanced by that from custom shippers, who have contributed 30,334 tons. As far as tonnage goes, this last figure looks very small in view of the other figures, but it must be remembered that a large proportion of it is made up of high-grade silver-lead and zinc concentrates, while

ZINC PLANT FLOW SHEET TRAIL SMELTER



To accompany Report of
A.G. Langley, Resident Mining Engineer, 1922.

the fact that it is contributed by about eighty shippers, of whom sixty-six are operating in this district, is significant.

The plant erected for the treatment of custom zinc ore was completed on June 1st. It comprises a complete roasting and leaching plant as a separate unit, with a capacity of 30 tons. Among the improvements made during the year the following are probably the most important: The lead-refinery has been enlarged to a capacity of 150 tons of refined lead a day. The silver-refinery has necessarily had a corresponding enlargement made. The electrolytic-zinc refinery has had its capacity enlarged to 100 tons of refined zinc a day. The machine-shop and foundry of this plant are said to be the largest and most complete in the Province. Hardinge mills, mineral-separation machines, and other machinery for the new mill at Kimberley are now being built at Trail. The machine-shop is equipped with all the necessary lathes, planers, etc., to handle anything from the smallest part of a flotation-machine to the largest Hardinge mill. The new foundry building is 70 by 96 feet, ground dimensions, and is built of steel and concrete. It will have two cupolas, a core-drying oven, and a brass-foundry. About 1,200 men are steadily employed by the company at this smelting and refining plant.

The new schedule and charges for the treatment of zinc ores, which was given out by the company in April, provides for the payment of zinc ores on a sliding scale, depending on the zinc content, at the London Metal Exchange spot quotation for G.O.B. smelter, less 3.6 cents a pound. For example, an ore containing 50 per cent. zinc, 85 per cent. of the zinc is paid for, and for an ore containing 30 per cent. zinc, 60 per cent. of the zinc is paid for. On ores and concentrates other than flotation concentrates a charge of \$1 a ton of ore is deducted from the zinc value.

Should the residues, after leaching, contain sufficient values in gold, silver, and lead to pay for smelting, the following percentages of the values are paid for: 80 per cent. of the gold and 80 per cent. of the silver. The lead contents are determined by the wet method of analysis, from which is deducted 5 units or 100 lb. of lead per ton of ore, and then 80 per cent. of the remainder is paid for. The charges for smelting residues increase as the zinc content decreases. For instance, the charge for a dry ton for smelting residues is \$5 for an ore carrying 50 per cent. zinc and \$8.50 for a 30-per-cent. zinc ore. The schedule for the treatment of lead ores was modified by a reduction in the charge for marketing and refining from 1½ cents a pound to 1¼ cents a pound, and the zinc penalty was reduced from 50 cents a unit to 30 cents a unit of zinc contained in the ore.

REVELSTOKE, TROUT LAKE, LARDEAU, AND ARROW LAKE MINING DIVISIONS.

No operations on a large scale have been carried on in these Divisions, mining activities being chiefly confined to leasing and prospecting. Latterly there has been a more optimistic feeling prevailing in the several mining centres and a marked improvement in conditions is expected next year.

REVELSTOKE MINING DIVISION.

The activities during the season may be briefly summarized as follows:—

The *Lanark* mine shipped 55 tons of silver-lead concentrates in September. Subsequently the mill was shut down and a contract was let to continue the lower tunnel. This work was temporarily discontinued towards the end of the year.

The Waverley Mines Company has had a crew employed on the construction of a section of new road from Flat creek. In the mine the lower tunnel is reported to have been cleaned out.

Ole Sandberg and Gus Hedstrom have built new cabins at the *Snowflake* group on Silver creek and cleaned out the trail. Joe Kirkpatrick and Robert Armstrong did some work on their property on Isaac creek.

In the Big Bend district lode-mining and prospecting generally has been inactive, although gold-placer mining has been continued on Goldstream and French creek by Alec. McRae and L. N. Remillard, Dunc. Fulmore, and associates; also on the Columbia river by Gus. Peterson and Raymond Allen.

Gus Lund and J. Kempe spent part of the season prospecting their claims near Goldstream. E. McBean has been prospecting his properties on Carnes creek. J. C. Montgomery, the owner of the *Montgomery* group on Downie creek, staked a number of claims on Keystone mountain.

**Snowflake
Group.***

This property, consisting of nine claims owned by Ole Sandberg and Gus Hedstrom, of Revelstoke, is situated on the East fork of Silver creek and is reached by a trail 7 miles in length which starts from the Canadian Pacific Railway tracks 2 miles west of Albert Canyon. The claims staked are on the north-westerly continuation of the *Woolsey* vein, geological conditions and ore occurrence being almost identical on both properties. The *Woolsey* group was described in the Annual Reports for 1918 and 1919. The elevation of the *Snowflake* camp is 5,500 feet above sea-level, or 3,300 feet above Albert Canyon. New cabins were being built at a convenient distance from the workings when the property was visited in September.

The vein, 12 to 17 feet wide where examined, is a quartz-filled fissure conforming to the stratification of the enclosing carbonaceous slates and is remarkable for its persistence and continuity, being easily traceable for thousands of feet north-westerly up the mountain from the *Woolsey* workings. The vein dips at 40° to 50° to the north-east. The elevations along the outcrop range from about 5,800 feet at the south-easterly end of the claims to about 7,000 feet on the summit. One claim has been staked beyond the summit.

The principal ore-mineral is argentiferous galena occurring in streaks, bunches, and disseminations in the quartz, the associated minerals being zinc-blende and pyrite, which do not appear to be intimately mixed with the galena. The ore, therefore, is chiefly of the concentrating variety, though some high grade could be mined for shipment.

The workings examined, consisting of open-cuts scattered along the outcrop for several hundred feet, are at the south-easterly end of the claims on the ground adjoining the *Woolsey* group. At 6,000 feet elevation an open-cut shows a width of 1 foot of nearly solid galena on the foot-wall. A short distance to the south-east and a little below it an open-cut shows the vein 12 feet wide, with from 1 to 1½ feet of nearly solid galena on the foot-wall, with several feet of milling-ore on the hanging-wall.

Continuing south-easterly a short distance and a little lower down the hill, an open-cut shows the vein 17 feet wide, with 4½ to 5 feet of milling-ore (containing a streak of solid galena) on the foot-wall and 3 to 4½ feet of milling-ore on the hanging-wall. The showings in this open-cut appear to be part of an ore-shoot of appreciable length, possibly several hundred feet long.

Ore sorted for shipment will assay from 50 to 80 oz. in silver, 40 to 60 per cent. lead, and 4 to 6 per cent. zinc. The values to be expected from the milling-ore are indicated by a milled sample of 30 lb. taken across a width of 9½ feet on the adjoining *Woolsey* property, which assayed: Silver, 6.6 oz.; lead, 6 per cent.; zinc, 4 per cent.

From the cursory examination made it would appear that further work is required to determine the character and continuity of the deposit; the future of the prospect depending on the development of a large tonnage, having in view the ultimate erection of a concentrator. It would be premature to elaborate on future operations, but it may be said that the property has many natural advantages, as it can be developed at depth by tunnelling; there is a plentiful supply of mining timber available, while the economical development of water-power on Silver creek should present no difficulty.

BIG BEND DISTRICT.*Placer-mining.*

Of the many creeks in the Big Bend district which have been worked for placer gold, French creek is the most important historically and in point of recorded output. This creek is a tributary of Goldstream, which flows into the Columbia river about 70 miles north of Revelstoke. The placer-diggings date back to 1865 and 1866, during which years a considerable amount of gold was taken out. This placer excitement then died down, and with the exception of the spasmodic activities of sundry company promoters no important development is recorded until 1897 and 1898, when the French Creek Hydraulic Company spent over \$100,000 on plant, sawmill, buildings, etc. Financial difficulties are said to have been the cause of this company having ceased operations.

Since then placer-mining in the Big Bend has been dormant, except for the efforts of a few miners who have never lost faith in the district and who still continue the search for pay-dirt. Among these may be mentioned L. N. Remillard, Dunc. Fulmore, and associates, who own the *Goat* and *Gopher* bench leases on the western side of French creek about a mile up from Goldstream. Mr. Remillard has been exploring this ground since 1910, the work done by him and associates including a considerable amount of drifting and sinking. The present workings

are along what appears to be an old channel following an irregular course more or less parallel to the existing bed of French creek. From a casual inspection of the ground it would appear that French creek has been gradually forced easterly to its present position, occupying successive channels, which in turn became blocked by boulders and detached masses of country-rock. The results of recent work are encouraging and indicate possibilities of developing a block of ground which might justify hydraulic operations, providing water-power can be developed economically from French creek. The owners intend to thoroughly test the ground, however, before anything else is attempted.

Among others who have great faith in the placer possibilities of the district is Alec. McRae, who has been prospecting around Camp creek for many years. Last summer Mr. McRae was drifting in the northerly bank of Goldstream about $1\frac{1}{2}$ miles from the Columbia river. In the drift the ground is composed of hard cemented gravel and glacial drift containing some garnets and small amounts of gold. Previously Mr. McRae diverted the water by building a wing-dam and sunk a shaft in the bed of the stream, but unfortunately this work was damaged at high water and the shaft flooded.

Raymond Allen's placer-diggings are situated on a bench on the eastern side of the Columbia river about a mile northerly from Goldstream. Mr. Allen has lived and worked there almost continuously since 1884 and is the oldest timer in the Big Bend. Single-handed he has accomplished a large amount of work, including the construction of some 4 miles of ditch and 3,000 lineal feet of sluice-boxes built at different times. Mr. Allen sawed all the lumber for his cabin and for the sluice-boxes in a sawmill built by himself. This mill, now disused, was driven by an 8-foot overshot water-wheel. The construction of this plant affords a striking example of mechanical ingenuity. Adjoining the cabin there is a neat little garden containing wheat, potatoes, turnips, and other vegetables, which, with occasional supplies from Revelstoke, make the owner independent of the outside world. There is no information available as to the amount of gold recovered by Mr. Allen in all these years, but his workings cover a considerable area of ground.

Groundhog Basin.*

The Groundhog basin lies at the head of McCulloch creek, a tributary of Goldstream, about 75 miles from Revelstoke. This old quartz camp, where some forty-one claims were staked in 1895 and 1896, has been abandoned for over twenty years, but taxes are still being paid on five Crown-granted claims alluded to below. The country surrounding the basin is very beautiful, with open grassy slopes and scattered small evergreens, giving it a park-like appearance. Old placer-workings extend close up to the basin on the upper portions of McCulloch creek, Graham creek, and French creek, tributaries which drain the high ground towards the south-west, north-east, and south respectively.

The claims staked cover an area approximately 4 miles in length by 2 miles in width, the elevations ranging from 6,000 to 7,000 feet above sea-level. Throughout the area staked numerous outcroppings of quartz occur in a schist formation, the general strike of which is north-westerly, with strata dipping at low angles to the north-east. There is evidence of intense glacial erosion, the formation being considerably disturbed in places. Especially is this disturbance of the strata noticeable towards the French Creek slope.

The quartz-outcroppings appear to belong to two systems—the first series cutting the formation in a northerly direction, with steep dips to the west; the second series conforming to the stratification of the enclosing rocks. In the latter case the quartz-bodies apparently occur as lenses in the schists and attain greater widths than those cutting the formation. The mineralization consists of auriferous pyrites and in some places (chiefly in the leached and oxidized quartz) specks of free gold. Work, to any extent, has only been done on the *Ole Bull* and *Orphan Boy* groups.

Ole Bull Group.*

This group, owned by English interests represented by E. C. Erbslow, consists of the *Ole Bull*, *Ole Bull Fraction*, *Big Bend Belle*, *C.O.D.*, and *Bear Fractions*, all Crown-granted. On the *Ole Bull* claim an incline shaft was sunk 100 feet on a quartz vein which cuts the formation in a northerly direction, dipping at about 80° to the west. At the collar of the shaft, which was full of water, there is 18 inches of quartz mineralized with pyrite and some free gold in the leached portions. Below the quartz on the foot-wall there is 18 inches of decomposed and honeycombed schist which, on panning, showed numerous colours. A sample across the 18 inches of quartz gave: Gold, 0.32 oz.; silver, 0.7 oz.

Exposed in open-cuts and stripping on the same property there are many other quartz-showings containing varying amounts of pyrite, but it can only be demonstrated by development if there exist any ore-bodies of economic value. It is understood that the English company, which in 1896 acquired the property from Gus Lund, systematically sampled the shaft and surface showings, but no information is available as to the results obtained.

*Orphan Boy Group.**—On account of stormy weather, which seriously interfered with the examination of the Groundhog basin, this old abandoned property was not visited. The writer was informed, however, that the development chiefly consisted of short tunnels which are now caved and inaccessible. The quartz-showings are said to show much the same characteristics as noted throughout the basin.

Monarch Group.* This group, consisting of five claims owned by G. Lund and J. Kemps, is situated on the eastern side of the Columbia river a short distance above the mouth of Goldstream, 70 miles north of Revelstoke. The rocks in the vicinity consist of serpentine interbedded with graphitic and talcose schists having a north-westerly strike parallel to the Columbia river and dipping at 25° to 40° to the north-east, or into the hill. A short distance to the east there is a wide belt of limestone which is well exposed in the imposing falls on Goldstream, about a mile from the Columbia river.

The development done is chiefly on the *Monarch No. 4* claim, about a mile north of Goldstream, and consists of three short crosscut tunnels. About 150 feet above the Columbia River level the lower tunnel, 115 feet in length, crosscuts several layers of talcose material and serpentine interbedded with graphitic and talcose schists. Close to the portal of the tunnel there is a width of 7 feet of material which, on analysis, proved to be a tale of very fair quality, except that it contains too much iron to be used as a filler for paper. The iron appears to occur as small grains of magnetite, which might be largely removed magnetically did the value of the material justify it, which unfortunately it does not, being so far from transportation. The analysis is as follows: Silica, 61 per cent.; iron oxide, 4.9 per cent.; alumina, 0.6 per cent.; magnesia, 32 per cent.; lime, trace; loss on ignition, 1 per cent. Three other samples representing widths of 6 feet, 12 feet, and 30 feet of similar material from the same tunnel, on analysis, proved to be not tale and valueless.

Higher up the hill and a short distance from the lower tunnel there are outcroppings of serpentine containing stringers and veinlets of asbestos of the actinolite variety. At this point glacial erosion of the rocks has been severe and a crosscut tunnel driven just below an outcrop of serpentine came into gravel on being driven a short distance. Outcrops of serpentine, from 200 to 250 feet above and parallel to the Columbia, can be traced to within a short distance of Goldstream.

There are also some quartz-outcrops on the claims, one of which, 15 feet wide on the *Monarch No. 1* claim, was crosscut by a short tunnel. The lower 6 feet of the showing contains pyrite and is considerably leached and decomposed. A sample across the 6 feet, however, gave but negligible results on assay.

J. and L. Group.* This group, consisting of five claims owned by E. McBean, of Revelstoke, is situated on the southern side of the East fork of Carnes creek, half a mile above its intersection with the main creek. Carnes creek joins the Columbia river at a point about 24 miles northerly from Revelstoke. The trail, 9 miles in length from the Columbia to the mine cabin, gains in that distance an elevation of 1,050 feet above the river, or a total elevation of 2,650 feet above sea-level. The formation, consisting of schist and limestone, shows uniformity. The strike is N. 65° W. and dip from 30° to 50° to the north-east. The vein, conforming to the stratification of the enclosing rocks, follows a contact between schist and limestone, cutting diagonally up and around a shoulder of the mountain in a south-easterly direction from the creek. The hanging-wall of the vein is schist and the foot-wall is limestone. The vein, from 4 to 10 feet in width, is apparently of the bedded-fissure type, being well defined, with, in places, distinct gouges on both walls.

The ore is a complex mixture of iron, zinc, and lead sulphides, carrying gold and silver values. The solid sulphide ore occurs in the vein in bands from a few inches up to 3 feet in width; but in places the vein is entirely decomposed. The gold values are apparently associated with the iron sulphides, which predominate in the ore, the silver probably being chiefly associated with the galena. In two places assays of samples gave from 0.5 to 0.8 per cent. copper, in

addition to gold, silver, lead, and zinc. Numerous other samples, however, did not contain any copper.

The vein was first encountered at the creek, but little work was done at this point. The highest workings are 1,800 feet above the creek. Commencing at the highest point near where the vein crosses the summit of the ridge, and gradually descending towards the creek and going around the mountain towards the north, the development and ore-showings examined are as follows:—

Near the summit of the ridge, or 1,800 feet above the creek, the vein is 5 feet wide where exposed in an open-cut. Some 800 feet north-westerly along the outcrop and 1,700 feet above the creek an open-cut shows 6 feet of ledge-matter, with, towards the hanging-wall side, a band of solid ore 8 to 10 inches wide. A sample across 8 inches gave: Gold, 0.8 oz.; silver, 0.8 oz.; copper, *nil*; lead, *nil*; zinc, 4 per cent. The earthy decomposed ledge-matter on each side of the solid ore gave but negligible results upon assay.

At 1,600 feet above the creek and 170 feet north-westerly 2 feet of solid ore is exposed in an open-cut. A sample across 2 feet gave: Gold, 0.36 oz.; silver, 2 oz.; copper, *nil*; lead, *nil*; zinc, 3 per cent.

At 1,550 feet above the creek and 575 feet farther north-westerly an open-cut shows 8 feet of solid ore and disseminated mineral in decomposed ledge-matter. The solid ore is in two bands, each 18 inches wide on hanging-wall and foot-wall respectively. A sample across the 8 feet gave: Gold, 0.24 oz.; silver, 4.5 oz.; copper, *nil*; lead, 2 per cent.; zinc, 2 per cent.

At 1,500 feet above the creek and 175 feet farther to the north-west an open-cut shows the vein to be nearly 9 feet wide, with bands of solid ore on foot-wall and hanging-wall, samples of which gave as follows:—Across 2½ feet on hanging-wall side: Gold, 0.3 oz.; silver, 2 oz.; copper, *nil*; lead, *nil*; zinc, 5 per cent. Across 1 foot on foot-wall side: Gold, 0.26 oz.; silver, 1.2 oz.; copper, *nil*; lead, trace; zinc, 3 per cent. Upon assay the 5½ feet of parting proved to contain no values. The ore, however, would break freely from the waste.

At 1,220 feet above the creek and 1,000 feet farther to the north-west there is a tunnel 90 feet long which crosscuts the vein at a depth of 60 feet below the outcrop. From the end of this crosscut a winze has been sunk 125 feet on the vein, which is here from 5 to 6 feet wide, much crushed and decomposed. Throughout the lower 80 feet of the winze there is a band of solid ore, 6 to 20 inches wide, close to the hanging-wall. A sample across 6 feet at the bottom of the winze gave: Gold, 0.32 oz.; silver, 3 oz.; copper, *nil*; lead, 3 per cent.; zinc, 2.5 per cent.

At the top of the winze the vein was drifted on 80 feet south-easterly. The vein in this drift is soft and entirely decomposed for a width of from 4½ to 6 feet. A sample across 4½ feet gave: Gold, 0.6 oz.; silver, 6 oz.; copper, *nil*; lead, 8 per cent.; zinc, 2 per cent.

At about 1,100 feet above the creek and 760 feet horizontally around the hill to the north there is an open-cut which shows 2 feet of solid ore against the hanging-wall, with some oxidized ledge-matter below it. A sample across the 2 feet gave: Gold, 0.30 oz.; silver, 0.8 oz.; copper, *nil*; lead, *nil*; zinc, 2 per cent.

At 970 feet above the creek and 675 feet farther round the hill towards the north an incline shaft has been sunk 135 feet on the vein, which is 4 feet wide. Throughout the lower 75 feet of the shaft there is a band of solid ore from 1½ to 2 feet wide along the foot-wall, the schistose ledge-matter on the hanging-wall being crushed and stained from oxidation. The upper part of the shaft contains streaks of solid ore in decomposed ledge-matter. Assays from the incline gave the following results:—Across 1½ feet of ore from bottom of shaft: Gold, 0.42 oz.; silver, 9 oz.; copper, *nil*; lead, 8 per cent.; zinc, 6 per cent. Across 2 feet of ore 50 feet up from bottom of shaft: Gold, 0.26 oz.; silver, 8 oz.; copper, 0.5 per cent.; lead, 4 per cent.; zinc, 7 per cent.

At about 610 feet above the creek and 665 feet northerly around the hill there is 2½ feet of solid ore exposed in a short tunnel, an average sample of which gave: Gold, 1.14 oz.; silver, 1.5 oz.; copper, *nil*; lead, 1 per cent.; zinc, 9 per cent.

At 510 feet above the creek and 160 feet northerly along the outcrop there is a tunnel 217 feet in length. The first 100 feet of this tunnel, having been driven in the limestone footwall, does not expose the vein, but a change of direction just beyond this point brought the vein into the tunnel, showing an average width of about 2 feet of ore containing considerable zinc-blende. A sample across 2 feet, 160 feet from the portal of the tunnel, gave: Gold, 0.30 oz.; silver, 7 oz.; copper, *nil*; lead, 9 per cent.; zinc, 20 per cent. A grab sample from a large pile of ore

outside the portal of this tunnel gave: Gold, 0.62 oz.; silver, 8 oz.; copper, 0.7 per cent.; lead, 8 per cent.; zinc, 14 per cent.

In addition to the workings along the section of the outcrop above described, there are a number of other open-cuts which, together with the workings mentioned, trace the vein at short intervals for over 5,000 lineal feet. In these open-cuts, which have been omitted in the description, the vein shows much the same characteristics as noted above, the mineralization being remarkably persistent, indicating ore-bodies of great length. The average width sampled was 32 inches, but milling values would probably extend over a good stoping width in many places. The average in gold and silver (taken at 65 cents per ounce) gave \$10.90. Owing to lack of time an examination of the workings between the lower tunnel and the creek (750 lineal feet) could not be made, but the writer was informed that the vein was traced throughout by open-cuts and stripping, with good ore-showings in places.

Transportation would not present a difficult problem, as the country traversed between the Columbia river and the property is of the easiest description for wagon-road construction, with only two short-span bridges required in the entire distance. As the elevation of the cabin is only 1,050 feet above the river a very easy grade is obtainable.

Adequate water-power for mining and milling could probably be developed economically at the intersection of the East fork and Carnes creek, half a mile below the property. There is an abundant supply of mining-timber on the claims.

Providing a satisfactory solution of the treatment of the ore can be made, the *J. and L.* group would seem to have the makings of a mine with some life in it.

TROUT LAKE AND LARDEAU MINING DIVISIONS.

While there were no new developments of striking importance, there was a slight increase in mining activity; this, together with the more optimistic feeling prevailing and the improvement in marketing conditions, surely presages a renewal of activity in this well-mineralized area.

A number of properties were examined and investigated by Major Armstead, of New York, with the result that the *Cromacell* group was acquired by him and a long tunnel is being driven to explore the vein at depth. A. Garrett, a pioneer mining man of the Trout Lake district, is in charge of the work. Should the results of this work come up to expectations, it is understood that an extensive scheme of development will be decided upon, which may be far-reaching in its effects.

Among other activities the following have been reported:—

True Fissure.—A small crew of men has been steadily employed during the year at development, which consists of advancing the lowest level. It is understood that this work will be continued during the winter months.

Foggy Day, belonging to Mrs. Jowett, of Trout Lake, was bonded to the Silver Crown Mining Company, Limited, of Spokane, which had a small crew of men at work during the season.

J. Kirkpatrick, R. Armstrong, and W. Glenn are interested in a discovery of Iceland spar near the head of Lake creek. M. F. Bancroft, of the Geological Survey, accompanied them to the property. It is understood that the prospects for mining a grade suitable for market conditions are encouraging.

Coarse gold recovered from the gravels of Lardeau creek by Dan Savoy, an old-time placer-miner, stirred up quite a little excitement locally, which resulted in a few claims being staked and a little placer-mining being done. Dan Savoy has been more particularly interested in the possibilities of the gravel-deposit near the mouth of the creek, which forms a flat of considerable dimensions. He informed the writer that it was his intention to thoroughly test this ground with a view to working it on a large scale.

Gus Olson, of Trout Lake, did a lot of work on his placer claim below the canyon on Lardeau creek. Sam Cavanaugh was also placer-mining on the creek above Ferguson.

This group comprising the *Goldenville*, *Ophir*, *Olive Mabel*, and *Foundation*, is situated on the summit of the divide between Gainer and Porcupine creeks, which latter is a tributary to the Duncan river. Leaving Ferguson, the road up the South fork of Lardeau creek is followed to 10-Mile, from whence a trail leads up Gainer creek; then climbs steeply to the summit, skirting the base of a towering ridge of limestone, locally known as the "Lime Dyke," the peaks and ridges of which can be seen far in the distance. This route is circuitous and the claims are reached in a distance of about 18 miles from Ferguson.

On behalf of a Nelson syndicate, C. Woodrow and R. G. Elliott put in a season prospecting the area in an endeavour to determine the possibilities of a series of small gold-quartz veins.

The formation underlying the ridge on which the claims are staked consists of a green schistose rock of igneous origin. In this schist there is a series of small gold-quartz veins, both conforming to and cutting the schistosity of the rock. They occur irregularly and apparently lack persistency in strike. In places high gold values have been obtained, but on account of the narrow widths it is doubtful if any one of them could be mined profitably as an individual deposit.

In places where the frequency of these veins was more pronounced it was thought that the schist and the quartz might carry sufficient values to allow mining on a large scale. In this connection it was stated that they intended to test the ground by trenching and taking large representative samples.

The elevations of the various open-cuts and shallow workings, some of which were done many years ago, range from about 7,500 feet to over 8,000 feet above sea-level. At the latter elevation an old shaft had been sunk, which could not be examined as it was caved and filled with snow, but a sample taken of the best-grade ore from a pile containing about 5 tons gives an idea of the values which might be expected; it ran: Gold, 9.80 oz.; silver, 0.6 oz. to the ton; bismuth, 3 per cent. On account of the caved condition of these old workings not much information regarding the vein could be obtained, but it was evidently a small quartz-filled fissure cutting the formation.

Following down the ridge two shallow shafts had been sunk on two small stringers. A sample taken from a few tons of ore on the dump ran: Gold, 3.06 oz.; silver, 0.6 oz. to the ton; bismuth, a trace. Neither of these samples gave any tellurium. This is mentioned as the ore was thought to be a bismuth-telluride. The ore consists of a honeycombed quartz and a more massive variety with which is associated siderite and a little bismuthinite. The quartz with bismuthinite apparently replaces the siderite and represents a second period of mineralization. A small portable mill would be of great help in testing ground of this nature.

ARROW LAKE MINING DIVISION.

Work was continued at the *Millie Mac*, near Burton City, by H. E. Forster, the owner, and 14 tons was shipped during the year.

The trail to the *Big Ledge* was cut out and it is understood that further work of an exploratory nature was done on the property, which is situated near the head of Pingston creek. A trip could not be arranged to the property this year, but it will be examined next year, unless something unforeseen happens.

NORTH-EAST KOOTENAY DISTRICT.

GOLDEN MINING DIVISION.

REPORT BY G. E. SANBORN, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Golden Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—GOLDEN MINING DIVISION.

Free miners' certificates (ordinary)	82
Free miners' certificates (special)	3
Mineral claims recorded	19
Placer claims recorded	9
Certificates of work issued	13
Conveyances (mineral)	4

WINDERMERE MINING DIVISION.

REPORT BY E. M. SANDILANDS, MINING RECORDER.

I have the honour to submit the office statistics of the Windermere Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—WINDERMERE MINING DIVISION.

Free miners' certificates issued (ordinary)	78
Free miners' certificates issued (special)	1
Claims recorded (quartz)	53
Certificates of work issued	73
Bills of sale, agreements, bonds, etc.	21

SOUTH-EAST KOOTENAY DISTRICT.

FORT STEELE MINING DIVISION.

REPORT BY F. A. SMALL, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Fort Steele Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—FORT STEELE MINING DIVISION.

Mineral claims recorded (Form D)	145
Certificates of work (Form E)	159
Certificates of work (Form I)	22
Partnership agreements	1
Gold Commissioner permits	9
Powers of attorney	2
Agreements of sale	10
Leaves of absence	1
Affidavits filed	304

Revenue.

Free miners' certificates	\$1,617 00
Mining receipts	2,169 60
Total	\$3,786 60

NORTH-WEST KOOTENAY DISTRICT.

REVELSTOKE AND LARDEAU MINING DIVISIONS.

REPORT BY JOHN LEE, ACTING GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Revelstoke and Lardeau Mining Divisions for the year ending December 31st, 1922.

REVELSTOKE MINING DIVISION.

OFFICE STATISTICS—REVELSTOKE MINING DIVISION.

(John Lee, Mining Recorder.)

Free miners' certificates	118
Free miners' certificates (company)	2
Locations recorded	88
Certificates of work recorded	52
Bills of sale recorded 7	10
Powers of attorney recorded	5
Groupings recorded 7	4
Placer claims recorded 11	4

LARDEAU MINING DIVISION.

OFFICE STATISTICS—LARDEAU MINING DIVISION.

(Ernest Roberts, Mining Recorder.)

Free miners' certificates issued	36
Locations recorded	48
Certificates of work issued	75
Bills of sale	4
Notices to group 11	12

Revenue.

Free miners' certificates	\$256 50
Mining receipts	438 25
Free trader's licence	~~15 00~~
Total	~~\$709 75~~

SLOCAN DISTRICT.

AINSWORTH MINING DIVISION.

REPORT BY RONALD HEWAT, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Ainsworth Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—AINSWORTH MINING DIVISION.

Free miners' certificates	164
Free miners' certificates (company)	5
Mineral claims located	94
Certificates of work recorded	280
Bills of sale, agreements, etc.	22
Dredging and placer leases recorded	9
Leases of reverted mineral claims	14

SLOCAN MINING DIVISION.

REPORT BY ANGUS McINNES, MINING RECORDER.

I have the honour to submit the office statistics of the Slocan Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—SLOCAN MINING DIVISION.

Free miners' certificates	134
Claims recorded	30
Assessments recorded	83
Cash receipts	\$3,142 05

SLOCAN CITY MINING DIVISION.

REPORT BY T. McNEISH, MINING RECORDER.

I have the honour to submit the office statistics of the Slocan City Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—SLOCAN CITY MINING DIVISION.

Free miners' certificates issued	64
Certificates of work recorded	72
Locations recorded	33
Transfers recorded	8
Notices to group	8
Marriage licences issued	~~2~~
Poll-tax collected	~~22~~
Resident special firearms licences issued	~~4~~
Resident general firearms licences issued	~~9~~
Resident ordinary firearms licences issued	~~25~~
Receipts	\$864 35

TROUT LAKE MINING DIVISION.

REPORT BY OSCAR JACOBSON, MINING RECORDER.

I have the honour to submit the office statistics of the Trout Lake Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—TROUT LAKE MINING DIVISION.

Free miners' certificates issued (ordinary)	48
Free miners' certificates issued (company)	1
Certificates of work recorded	117
Notices to group filed	24
Locations of mineral claims recorded	33
Locations of placer claims recorded	2
Rerecording placer claims	3
Transfers of mineral claims recorded	14
Transfers of placer claims recorded	2
Lay-overs of placer claims recorded	3
Declaration of work and expenditure, dredging lease	1
Agreements of bonding recorded	1

NELSON DISTRICT.

NELSON MINING DIVISION.

REPORT BY J. CARTMEL, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Nelson Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—NELSON MINING DIVISION.

Free miners' certificates (individual)	373
Free miners' certificates (company)	4
Claims recorded (mineral)	175
Certificates of work recorded (mineral)	132
Agreements, transfers, etc. 7	63

ARROW LAKE MINING DIVISION.

REPORT BY WALTER SCOTT, MINING RECORDER (OFFICE AT NAKUSP).

I have the honour to submit the office statistics of the Arrow Lake Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—ARROW LAKE MINING DIVISION.

Free miners' certificates	44
Certificates of work recorded	16
Mineral claims recorded	8

ROSSLAND DISTRICT.

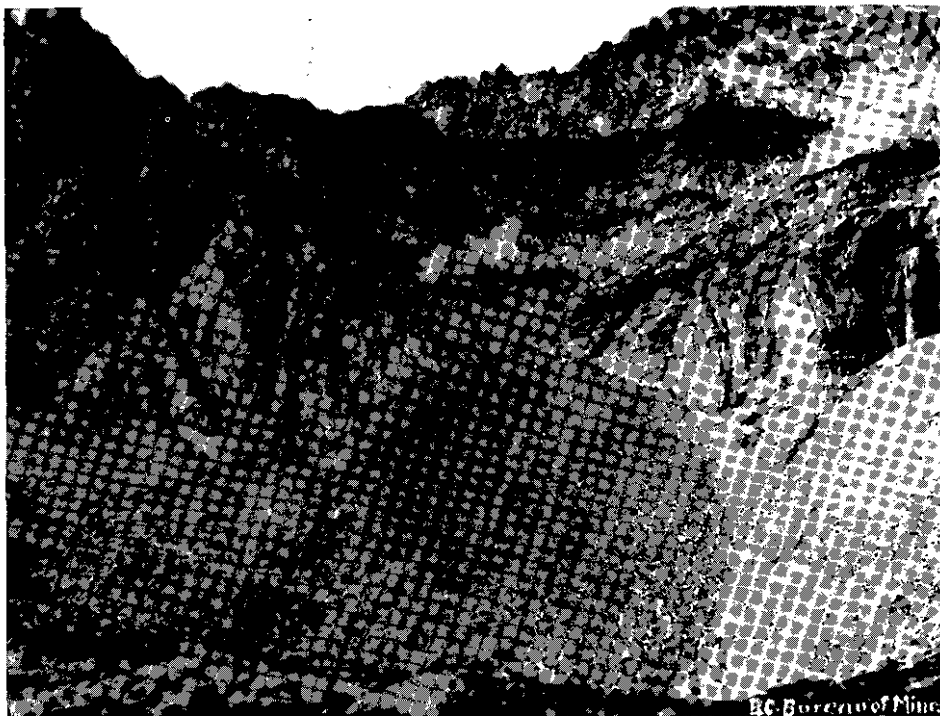
TRAIL CREEK MINING DIVISION.

REPORT BY H. R. TOWNSEND, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Trail Creek Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—TRAIL CREEK MINING DIVISION.

Free miners' certificates (individual)	104
Free miners' certificates (company)	4
Free miners' certificates (special)	1
Mineral claims located	27
Certificates of work recorded 4	52
Bills of sale 2	19
Leases of reverted mineral claims (section 185A, "Taxation Act") 6	7



Steele Group, Windermere M.D.—Tunnel on Hillside.



Steele Group, Windermere M.D.—Workings of.

WESTERN DISTRICT (No. 6).

REPORT BY WM. M. BREWER, RESIDENT MINING ENGINEER.

The Western Mineral Survey District (No. 6) includes the seven most westerly Mining Divisions. These are the Alberni, Clayoquot, Quatsino, Nanaimo, and Victoria Mining Divisions, embracing the whole of Vancouver island; also the Vancouver and New Westminster Mining Divisions, and a portion of the Nanaimo Mining Division, on the Mainland.

INTRODUCTION.

As an introduction to the following annual report on the Western Mineral Survey District (No. 6), the writer desires to express his appreciation for the numerous courtesies and favours that have been extended to him during the past year by the officials of mining companies, prospectors, and others connected with the mining industry, and takes this opportunity to extend his sincere thanks for many kindly acts and the whole-hearted assistance that he has received.

FUTURE PROSPECTS.

The metalliferous-mining industry in the Western District (No. 6) during 1922, if judged merely from the productive view-point, would make a discouraging record. The reasons for non-production are owing to the destruction by fire in 1921 of the concentrating-mill of the Britannia Mining and Smelting Company at Britannia Beach; the closing-down of the *Marble Bay* mine on Texada island; the lack of water for power purposes at the plant of the Tidewater Copper Company on Sidney inlet, on the west coast of Vancouver island; and the failure of the Consolidated Mining and Smelting Company, due to the low price of copper, to erect concentrating plants on their *Sunloch* and *Old Sport* properties, as was proposed by the company about three years ago.

The properties mentioned are the only ones in the district that are sufficiently developed at the present time to rank as producers of copper-gold-silver ore. There are others which possess very promising possibilities, and in the event of an increase in the price of copper some of these will probably be further developed and may later become productive.

The most important feature connected with the metalliferous-mining industry in the Western District during 1922 has been the extent to which development-work has been carried on at the Britannia and Tidewater Companies' properties, detailed descriptions of which will be found later in this report.

The erection of the concentrating-mill at Britannia Beach, to replace the plant destroyed by fire in 1921, is an assurance that during 1923 the production from the Western District will show an increase in copper, silver, and gold.

Proposed operations by other companies and individual owners of metalliferous-mining properties during 1923 indicate such progress in the industry during the coming year that it is quite excusable to feel optimistic with regard to the future.

TALKS TO PROSPECTORS.

In compliance with instructions from the Hon. William Sloan, Minister of Mines, the writer early in the year 1922 resumed the plan inaugurated in 1921 of delivering a series of talks to prospectors and others interested in mining. Between February and April four of such talks were given in each of the following places: Vancouver, Victoria, Duncan, Ladysmith, Cassidy, Nanaimo, Cumberland, and Port Alberni.

The fact that these addresses were listened to by larger audiences than in 1921, especially in Vancouver, Victoria, Nanaimo, and Cumberland, was gratifying and indicated a greater interest in the mining industry than for some years previously, especially by prospectors.

A larger number of prospectors was noticed in the mountains during 1922 than there has been during recent years. Some of these men took advantage of the "Taxation Act Amendment Act, 1916," whereby leases could be obtained from the Government of Crown-granted mineral claims that had reverted to the Crown at tax sales, and in some instances the conditions provided

in the Act for obtaining a Crown grant have been complied with, which should result in the resumption of active operations on some mineral claims that have been idle for several years.

"IRON-ORE SUPPLY ACT, 1919."

From May 22nd, 1922, to June 7th the writer was engaged in supervising the mining and shipping of about 10 tons of magnetite-iron ore, under the provisions of the "Iron-ore Supply Act, 1919," to the Vancouver Engineering Works, Vancouver, who reported that it was used satisfactorily in an electric furnace as an admixture with scrap steel and iron for castings.

This ore was procured from the deposit about 1½ miles above the mouth of the Sarita river, on Barkley sound, which was the most easy of access, and economical as regards transportation, of any of the various deposits of magnetite. An assay of an average sample of the shipment yielded: Iron, 52.4 per cent.; phosphorus, trace; sulphur, 0.2 per cent.; titanium, *nil*; silica, 4.6 per cent.; lime, 7.4 per cent.

Magnetite carrying a higher percentage of iron could have been obtained from other deposits near Barkley sound, but the cost of transportation from these mine-workings would have been considerably greater.

EXAMINATIONS OF MINERAL CLAIMS.

During 1922 about forty examinations of mineral claims were made, located in isolated positions, usually separated by several miles, so it was necessary to travel by launch along the Mainland coast, sailing into Howe sound, Jervis, Toba, Bute, and Knight inlets, also to visit Texada, Quadra, Lasqueti, and Jarvis islands between the Mainland and Vancouver island. This trip occupied twenty-five days in June. Several trips were also made on the Mainland and in the interior of Vancouver island near the east coast. A month was devoted to a trip along the entire length of the west coast of Vancouver island, with side-trips up the various canals and inlets.

Reports on the properties examined will be found later under the heading of the Mining Divisions in which they are situated.

LABOUR CONDITIONS.

It is very gratifying to be able to call attention to the fact that the conditions between the mining operators and their employees have been harmonious.

The marked improvement in the quarters of the employees as compared with a few years ago is most noticeable. In isolated outlying camps where modern conveniences, such as bath, reading and recreation rooms, steam heat, and running water, were unknown a few years ago, these are now found in the buildings occupied by the men and are appreciated by the rank and file of the workers. In the larger camps moving pictures are shown at least once or twice a week.

OUTLINE OF THE GEOGRAPHY AND GEOLOGY.

The geographic boundaries of the Western District (No. 6) have been given in previous reports and need not be repeated.

The geology of portions of the district was described by the late Dr. G. M. Dawson, A. R. C. Selwyn, and James Richardson as early as between 1871 and 1876 in the early Reports, Geological Survey of Canada. Since about 1908 the Geological Survey has given so much attention to the district that, with the exception of the most remote parts, approximately the whole of it has been examined in detail by the geologists of the Survey, and a large portion has been correctly mapped by its topographers. The reports of these examinations have been published from time to time by the Geological Survey and are as follows:—

J. A. Baneroff. Geology of the Coast and Islands between the Strait of Georgia and Queen Charlotte Sound, B.C. Memoir No. 23, 1913.

D. D. Cairnes. The Lime Belt, Quadra (South Valdes) Island, B.C. Summary Report, 1913.

Chas. Camsell. Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet. Summary Report, 1917, Part B.

Charles Camsell. Indian River Copper Deposits, Vancouver Mining Division. Summary Report, 1917, Part B.

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- Charles H. Clapp. South-eastern Portion of Vancouver Island. Summary Report, 1908.
 Charles H. Clapp. Southern Vancouver Island, Summary Report for 1909.
 Charles H. Clapp. Southern Vancouver Island. Memoir No. 13, Canada Department of Mines, Geological Survey Branch, 1912.
 Charles H. Clapp. Nanaimo Map Area. Memoir No. 43, Canada Department of Mines, Geological Series, 1914.
 Chas. H. Clapp and H. C. Cooke. Sooke and Duncan Map Areas, Vancouver Island. Memoir No. 80.
 V. Dolmage. Quatsino Sound and Certain Mineral Deposits of the West Coast of Vancouver Island, B.C. Summary Report, Canada Department of Mines, Geological Survey, 1918, Part B.
 V. Dolmage. Barkley Sound, Vancouver Island, B.C. Summary Report, Canada Department of Mines, Geological Survey, 1919, Part B.
 V. Dolmage. Sunloch Copper District, B.C. Summary Report, Canada Department of Mines, Geological Survey, 1919, Part B.
 V. Dolmage. West Coast of Vancouver Island between Barkley Sound and Quatsino Sound. Summary Report, 1920, Part A.
 W. A. Johnson. Sedimentation of the Fraser River Delta. Memoir 125, 1921.
 O. E. LeRoy. Preliminary Report on a Portion of the Main Coast of British Columbia and Adjacent Islands. Publication No. 996, 1908.
 R. G. McConnell. North-western Portion of Texada Island. Summary Report, 1908.
 R. G. McConnell. Texada Island and Moresby Island, B.C. Summary Report, 1909.
 J. D. MacKenzie. Copper Deposits of Lasqueti Island, British Columbia. Summary Report, 1921, Part A.
 J. D. MacKenzie. The Coal Measures of Cumberland and vicinity, Vancouver Island, B.C. Monthly Bulletin of the Canadian Institute of Mining and Metallurgy, June, 1922.
 S. J. Schofield. Britannia Map Area. Summary Report, 1918, Part B.

The geology of that part of the Western District (No. 6) on the Mainland may be generalized as including the southerly part of the Coast Range granodiorite batholith, in which are several occurrences of stratified rocks—schists, quartzites, argillites, and limestones—representing roof-pendants.

The occurrence of these roof-pendants in the batholith is given prominent mention by Chas. Camsell in his "Reconnaissance along the Pacific Great Eastern Railway between Squamish and Lillooet," published in 1918. An extract from his report is here reproduced for the benefit of prospectors who may have been inclined to neglect the Coast range as a field for prospecting. He says:—

"Geological maps of the western part of British Columbia show the Coast mountains to be made up of a great mass of eruptive rock, mainly granodiorite, forming a belt from 60 to 100 miles wide and 1,000 miles or more in length. Investigations of the past season have shown that in the section across the Coast mountains along the Pacific Great Eastern Railway such a simple condition does not exist, but instead there are several broad bands of stratified rocks—schists, quartzites, argillites, and limestones—which lie in the granodiorite and have been intruded by it. These bands are remnants of the old cover of the granodiorite batholith which were not destroyed at the time of intrusion nor removed by later erosion. They all strike parallel with the trend of the range, and, consequently, their greatest dimension is in a north-westerly direction and their shortest along the line of the railway. The contacts of these bands of stratified rocks with the granodiorite are all more or less mineralized. The lateral contacts are mineralized mainly by copper ores, and on the roof-contacts—that is, where the batholith plunges north-westerly or south-easterly under a roof of stratified rocks—the mineralization is often by the more precious metals.

"The significance of the discovery that large bands of sedimentary and other stratified rocks lie in what was formerly supposed to be nothing but a mass of granodiorite in the Coast mountains is far-reaching, and it is only fair to assume that the other sections through these mountains northward to the Yukon boundary will reveal the same conditions to a greater or less extent. The conditions are most favourable for the occurrence of metallic deposits of copper, lead, zinc, gold, and silver, and the whole interior of the Coast mountains of British Columbia,

therefore, becomes an excellent field for prospecting, and not only the eastern and western borders, as was formerly believed to be the case."

The fact that the *Britannia* mineral-belt, as well as the known mineralized zones in other sections in the Coast range all occur in the Western District is significant, and should encourage prospectors to devote more attention to the Coast range. There is the further fact that portions of both the easterly and westerly contacts of the granodiorite batholith which occur in the district, such as the Tatlayoko Lake and Klinaklini River sections on the easterly contact and the coast-line along the westerly contact, show indications of the occurrence of mineralized zones of sufficient promise to warrant more thorough and systematic prospecting.

The geology of Vancouver, Texada, and adjacent islands is described in detail in the Geological Survey Reports already referred to; therefore it is not deemed necessary to attempt a detailed description in this report.

ALBERNI MINING DIVISION.

The Alberni Mining Division has been prospected during the past thirty years for lode minerals to a greater extent than any other Mining Division on Vancouver island, for two reasons: First, because placer gold was discovered on China creek at an early date, which attracted many prospectors to the district; second, because the Alberni canal, which penetrates Vancouver island in a northerly direction from Barkley sound, enabled prospectors to explore the adjacent mountains more easily.

The result was the staking of a large number of mineral claims, on some of which exceptionally good outcroppings, usually of copper-sulphide ore, occurred, within easy access to deep-water transportation. Some of these mineral claims were developed into shipping-mines about twenty years ago, but further development proving disappointing the mines were closed down. This fact appears to have had such a depressing effect on the mining industry in the Alberni Mining Division that, despite the fact that there are several good prospects of copper ore easy of access to water transportation, but few are to-day being developed and many which have been Crown-granted have either been sold at tax sale or have reverted to the Government, and are now open for lease in accordance with the terms of the "Taxation Act Amendment Act, 1916."

This group of mineral claims, which was sold by H. Davie, of Port Alberni, **W.W.W. Group.** in 1921 to R. G. McLeod, of Vancouver, is situated near the headwaters of Franklin creek and was worked during 1922. McLeod organized a joint-stock company—the Port Alberni Gold Mining Company, Limited—during the winter of 1921–22 and sold sufficient stock to enable the company to start up development-work and purchase a Ross quartz-mill, which was hauled to the mineral claims over the old pack-trail that had been repaired by the company with the assistance of the Mines Department. The mill was erected during the past summer and fall; the old mine-workings cleaned out; the development-work, described in the Annual Report, 1921, was somewhat extended; and comfortable camp buildings were constructed.

As the W.W.W. group of mineral claims was examined during November, 1921, and described in the Annual Report for that year, on page 206, it is not deemed necessary to repeat that description.

The results from further operations on the W.W.W. group of mineral claims are awaited with much interest in that section of the Beaufort range, as there are other known occurrences of gold-bearing quartz veins in the same locality, and any success at the W.W.W. should encourage prospectors to more thoroughly prospect there.

The zone or belt of formation in which the gold-bearing quartz occurs belongs to Dawson's Vancouver group and classified by Clapp as "chiefly meta-andesite and granodiorite with limestone lenses and Sicker schists." This belt apparently extends from the vicinity of the headwaters of the Jump river, about 12 miles north of the lower end of Cowichan lake, where the *Silver Leaf* or *Service* group of mineral claims are situated, in a north-westerly direction along the south-westerly slope of the Beaufort range, towards the head of Alberni canal, and possibly beyond to the vicinity of the head of Taylor arm of Sproat lake and the head of Drinkwater river, which flows into the head of Great Central lake.

The portion of this belt of formation lying south-easterly from Alberni canal is included in the Esquimalt and Nanaimo Railway land grant, in which the title to the base metals is vested in the railway company, with only the precious metals vested in the Crown; but that

portion of the belt north-westerly from the Alberni canal is outside of that land grant, and titles to all minerals come under the provisions of the "Mineral Act."

This mineral claim is situated near Taylor river, about 3 miles above its mouth.

Morning. The claim is a restaking of one of the mineral claims included in the *Columbia* group, which is described by the writer in the Annual Report for 1916. The present recorded owner of the *Morning* mineral claim is A. L. Smith, of Alberni. No development-work has been done on the mineral claim since the examination made in 1916, up to October 20th, 1922, when it was again examined.

It is, however, worthy of note that the quartz veins which occur on the *Morning* mineral claim are apparently in a similar country-rock as the vein on the *W.W.W.* group, and outside of the Esquimalt & Nanaimo Railway land grant. This fact may indicate that the zone maintains continuity in that direction from the *W.W.W.* group, especially when it is considered that about 12 miles farther in a north-westerly direction in the mountainous country between the heads of Bedwell and Drinkwater rivers there occur, under similar geologic conditions, gold-bearing quartz veins. However, as no geological survey in detail has been made, such continuity is only referred to as a possibility worth proving by systematic prospecting.

On Big Interior mountain, about 10 miles north-westerly from the head of Great Central lake, George and Fred Drinkwater spent some time during the past summer prospecting, and located the *Hawk*, *Pigeon*, and *Lark* mineral claims, adjoining the *Big I.* group about a mile from Della lake.

CLAYOQUOT MINING DIVISION.

The Clayoquot Mining Division adjoins the Alberni Mining Division on the north-west. Mining in this Division during 1922 has not shown any marked progress, such as was anticipated early in the past year, when it was reliably reported that the *Prince* group of mineral claims, adjoining the *Indian Chief* group on Sidney inlet, had been acquired by an English or Scotch group of capitalists and that active operations would be started at once. Papers showing a deal had been made were filed in the Gold Commissioner's office in due form, but no work was commenced.

Another reason for lack of marked progress, so far as production of metals is concerned, was the fact that, although the Tidewater Copper Company at Sidney inlet made a determined effort to regularly operate the *Indian Chief* mine, it was so severely handicapped by lack of water for power purposes that it was unable to run the concentrating-mill, except for about two months, during the year, work being practically confined to extending development in the mine.

The climatic conditions on the west coast of Vancouver island generally, and particularly around Sidney inlet, were quite exceptional during 1922. Early in the year such severe frosts prevailed that the harbour in front of the beach camp was so frozen over that the West Coast steamer "Princess Maquinna" could not enter it until a channel had been opened by using dynamite to break away the ice. The spring and summer were so unusually dry that, instead of the precipitation being about 100 inches, as is usual, it was so extremely light that streams and springs which had never been known to fail to provide ample water in the past did not furnish sufficient water for domestic use.

In the Bedwell (Bear) River section, near the head of the river where J. B. Woodworth, of Thorley Park, Vancouver, is operating on the *You* group of mineral claims, he was severely handicapped by the heavy snowfall in that section during the spring, which delayed resumption of the work, suspended in the winter of 1921-22, until late in the summer of 1922.

While some prospecting was done in the vicinity of Kennedy lake and Kennedy (Elk) river, most of the work of this nature was done in the vicinity of Tahsis canal, Nootka sound, by Wm. Poole, who has been prospecting in that section for several years past, and who during 1922 resumed work on the *Star of the West* mineral claim, one of his recent locations.

SIDNEY INLET SECTION.

**Tidewater
Copper Co.** This company, the officers of which are S. P. Silverman, general manager; C. J. Abrams, general superintendent; and Wm. Coulter, mine superintendent, resumed work on the *Indian Chief* group of mineral claims in March, 1922, after about a year's suspension, due to the low price of copper. As the mine-workings on the *Indian Chief* group were fully described in the Annual Report, 1920, page 196,

only the new work done since resumption last spring and examined by the writer in August and September, 1922, will be described.

The development-work in the mine done during 1922 has been chiefly confined to extending the openings on the *Price* ore-body in order to determine the dimensions of that body and open it for stoping. The west drift from the No. 2 adit, at an elevation of about 1,550 feet, where the *Price* ore-body was first exposed by working-openings, had been extended about 160 feet up to August 24th, 1922, and the ore-body exposed for a total length of about 230 feet. An incline winze had been sunk in the ore-body on a 20° angle to a depth of about 200 feet for the purpose of exposing the ore-body on the level of the No. 3 adit, which was about 400 feet easterly from the known easterly boundary of the *Price* ore-body, and it was proposed to extend the No. 3 adit to the easterly boundary of the ore-body in order that it might be prospected and that stopes could be opened on the level of the No. 3 adit, which would then be used as a main haulage-way to the aerial tramway, connecting the mine-workings with the concentrating-mill at the beach.

In the meantime in order to be able to mine ore for immediate delivery to the mill the incline winze was sunk and the ore above the incline mined by the "trap" system. By this system the roof of the incline is timbered and a series of chutes arranged in such a manner that the ore above the roof can be stoped out and dropped into ore-cars on the incline floor, hoisted to the level of the No. 2 adit, and trammed about 1,000 feet to the upper terminal of the aerial tramway at the portal.

The mine superintendent informed the writer that it was also the intention of the management to extend the No. 3 adit in a northerly direction to crosscut the formation between the productive ore-bodies on the southerly side of the property and those which had been developed to a considerable extent on the northerly side, about 800 feet distant from the incline winze on the *Price* ore-body. The level of the No. 3 adit is about 100 feet lower than the mine-workings, on ore-bodies, on the northerly side of the property and the intervening territory is all virgin ground. The surface between the south side mine-workings and those on the north side reaches an elevation of about 2,000 feet above sea-level, or about 450 feet higher than the level of the No. 2 south side adit.

The assay maps, which show the results from assaying average samples from the *Price* ore-body, demonstrate that the run of mine ore from that body will mill better than 2 per cent. copper, with low gold and silver values.

In the Green adit, driven at an elevation of about 1,550 feet, about 650 feet northerly from the south side of No. 2 adit, there is exposed a seam of high-grade copper sulphide about 18 inches wide. This occurs near the face of a crosscut on the northerly side of the Green adit and has been drifted on for about 20 feet, but no attempt had been made to develop it further.

Several improvements have been made at the Beach camp since work was resumed in March, 1922. The grade of the flume from Indian creek to the penstock has been changed so as to gain an increased volume of water, and some of the curves in the pipe-line have been removed. The main difficulty with regard to water-supply for power purposes is that it is practically impossible to construct reservoirs in either of the creeks from which water is taken, at a cost that would be sufficiently low in comparison with the supply gained to warrant such construction; consequently the power is developed from the water flowing in the two creeks, which are really torrential streams and consequently subjected to erratic variations with regard to a supply of water.

The concentrating-mill and aerial tramway since remodelling are working more efficiently. The product from the mill is averaging a concentrate with 44 per cent. copper, while the tailings carry such low values as to prove that the Peterson oil-floatation cells, with which the mill is equipped, are doing most excellent work.

During the writer's visit to Sidney inlet he made an attempt to examine the **Prince Group.** *Prince* group of mineral claims acquired by T. R. Marshall, of Scotland, about 1900, and developed to some extent about the same time, but later work was suspended and the claims Crown-granted. Dr. Marshall returned to Scotland, and except that the taxes were paid regularly the group of mineral claims was almost forgotten by most of the old-timers on the west coast. However, during the spring of 1922 a deal was made by which the property was acquired by a corporation organized in Scotland; the papers were filed in the office of the Gold Commissioner at Alberni and it was reported that active development was to be resumed.

Because of these reports an examination of the group of mineral claims was deemed to be desirable; consequently such was made on August 30th under the guidance of John Galt, a miner and prospector who had worked on the claims in 1901, and in company with C. J. Abrams and W. Coulter, of the Tidewater Copper Company.

The old pack-trail built by Marshall was found in fairly good condition from the junction between it and the Tidewater Company's trail near the latter's north side mine-workings to within about 200 yards of the ruins of the old Marshall camp, except the second bridge beyond the Tidewater Company's workings; beyond that point the trail is obliterated by fallen trees, salmon-berry, huckle-berry, and devil's-club bushes.

The development-work on the *Prince* group of mineral claims consists of an upper and lower adit, the upper adit being about 25 feet long about 50 feet above the lower one, which is about 100 feet long. The two adits are connected by a winze. This winze is sunk at least 50 feet, and to an unknown depth below the lower adit, and was full of water. On account of the unsafe condition of the connecting winze and water in the lower part no examination could be made.

The new corporation which has acquired the *Prince* group did not commence operations during 1922.

You Group. J. B. Woodworth, of Thorley Park, Vancouver, continued development-work on the *You* group of mineral claims near the head of Bedwell river. This group of mineral claims was fully described in the Annual Report for 1921; therefore it is unnecessary to repeat. By reason of the extremely heavy snowfall late in the spring of 1922 in the rugged mountain range in which the *You* group is located, Mr. Woodworth was seriously handicapped in his efforts, and especially so when his camp cabin was destroyed by fire about the time he was ready to build the small quartz-mill he had packed on to the property. Despite such handicaps he continued his efforts and, unless some unforeseen accident happens, expects to be producing gold bullion in 1923.

In the reports on this group, situated on Tofino river about $1\frac{1}{2}$ miles above its mouth where it empties into Tofino inlet, in the Annual Reports, 1919 and 1921, the elevation of the mine-workings is recorded as 2,500 above sea-level. This elevation is incorrect, as the writer found last summer, and in justice to the owners of the *White* group of mineral claims he desires to make the correction in this report. The correct elevation for the base of the cliff where prospecting-work has been done is between 800 and 900 feet above sea-level.

The *White* group was quite fully described in the reports mentioned; no extensive work was done during 1922.

Ormond Group. This group of mineral claims is on the westerly side of Matilda creek near the Ahousat Indian Reservation, with the prospecting-work about a mile from the shore and at an elevation of about 1,000 or 1,100 feet above sea-level. It was examined on August 29th, 1922, to ascertain to what extent development-work had been done since an examination and report was made by the writer in 1916, but no further work of any consequence was found to have been done.

The property has been under option to Victoria promoters, but until the copper market is more active and the price higher it must remain idle.

Assessment-work was done on several mineral claims in the vicinity of Kennedy lake and other portions of the Clayoquot Mining Division during 1922, but no production was made.

NOOTKA SECTION.

Star of the West. The most persistent prospecting noticed during 1922 was done by Wm. Poole in the Nootka section on Tahsis canal. This is a comparatively narrow channel of inland water connecting Nootka sound at the south end with Esperanza inlet on the north. The Tahsis canal is about 18 miles in length. The narrows through which is the channel towards the open water of the Pacific branches off to the west from the main canal about 12 miles northerly from the entrance into Nootka sound.

The *Star of the West* mineral claim is in the mountains near the head of the canal, where is also located an extensive belt of limestone, fully crystalline and forming beds of excellent marble. This belt of limestone extends in a south-easterly direction and is apparently continuous to Deserted creek, Tlupana arm of Nootka sound, where the works of the Nootka Marble Company, at present idle, are situated.

As the *Star of the West* mineral claim is only a comparatively recent location, on which there is an ore-body consisting of a vein carrying minerals, of which chalcopryrite, iron pyrites, and zinc-blende predominate, in a quartz gangue, there has not yet been much development-work done.

The discoverer, Wm. Poole, is one of the oldest, most thorough and industrious prospectors on Vancouver island and has been prospecting on the west coast for about thirty years. He owns the *Star of the West* mineral claim in company with T. T. Gardhouse, of Nootka.

One sample from the claim assayed: Gold, 0.04 oz.; silver, 4 oz.; copper, 7 per cent.; zinc, 15 per cent.

As Wm. Poole expected to continue work of a development character during most of the winter, this property ought to be fairly well prospected and well worth an examination by mining engineers looking for such a class of ore.

QUATSINO MINING DIVISION.

The Quatsino Mining Division adjoins the Clayoquot Mining Division on the north-west and occupies all of the west coast, and adjacent islands to the north-westerly end of Vancouver island, including the Triangle group of islands off of Cape Scott. The metalliferous-mining industry in this Division has been practically at a standstill during 1922; assessment-work only having been done on several mineral claims that have not been Crown-granted.

A deposit of magnetite-iron ore, on which three mineral claims have been located and recorded, has been discovered by F. G. Patterson, of Quatsino. This is located about 5 miles from the mouth of the Ingersoll river, which flows in a northerly direction into Quatsino sound opposite to Limestone island. No work except some prospecting has been done on the discovery, nor has any trail been cut to the deposit. A sample of magnetite, taken by Patterson, assayed at the Government Assay Office at Victoria, yielded: Iron, 64 per cent.; silica, 5.8 per cent.; phosphorus, trace; sulphur, trace; titanium, *nil*.

This group contains the *Cracker Jack*, *Millington*, *Hood*, *Mollie B.*, *Mollie Bacon*, and *Paystreak* mineral claims. It is owned by Dave Spooner and associates, of Holberg, and was examined on August 17th, 1922. The group is located near the Spruce river about 2½ miles above its mouth. The Spruce river flows into the West arm of Quatsino sound at its head. In the Annual Report for 1919 the group is fully described. In this report only the extension of the work done since 1919 will be mentioned. This work has been extending the length of the upper adit and driving a short crosscut towards the west from a point about 30 feet from the present face of the adit. The expectation that the work would show a continuity at depth of the ore exposed in a long open-cut on the surface above the adit was not fulfilled. From the lower adit, driven at about 100 feet lower elevation than the upper adit, a second drift towards the east has been driven 26 feet long from a point about 10 feet southerly from the No. 1 east drift, which it parallels. This work also failed to prove continuity with depth of the outcrop on the surface.

This group contains several mineral claims owned by P. Oboling, F. Bowerman, A. Wakefield, and the Spooner Bros., of Holberg. The group is in the mountainous country on the northerly side of the West arm of Quatsino sound and near 6-Mile creek, which empties into the West arm about 6 miles below the head of the arm. The property is reached at present by following a blazed trail from near the mouth of 6-Mile creek in a north-westerly direction for a distance of about 5 miles, but the owners purpose cruising a new route by which the distance should be reduced by about 2 miles.

On the *Bowerman* group there is a wide mineralized zone, apparently about 200 feet in width, made up of breccia, quartz, and calcite, with impregnations of minerals, in which zinc-blende, some galena, and iron pyrites can be identified. The values are apparently very erratic, as well as low grade, as is shown by the following from general samples taken on August 22nd, 1922, which assayed:—No. 1: Gold, trace; silver, trace; copper, *nil*; lead, *nil*; zinc, 1.5 per cent. No. 2: Gold, trace; silver, 0.8 oz.; copper, *nil*; lead, 1.7 per cent.; zinc, 10 per cent. No. 3: Gold, silver, copper, and lead, *nil*; zinc, 3.5 per cent. From a general sample assayed on December 17th, 1919: Gold, trace; silver, 2 oz.; copper, 0.7 per cent.

The apparent considerable extent of the mineralized zone has encouraged the owners to do extensive work on the group, with the expectation of being able to develop a big low-grade

concentrating proposition; consequently, the following development-work has been done: No. 1 or upper adit, about 21 feet long, with open-cut approach about 25 feet long; No. 2 or lower adit, about 44 feet long, with open-cut approach about 20 feet long; an open-cut 83 feet long, 8 feet deep, about 1,000 feet south-easterly from and 200 feet lower than No. 1 adit; also several other open-cuts and trenching.

**Copper King
Group.**

This group contains two mineral claims recorded as the *Copper King No. 1* and the *Albion*, situated near the shore on the southerly end of Atkins bay, at the entrance to the South-east arm of Quatsino sound, and about 3 miles from Quatsino settlement. The group is owned by F. G. Patterson, Quatsino. Outcroppings of copper ore, consisting of some azurite, malachite, and chalcopyrite, occur in lenses both at and near the contact of limestone and the volcanic rocks of the Vancouver series.

Development-work was first done on the *Copper King* group in 1906, when a shaft said to be 30 feet deep was sunk, but at the time of the recent examination on August 15th, 1922, this shaft could not be examined because of the rotten condition of the timbering and quantity of water in the shaft. On the old dump at the collar of the shaft there still remained a quantity of copper ore of the varieties mentioned, but no sample was taken because the old dump had evidently been sorted over, and no sample taken would represent an average of the ore taken out when the shaft was sunk.

There was also a series of four open-cuts near the shaft which had evidently been made in the endeavour to determine the strike and dip of the ore-body, which belongs to the contact-metamorphic type. From these openings it appeared that the strike of the contact was in a north-westerly direction, but the dip could not be determined, nor can any continuity between the lenses be proven until further work is done.

A sample was taken from the most recent work, which was a deep open-cut a short distance westerly from the old shaft. This sample represented a section about 6 feet wide across the bottom of the open-cut. The sample assayed: Gold, trace; silver, trace; copper, 5 per cent.

NANAIMO MINING DIVISION.

The Nanaimo Mining Division, by far the largest in area of any of the Mining Divisions in the Western Mineral Survey District, occupies areas on both Vancouver island and the Mainland, together with several islands lying between Vancouver island and the Mainland. The Mining Division comprises a strip along the easterly coast of Vancouver island from the extreme north-westerly end to Ladysmith, on the south-easterly coast, a distance of approximately 250 miles, and of irregular width, between about 8 miles minimum and from 25 to 30 miles maximum, including approximately two-thirds of the Esquimalt & Nanaimo Railway land grant. On the Mainland the Nanaimo Mining Division extends inland from the coast and occupies an irregular area which includes the Coast range of mountains from Seymour inlet opposite the north end of Vancouver island as far south-easterly as the west side of Jervis inlet; the maximum width from south-west to north-east being approximately 150 miles at the north-westerly end and approximately 100 miles at the south-easterly boundary.

That portion of the Nanaimo Mining Division on the Mainland has been explored but comparatively little, despite the fact that there are several inlets which penetrate the Mainland coast and practically cut across the Coast range formation, and offer splendid opportunities for comparatively easy access into the mountainous country and to observe the rock formations adjacent to the inlets. These inlets are navigable for large vessels, and, being inland waters, afford sufficient shelter for small craft such as a prospector would use. The heads of the inlets are fed from rivers, up which canoes can be poled for several miles. These conditions tend to make this section of the Nanaimo Mining Division very attractive to prospectors.

The greatest part of the Nanaimo Mining Division on Vancouver island is occupied by coal-measures and is in the Esquimalt & Nanaimo Railway land grant, which deters prospectors from exploring the mountainous country within those boundaries.

Discoveries of gold-silver-copper-lead-zinc ores have been reported recently in the vicinity of Kains and Quatze lakes, also near the Shushartí and Nahwitte rivers, and as the locators of bench placer leases in the neighbourhood of Cape Sutil (Commerell) and Nahwitte river have so far complied with the Act under which such leases were granted, it would appear as though the conditions were sufficiently promising to warrant further prospecting and developing.

From June 22nd to July 17th, 1922, the writer was occupied in making a cruise along the coast from Jervis inlet north-westerly and visited all of the mineral claims on which work was being done, and on which owners, or the representatives of owners, could be found to act as guides to the workings of the ore-bodies.

By reason of the extremely heavy pall of smoke from forest fires which overhung the adjacent mountains and the waters of the inlets it was impossible to obtain as much information relative to the rock formations as was expected. Sufficient evidence, however, of the occurrences of belts or zones of stratified rocks was observed to confirm the opinion expressed by Chas. Camsell, namely: "It is only fair to assume that other sections through these mountains northward to the Yukon boundary will reveal the same conditions to a greater or less extent. These conditions are most favourable for the occurrence of metallic deposits of copper, lead, zinc, gold, and silver, and the whole interior of the Coast mountains of British Columbia therefore becomes an excellent field for prospecting, and not only the eastern and western borders, as was formerly believed to be the case."

No prospectors were found in any of the inlets mentioned during the cruise, and it was only in Knight and Seymour inlets that any mineral claims had been located. These claims were fully described in the Annual Report for 1919, pages 210-212, and as the development-work has not been materially extended it is not necessary to further refer to those claims.

POWELL RIVER SECTION.

This mineral claim is on the Mainland near the coast, about 8 miles north-westerly from the Powell River pulp-mills, and is easily reached by launch from Powell river to a point on the shore nearly opposite Dinner rocks and from there by trail about a mile. The claim is owned by W. J. Uzzell, post-office address Box 88, Powell River. On the *John Bull* there occurs a wide mineralized belt near the contact of the Coast Range batholith and crystalline limestone. The mineralization is chiefly made up of zinc-blende associated with small quantities of pyrite, galena, chalcopyrite, and magnetite. The ore-deposit belongs to the contact-metamorphic type, with the minerals occurring largely as replacing the metamorphosed limestone. The formation is cut by a series of intrusive igneous dykes of porphyritic structure.

The development-work on the *John Bull* is near the north-east corner of the claim and consists of three old shafts and several open-cuts. One shaft, nearly full of water, is said to be 30 feet deep, but could not be examined. This shaft was sunk in crystalline limestone on the south side of the ore-outcroppings, but near the bottom is said to have cut into the ore-body for a width of about 15 inches.

A sample from a small dump said to represent the ore from the bottom of the shaft, assayed: Gold, trace; silver, 4.4 oz.; copper, 0.8 per cent.; zinc, 10 per cent. A sample from the surface outcroppings assayed: Gold, trace; silver, trace; copper, *nil*; zinc, 17.5 per cent. A sample from an open-cut 18 feet long by 8 feet wide, and about 10 feet deep at deepest part, assayed: Gold, 0.02 oz.; silver, 0.2 oz.; copper, 0.2 per cent.; zinc, 31 per cent.

A pit about 100 feet southerly from first-mentioned shaft is about 10 feet deep. In it the mineralization is made up of magnetite, with a very little copper sulphide, not considered worth sampling. Another shaft is about 12 feet deep, sunk in overburden to bed-rock. A sample from the ore exposed in this assayed: Gold, trace; silver, 1.2 oz.; copper, *nil*; lead, 2 per cent.; zinc, 1.6 per cent. Further work consists of an open-cut about 15 feet long by 8 feet wide, which opens into a natural cave in the limestone between 30 and 40 feet long.

There has not been sufficient development-work done on the claim, in a condition to be examined, to warrant any opinion other than that the mineral claim is a good prospect, having possibilities, and especially so when its location with regard to deep-water transportation facilities are considered.

In connection with the *John Bull*, it is worth considering the occurrence of ore of a similar character on the *Florence* and *Zone* claims, located near the *John Bull*, but somewhat farther removed from the shore and about 300 feet above sea-level. These claims were examined in 1917 and descriptions of them published in the Annual Report for the year.

The *Copper Bowl*, *Mayflower*, and *Ophir* groups of claims in the mountains bordering on the west side of Powell lake, on which occur copper-sulphide ore, were not examined during 1922, as they were all fully described in the Annual Report for 1921.

TEXADA ISLAND SECTION.

The mining industry on Texada island during 1922 was not as progressive as is desirable; so far as production is concerned, there was none, as the *Marble Bay* mine, a regular producer since 1898, was closed down early in 1921 and has not since been operated.

A body of copper-gold-silver ore was discovered by diamond-drilling below the 1,700-foot level, or about 1,500 feet vertically below sea-level, previous to closing the mine down. The management had made arrangements to extend the incline winze already sunk below the 1,600-foot level to the newly discovered ore-body below the 1,700-foot level, but the price of copper remained too low to warrant the extension of the workings at that time, nor has there been sufficient improvement since to warrant such work.

Owing to the death of the late Harry Whitney Treat, who was killed as the result of an automobile accident during 1922, there is a possibility of some action being taken by the executors of his estate with regard to the mining properties owned by the Vananda Copper and Gold Company on Texada island. The late Mr. Treat was the trustee for the bondholders of the company, and until his estate is administered it is impossible to say to what extent the change will affect the affairs of the company, which has not been in active operation since about 1902.

The formerly productive mining properties owned by the bondholders of the company are the *Copper Queen*, *Cornell*, *Little Billy*, and *Loyal* mines, near Vananda. Although none of these mines have been worked by the company or bondholders directly since 1902, each and every one of the mines have been worked intermittently by lessees, the latest work done being by Thomas Davis in 1916 and 1917 on the *Loyal* mine, under lease from the late Mr. Treat as trustee.

About the time that the Tacoma Steel Company, which owns the *Marble Bay*, decided to close it down, a proposition was being discussed between that company and the late Mr. Treat as to an arrangement by which the *Security* mineral claim, owned by the Vananda Gold Copper Company and which adjoins the *Marble Bay*, should be prospected from the 1,500-foot level of the *Marble Bay* mine by extending the southerly drift on that level into the *Security* ground, but this proposed arrangement had not been carried out previous to the death of Mr. Treat.

This company, which owns the magnetite-iron ore deposits on the west coast of Texada island, suffered the loss by death of Captain William Lee, who has been identified with the company as a local manager since the purchase of the properties about 1875. Captain Lee was a veteran of the Civil War in the United States, and after being mustered out from the army in 1866 he became associated with the late General Warner in mining iron ore and operating blast-furnaces at Tecumseh, Alabama. It was on the advice of Captain Lee that Goodall, Perkins & Prescott, of San Francisco, purchased the Texada iron-ore deposits and later built a small charcoal blast-furnace at Irondale, near Port Townsend, Washington, which the company operated for a period under the superintendence of Captain Lee, who manufactured charcoal pig-iron from the Texada Island ores mixed with bog-iron ore from the State of Washington.

The pig-iron manufactured was used in the construction of the United States battleship "Oregon," which was built by Goodall, Perkins & Prescott in San Francisco, when that firm owned the Union Iron Works of San Francisco, and also the Pacific Steamship Company that plied between San Francisco and Seattle and other Puget Sound ports. On the completion of the United States battleship "Oregon" the blast-furnace at Irondale was closed down and sold about 1901 to the late Homer Swaney, who was drowned when the steamship "Clallam" was wrecked near Victoria.

The death of Captain Lee will be quite a loss to the community of Texada island, because, in addition to acting as local manager for the Puget Sound Iron Company, he was also very active in prospecting and doing development-work on the *Nancy Bell* group of claims, in the ownership of which he was associated with Hugh McMillan, of Nanaimo, and William McDonald, of Vananda. Mr. Lee was the prime mover in the development of the *Retriever* group of claims on the west coast of Texada island, on which he built a concentrating-mill equipped with Faust concentrating-tables; but owing to financial difficulties the company which was organized to operate this property suspended work about 1920.

This group, which contains the *Marjorie*, *Fairview*, *Wild*, *Saga*, and *Tenas* **Marjorie Group.** *Fraction* mineral claims, was operated during a portion of 1922 by the Convan Mines Company, Limited, of which Jack McConville is superintendent. The work carried on consisted of an extension of the development-work described in the Annual Report for 1921; also the erection of a Ross quartz-mill $5\frac{1}{2}$ feet high by $3\frac{1}{2}$ feet diameter. It was being operated in May last when the examination was made on the property. The *Marjorie* group is situated on Texada island, about $1\frac{1}{2}$ miles northerly from Vananda, and is reached by a branch road from the main Vananda-Iron Mines wagon-road.

The prevailing country-rock on the *Marjorie* group is porphyrite, but the contact between Marble Bay limestone and the porphyrite occurs close to the easterly boundary of the *Saga* mineral claim. The porphyrite has been very much sheared and fissured, resulting in the occurrence of a series of eight parallel veins filled with gold-bearing quartz and some calcite, associated with such minerals as siderite, pyrite, and ankerite.

The quartz veins strike south-westerly and dip vertically; they vary in width from a few inches to 4 feet, and also vary in length, the maximum length proven by open-cuts being 144 feet. The walls of these veins are well defined, especially the foot-wall, and there is gouge between the mineralized vein-filler and the walls, which assists in mining the vein separately from the country-rock.

The recent development-work consists of open-cuts, of driving a drift 80 feet long on the 60-foot level of the main shaft on the *Saga*, and stoping ore at a point on the drift near the shaft, the stope being about 12 feet high and 14 feet long; the ore mined from it was hoisted and milled in the Ross mill. The drift along the strike of the vein shows the persistent continuity of the vein-filler, also its variable width, from a few inches to a maximum of $2\frac{1}{2}$ feet. At the face of the drift a fault occurs which has apparently cut through and displaced the vein. No effort had been made to trace the vein beyond the fault.

About 200 feet southerly from the shaft just referred to, an open-cut has been made 144 feet long, exposing a vein known as the "Big vein," being 4 feet wide, and paralleling the one at the shaft. This vein is dipping about 80° in a northerly direction and towards the first vein mentioned. A sample taken across the vein at a point about 30 feet from the entrance to the open-cut assayed: Gold, 0.32 oz.; silver, trace; copper, *nil*.

There are five other veins between the Big vein and the shaft vein, also two other veins, separated by only a few inches of country-rock on the northerly side of the shaft vein. These two last mentioned have been exposed by an open-cut about 125 feet long and between 6 and 7 feet deep. These veins show similar conditions with regard to continuity, variable width, and mineralization as the Big vein, but were not sampled, chiefly because the examination was being made principally to see the Ross mill running and to sample the heads and tails from it.

The milling plant, which was completed in March, 1922, consists of a Ross (ball) quartz-mill 5 feet 6 inches high by 3 feet 6 inches diameter, which has a capacity to crush $1\frac{1}{4}$ tons of vein-filler an hour. Attached to the mill is one Faust concentrating-table and six oil-flotation barrels. The barrels are arranged one below the other, starting on a level near the roof of the mill, so that concentrates can be pumped from the discharge of the table, or as tailings from the mill itself, into the upper one of the series of oil-flotation barrels, and the overflow, after a clean concentrate has been drawn off, passes into the next barrel below.

Samples were taken from the heads, concentrates, and tails, as follows, which assayed: Heads: Gold, 0.40 oz.; silver, 0.5 oz. Concentrates: Gold, 0.28 oz.; silver, 0.1 oz. Tails: Gold, 0.04 oz.; silver, trace; copper, 0.7 per cent. The milling results from treatment of the ore were so unsatisfactory that the mill was closed down later and all work temporarily suspended.

This mineral claim adjoins the *Marjorie* on the north and is owned by Harry **Eldorado.** McGregor and Malcolm Galbraith, of Vananda. On the *Eldorado* there occurs a series of veins in a shear-zone in the porphyrite country-rock very similar to that on the *Marjorie* mineral claim. An examination was made in May, 1922, when the owners were doing their annual assessment-work. A quartz vein that outcrops near the south end of the *Eldorado* was being exposed by an open-cut about 30 feet long, in which the vein showed a maximum width of 4 feet, but pinching down to a few inches in places along the strike. The strike of this vein is N. 60° E. and dip vertical.

Another quartz vein has been exposed near the centre of the location-line on the *Eldorado* in an open-cut 125 feet long and exposing a continuous quartz vein averaging about 3 feet wide,

with a strike nearly east and a dip about 80° towards the south. The vein occurs in the porphyrite country-rock about 300 feet from its contact with the Marble Bay limestone. Near the west end of the open-cut referred to there is a junction of the quartz vein exposed in the open-cut with another quartz vein with its strike nearly at right angles to the open-cut. At the junction of the two veins the quartz is 10 feet wide. Three samples were taken from different points in the veins; the assays showed that none of these samples carried any values.

**Nancy Bell
Group.**

This group of mineral claims contains three Crown-granted claims designated as Lots 44, 46, and 105, owned by William Lee; William McDonald, of Vananda; and Hugh McMillan, of Nanaimo. The property was examined on May 8th, 1922. Owing to the fact that the development-work and prominent features on this group were fully described in the Annual Report for 1921, that description will not be repeated in this report, but reference will only be made to the extension of the development-work done since then.

This development-work consists of a shaft sunk about 30 feet deep near the north-western corner of the *Nancy Bell*. In this shaft is exposed an ore-body at the contact between a porphyrite hanging-wall and altered limestone foot-wall, having a strike apparently north-westerly and a dip about 70° towards the south-east. The hanging-wall of the ore-body is very well defined and there is gouge about 2 inches wide between the wall and the ore.

One sample taken across 4 feet at the bottom of the shaft assayed: Gold, 0.3 oz.; silver, 3 oz.; copper, 0.5 per cent. Another sample taken from a dump of about 80 or 90 tons of ore mined in sinking the shaft assayed: Gold, 0.56 oz.; silver, 3 oz.; copper, 1.8 per cent.; lead, 1.5 per cent.; zinc, 24.5 per cent.

Other new development-work was done on the old *Silver Tip* claim, which adjoins the *Nancy Bell* on the westerly side. Near this boundary an open-cut has been made on the *Silver Tip* claim 30 feet long by 6 feet deep, in which is exposed an ore-body in a shear-zone in porphyrite country-rock, having a strike easterly and a dip almost vertical, slightly inclined towards the south.

The ore-body exposed is 4 feet wide and the general appearance of the mineralization is very similar to that just described as occurring on the *Nancy Bell*, except that while the *Nancy Bell's* ore-body is close to the contact, that on the *Silver Tip* occurs entirely in the porphyrite country-rock, the nearest limestone to it being about 100 feet easterly. A sample taken from the open-cut on the *Silver Tip* assayed: Gold, 0.6 oz.; silver, 1.3 oz.; copper, 0.3 per cent.

Another open-cut has been made about 150 feet easterly from the one just described. In this there is exposed an ore-body which occurs under such similar conditions as to indicate that it may possibly be an extension of that already described, but the actual connection between the two open-cuts has not yet been determined. A sample taken across 3 feet of the last-mentioned open-cut assayed: Gold, 1.02 oz.; silver, 2 oz.; copper, 2.5 per cent.

The owners of the *Nancy Bell* group proposed continuing development-work with a small force of miners after the examination was made, but as the writer has had no opportunity to make a later examination the extension of work cannot be described.

**Lucky Boy
Group.**

Early in the spring of 1922 reports were circulated about a phenomenally rich strike of gold-bearing quartz having been made on Lot 300, about 2 miles north-easterly from Gillies bay, Taxada island, or about 6 miles south-easterly from Vananda. This resulted in the location of the *Lucky Boy*, *Little Bill*, *Guy*, and *Lloyd George* mineral claims, adjoining each other, and located from north to south, with the *Lloyd George* east of the *Little Bill*.

A series of narrow quartz stringers occurring in the Texada porphyrites attracted the notice of a rancher who was also a prospector. While picking around on the surface outcroppings he discovered some free gold in the quartz, and a sample of this quartz, it is claimed, assayed \$2,400 in gold to the ton. This discovery led to further prospecting-work, and a series of open-cuts was made on each of the mineral claims, in all of which the series of quartz stringers outcropped, striking in a northerly direction and dipping westerly, but nearly vertical.

Four samples were taken when the mineral claims were examined on May 11th, 1922, two from the *Lucky Boy* and two from the *Little Bill*, and assays were made at the Government Assay Office, Victoria, none of which, however, showed any values, and the discovery was evidently one of the freaks sometimes found in the porphyrites on Texada island.

Olympian. This mineral claim is about 2½ miles north-easterly from Gillies bay, Texada island, and is reached by travelling over the main Vananda-Gillies Bay wagon-road, about 6 miles from Vananda. The *Olympian* is owned by John D. Edwards, who resides on the property, for which he has obtained a Crown grant as Lot 461. The claim was located by Mr. Edwards several years ago, and although more than 75 years old at present, he has done all the prospecting and development work himself. This work consists of an adit about 130 feet long under cover, with an open-cut approach, crosscut, open-cuts, and stripping aggregating more than 100 feet in length, as well as some shallow prospect-holes.

The country-rock on the *Olympian* is Texada porphyryite, in which occurs a shear-zone over 50 feet wide in places. The shearing has been so pronounced that in places it approaches schistosity, with some silica accompanied by mineralization made up of iron pyrites, with some chalcopyrite and bornite. The mineralized zone appears to warrant further systematic prospecting, and may develop into a big low-grade copper proposition adaptable to the oil-flotation system of concentration.

Limestone-Quarries. During 1922 two limestone-quarries were in continuous operation. One of these, at Sturt (Marble) bay, was sold by the Tacoma Steel Company to the Powell River Company, Limited, which uses the limestone in the manufacture of pulp and paper. The other, located at Blubber bay, at the north-westerly end of Texada island, and owned by the Pacific Lime Company, is operated for commercial trade. The company has a kiln plant with a capacity to burn 150 barrels of lime daily and a hydrating plant with a capacity to treat 60 barrels of lump lime daily. The product is shipped to several markets by water.

LASQUETI ISLAND SECTION.

Lasqueti island, in the strait of Georgia, about 18 miles north-westerly from Nanaimo, was the scene of considerable prospecting-work during 1922, mainly owing to the development-work done on the *Venus* group of mineral claims during 1920, a report on which is in the Annual Report for that year. This work was continued during 1921 and about 1,000 tons of high-grade copper-gold-silver ore was shipped to the Tacoma smelter, but work was suspended soon after that shipment and was not resumed during 1922.

Lasqueti island was examined by the late J. D. MacKenzie for the Geological Survey of Canada in July, 1921, and his report is published in the Summary Report, 1921, Part A, pages 50-58, "Copper Deposits on Lasqueti Island, British Columbia." This report is devoted chiefly to the geologic conditions surrounding the *Venus* and *St. Joseph* groups in the vicinity of Barnes cove, but as the report also describes the geology of the island generally, and particularizes to some extent on the geologic conditions at False bay, on the south-west part of the island and southerly from Barnes cove, the section in which is located the *Old Bill* group examined by the writer on July 26th and 27th, 1922, the following extracts are made from MacKenzie's report:—

"*Satellitic Rocks of the Coast Batholith.*"—Under this name are included plutonic rocks which underlie the area between False bay on the south of the island and Barnes cove on the north. The rock at False bay is light grey, medium to fine, even-grained, with a pinkish cast on the weathered surface. Quartz is plainly visible in the hand specimen. In thin section the essential minerals are andesine (plagioclase feldspar) and quartz; with subordinate hornblende, biotite, and augite, and accessory apatite and magnetite. The constituents, except the quartz, are all sharply crystallized and the texture is even. The rock is fresh; the andesine is only slightly altered, and the biotite shows only incipient alteration to chlorite.

"In the vicinity of Barnes cove the most common rock is grey, fresh-looking, medium even-grained quartz diorite. In thin section it is generally similar to the rock just described, but there is noticeably less quartz and rather more ferro-magnesian minerals. This agrees with the difference in appearance in the hand specimen; the Barnes Cove rock being several shades darker than the False Bay variety and with inconspicuous quartz. The hornblende forms rims surrounding the augite, which is not abundant. The quartz diorite is usually fresh-looking and very little alteration can be detected in thin section, but in the shear-zones the rock is greatly altered and its identity is often doubtful in the field. This sheared, altered variety appears under the microscope as a mixture of altered feldspar, calcite, quartz, and chlorite, with the usual accessory minerals, and in addition titanite, which was not found in the slides of the fresher rocks. It is as a replacement of this altered and sheared quartz diorite that the ore-shoots occur.

"Near the contact with the volcanics variations in grain are common, but the quartz diorite is not chilled. In some places on the *Venus* group concentrations of bladed crystals of hornblende up to 2 inches long occur in irregular schlieren in the quartz diorite. At the contact on the shore west of the *St. Joseph* tunnel the intrusive is exceptionally rich in hornblende, which forms 80 per cent. of the rock, forming equant crystals up to $\frac{3}{16}$ inch across. This rock is tightly sealed against the volcanics, without any sign of chilling. Here, also, the contact relations indicate intrusion of the quartz diorite into rocks which were sufficiently hot not appreciably to chill the intrusive. The dykes and apophyses extending from the quartz diorite into the volcanics are frequently fine-grained, pinkish and reddish aplitic rocks. These aplites also occur in dykes or veins of varying shapes and size cutting the quartz diorite itself."

This group contains four mineral claims, known as the *Old Bill*, *Better 'Ole*, *Old Bill Group*, *Aladin*, and *Trio*, owned by the Kurtchals Bros., residents on Lasqueti island.

The group extends from the shore of False bay in a south-westerly direction from Barnes cove and about a mile from the mining-work done on the *Venus* group. The prevailing country-rock on the *Old Bill* group is quartz diorite, but the westerly boundary is very near the contact between that rock and the volcanic rocks named by McConnell as the Texada formation, made up of altered amygdaloids and agglomerates. On reference to MacKenzie's report it is found that he considers that the belt or zone of quartz diorite is continuous from Barnes cove southerly to False bay, with the widest part of the belt occurring on the east side of False bay.

The most promising showing of ore is on the *Trio* mineral claim in an adit driven on the shore of False bay above high-water mark. The adit was 29 feet long under cover on July 26th last, when the examination was made. It is approached by an open-cut in solid rock 9 feet long. The course of the adit is north-easterly, which is also the direction of the strike of the ore-body, while the dip is about 30° towards the north-west. A shallow winze has been sunk from the left side of the adit.

The ore-body occurs as a vein in a shear-zone in the quartz diorite. The width of the vein material varies from a few inches to about 2 feet. The mineralization is made up of iron pyrites, chalcopyrite, some magnetite, also some pyrrhotite. A sample representative of the sorted ore on the dump at the portal of the adit assayed: Gold, 0.2 oz.; silver, 1 oz.; copper, 4.5 per cent.

At a point about 70 feet westerly from the adit another vein outcrops, having its strike apparently parallel with the adit vein. The outcropping of this last-mentioned vein is principally pyrrhotite. A sample taken from the outcropping was found by assay to carry no commercial values. The work done on this showing consisted of making an open-cut approach to a portal of a proposed adit. Other mineralized outcroppings occurring on the *Old Bill* group are found on the *Better 'Ole* and *Aladin* claims belonging to the group and adjoining the *Old Bill* claim.

On the *Better 'Ole* claim a vein occurs on the beach below half-tide mark, the maximum width of which is about 2 feet, but although it is exposed at one point by a prospect-hole, it could not be examined as the hole was full of water. About 200 feet from the prospect-hole in a northerly direction there is an old adit above high-tide mark, known as the *Hudson's Bay* work. This was driven as a crosscut in a N. 40° W. direction, but it failed to expose any ore-body. Another adit has been driven about 40 feet long in a N. 20° W. direction on the *Aladin* mineral claim. No ore is exposed by this work.

It would appear as a result of the examination that the showings of ore on the *Trio* mineral claim are sufficiently promising to warrant further development-work, especially when it is considered that the vein system can be traced for about 900 feet, striking in a north-easterly direction, also that the property is so easy of access by water.

This mineral claim is on Jarvis island, lying between Lasqueti island and **St. Paul.** the south-easterly end of Texada island. The claim is owned by Paul Lambert, who also owns the island as a homestead and resides on it. An examination was attempted on May 18th, 1922, but owing to the absence of Mr. Lambert this was not satisfactory. Although the location posts of the mineral claim were found, also where a little prospecting-work had apparently been done, the writer was unable to locate any deposit of ore or promising indications of such.

The country-rock on Jarvis island, so far as could be determined by the examination, belongs to the volcanics named by McConnell the Texada formation. These rocks are considerably sheared and fractured with quartz veinlets similar to some of those on Texada island in the same country-rock, and it is quite possible that at some point an ore-body may occur.

QUADRA ISLAND SECTION.

Quadra island lies to the east from Vancouver island and is separated from it by Discovery passage and Seymour narrows. Quadra is the southerly of the three islands which form the Valdes group, the others being Maurelle and Sonora. Quadra island is the only one of these islands on which any mineral deposits have been discovered. The geology of the Valdes group of islands was examined by J. Austen Bancroft during 1907 and is described in Memoir No. 23, Geological Survey.

The mineral-deposits of Quadra island which have been prospected lie in the area bounded on the north by a line drawn from Granite bay to Bold point, and on the south by a line drawn from Heriot bay to Quathiaski cove. In this area the prevailing country-rock belongs to the Valdes group described by Bancroft as being made up of a series of volcanic rocks with a few intercalated beds of limestone. South of the latter line these volcanics pass beneath and probably underlie the stratified sands and clays of the southern end of Quadra island. North-easterly from the first-named line there occurs a wide belt of crystalline limestone which extends across the island, and the contact between the limestone and the volcanics is very closely conformable with the line from Granite bay to Bold point. Deposits of copper-gold-silver ores occur near the contact of the limestones and volcanics, and in shear-zones in the volcanics and sometimes in veins.

Writing of the Valdes formation, Bancroft says: "In general these rocks are compact and fine-grained to cryptocrystalline in texture; but over wide areas they are amygdaloidal, the amygdulæ sometimes comprising one-third of the rock."

**Radioactive
Ores.**

During the latter part of 1921 considerable interest was directed towards Quadra island because of the alleged discovery of radioactive ores on the island. While making examinations the writer took samples from such points as had already been sampled by H. E. Neave, of Esquimalt, whose location stakes were easily found. A small rocky island lying in Open bay was said to be the most promising locality, and here two samples representative of the so-called radioactive rock were taken. Two samples were also taken from similar rock on the *Bull*, *Meteor*, and *New Zealand* mineral claims, and five samples were taken from points on the *Senator* mineral claim near Gowlland harbour of rock very similar to that sampled by H. E. Neave and the officers of the Valdes Island Copper Company, owners of the *Senator* claim. These samples were all sent to Dr. H. V. Ellsworth, Department of Mines, Ottawa, for examination as to their radioactivity, and a copy of his report is as follows:—

"I have tested for radioactivity the following rock samples collected by Wm. M. Brewer, July, 1922, and find none of them appreciably radioactive: Nos. 6435 and 6436, Neave prospect, Open Bay island; No. 6437, *Bull* prospect, Open Bay island; No. 6439, *New Zealand* prospect, Open Bay island; Nos. 6440-6444, *Senator* prospect, Quadra island.

"When I say that these are not appreciably radioactive, I mean that none of them carries sufficient radium to give definite indications by the usual method of testing with the United States Bureau of Mines type alpha-ray electroscope. It is well known, of course, that all rocks carry radium in extremely minute amounts which can be determined by special refined methods. These minute amounts, however, are of no commercial importance whatever. The samples as received were broken down, quartered, and a 100-mesh sample of 5 grams was exposed for one hour in the electroscope. In no case was the fall of the leaf appreciably greater than the natural air leak.

“(Signed) H. V. ELLSWORTH.”

**Wanderer
Group.**

This group contains the *Wanderer* and prospect claims owned by Albert Ross and Edward Hamilton, of Granite Bay. The group is about $1\frac{1}{4}$ miles easterly from Deep Water bay, near the head of a small creek which flows into Deep Water bay and which provides fairly good shelter for light-draught vessels. The *Wanderer* group can be reached by either one of three routes; the first and easiest route, although the longest, is from Granite bay following an old logging-road for about 5 miles to the *Wanderer* camp. The *Wanderer* group was reported on in the Annual Report, 1921, pages 224 and 225, since when Mr. Ross has continued his development-work.

The main drift-adit has been extended about 25 feet, making a total length of 180 feet; a drift from the adit has been driven 25 feet, and a raise from the main drift is up 20 feet. These are the measurements of the extension of the work done since the examination in 1921.



Britannia Mine Glory-hole, Vancouver M.D.

Three samples were taken. One across 3 feet from the face of the main adit assayed: Gold, trace; silver, trace; copper, 0.7 per cent. A second one taken as a grab sample from the dump at the portal of the adit assayed: Gold, trace; silver, trace; copper, 1.7 per cent. The third sample, taken from the raise, assayed: Gold, trace; silver, 0.8 oz.; copper, 6 per cent. Two samples taken in 1921 from the dumps assayed: Gold, trace; silver, 1.8 oz.; copper, 19 per cent.; and gold, trace; silver, 1.8 oz.; copper, 15.5 per cent.

The development occurs on the southerly side of a deep canyon on the contact between the Valdes volcanic rocks and metamorphosed argillites; the ore-body occurring in a fissure in the shear-zone of the argillites.

This claim is situated half a mile west from Bold point, about 100 feet from **Ottawa Central**, the main wagon-road, and is owned by Wm. A. St. Dennis, of Bold Point.

The claim is at the contact between limestone and volcanic rocks of the Valdes formation. A prospect-hole has been sunk at the contact about 7 feet deep, 8 feet long, and 10 feet wide, in which there occurs a little molybdenite as mineralization in limestone. So far as can be seen, there was very little indication of any other mineralization.

This claim is located on the north-west side of Reade island, nearly opposite **Solomon**. Bold point, and is owned by C. A. Carlson, of Heriot Bay. The country-rock on Reade island is similar to the Valdes volcanics—considerably sheared and fractured. In the cleavage-planes on the face of a steep cliff there occurs some mineralization made up of iron pyrites, with occasionally some copper-carbonates stains. An open-cut 7 feet high has been made by shooting off a portion of the face of the cliff. The mineralization at this point does not appear to be sufficiently promising to warrant further work.

STRATHCONA PARK SECTION.

This company is the owner of three groups of mineral claims, known as the **Paramount Mining Co.** *Lynx*, *Paw*, and *Shot* groups, which originally comprised a total of forty mineral claims, as follows: Fourteen in the *Lynx* group, eight in the *Paw* group, and eighteen in the *Shot* group. All these claims are located near the head of Buttle lake in the Strathcona Park Reserve. The *Lynx* and the *Paw* groups are located on Myra creek, which flows into Buttle lake near its head. The claims on the two groups are staked in solid blocks, the *Lynx* group on the northerly side of Myra creek and the *Paw* group on the southerly side, the groups being connected by one mineral claim which is staked from side to side of Myra creek. The *Shot* group is located on Price creek, flowing into Buttle lake and separated from Myra creek by a divide with an elevation of about 5,000 feet.

These groups are reached from Campbell River, the northern terminus of the Island Highway and a port of call for nearly all vessels sailing north. From Campbell River the route travelled to the head of the south end of Buttle lake is by auto or wagon road to the foot of Upper Campbell lake, a distance of about 16 miles; thence by pack-trail about 14 miles to the northerly end of Buttle lake; thence by boat or launch up Buttle lake to the mouth of Myra creek, a distance of about 22 miles. From 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.

The rock formation of the mountains adjacent to the northerly end of Buttle lake belongs to the series of the Vancouver volcanics, but at Marble creek, a tributary on the west side about 9 miles up, there is a well-defined contact between the volcanic rocks and a belt of crystalline limestone. On the *Lynx* group there occurs a zone of metamorphic talcose schist, green in colour and often as much as 1,000 feet in width. There are innumerable narrow stringers of quartz in the schist and these are mineralized with chalcopyrite, pyrite, and some zinc-blende. The mineralization occurs in zones of concentration of varying width.

Since the summer of 1920 systematic prospecting, both by working-openings and diamond-drilling, has been carried on by the Paramount Mining Company (Joseph Errington, managing director) at the cost of approximately \$50,000. As a result of this prospecting the company has applied for Crown grants for seventeen claims in all, allowing about six claims to lapse owing to the fact that they did not appear to possess possibilities which warranted continuing development-work. The seventeen claims are all in good standing and it is presumed that Crown grants will be granted at an early date.

The future development of these groups would appear to depend to a great extent on the question of transportation. Judging from the results obtained from the extensive prospecting-work done, it would appear there is an extensive low-grade deposit well adapted for concentration by the oil-flotation process. The property is well supplied with water for all purposes required. Myra creek carries a considerable volume of water and near its mouth there is a series of falls aggregating about 200 feet in height.

FREDERICK AND PHILLIPS ARMS SECTION.

Frederick and Phillips arms are two arms of Cardero channel, with their entrances opposite to the north-west end of east Thurlow island. From 1896 to 1900 mining was very active around these arms owing chiefly to the operations carried on by the Dorothy Morton Mining Company on Fanny bay.

There was a report that the *Colossus* group on Estero basin, originally owned by the Kamloops Mines Company, Limited (Joseph Argall, superintendent), was to be reopened and the development-work extended by Dixon & Rowley, of New Westminster, who had acquired the property and had staked an additional claim under the name of the *Lagoon*, but, although some attempt was made to clean out the old mine-workings, no determined effort was made to extend the development-work, owing, as explained by owners, to the unsatisfactory condition of the copper market.

The *Colossus* group contained the *Colossus*, *Rio Tinto*, *Blue Bell*, *Portage*, and *Champness Fraction*, all Crown-granted, on which taxes were duly paid until about 1918. The claims were offered at a tax sale on November 3rd, 1919, and, not being sold, were forfeited to the Crown on January 25th, 1921.

No attempt was made to examine the *Colossus* group during the writer's visit to the vicinity in June, 1922, as there was nobody in the vicinity to represent Dixon & Rowley, and any examination made in the absence of the owner is always unsatisfactory.

Tidewater Group. This group consists of the *Tidewater*, *Bonanza*, *Irondale*, and *Iron Duke* mineral claims, situated about 3,000 feet from the head of Fanny bay, at an elevation of about 1,400 feet above sea-level. The *Tidewater* group is owned by P. H. McDonald and R. M. Morgan, of Thurlow. The country-rock

on the *Tidewater* belongs to the Vancouver volcanics, which are in places considerably sheared and very heavily stained with iron oxide, while in the sheared zones occur fissures filled with magnetite-iron ore. On the *Bonanza* deposits of magnetite were examined which outcrops in bluffs up the precipitous mountain-side for about 600 feet elevation. In places these deposits reach a width of 10 or more feet.

Samples taken on the *Bonanza* claim from an open-cut made into the side of the mountain assayed as follows: (1.) Iron, 60.4 per cent.; silica, 11 per cent.; sulphur, trace; phosphorus, trace. (2.) Iron, 43.9 per cent.; silica, 33.8 per cent.; sulphur, trace; phosphorus, 0.15 per cent. (3.) Iron, 49.8 per cent.; silica, 28 per cent.; sulphur, trace; phosphorus, 0.05 per cent.

Shoo Fly. This mineral claim, owned by Dan McCallam, of Vancouver, is situated in the mountains at the head of Fanny bay, about a mile westerly from the beach and about 600 feet elevation. The country-rock of the claim belongs to the Vancouver volcanics, in which occur deposits of magnetite similar to those already described as on the *Tidewater* group. The development-work consists of a crosscut adit about 100 feet long, 40 feet of which crosses solid iron ore that outcrops above the adit. The mountain rises very precipitously for about 1,000 feet, and the outcroppings of magnetite can be seen, but whether these continue to depth has not been determined, and the mountain-side is so precipitous that it is almost impossible to climb in order to prospect.

Two samples were taken from the crosscut adit, which assayed as follows: (1.) Iron, 52 per cent.; silica, 17.3 per cent.; sulphur, 2.2 per cent.; phosphorus, 0.21 per cent. (2.) Iron, 41.8 per cent.; silica, 32.9 per cent.; sulphur, 2.7 per cent.; phosphorus, 0.14 per cent.

SHUSHARTI BAY SECTION.

The Shusharti Bay section is applied to that part of the north coast of Vancouver island which extends from Shusharti bay to Fisherman bay, near Cape Scott. Attention has been attracted to this district several times in the past because of the reported discoveries of placer gold associated with the black sand on the beaches.

During 1921 sixteen bench placer leases were granted along the shore in this district. During 1922 leases Nos. 5 to 14, inclusive, were consolidated under provisions of section 118 of the "Placer-mining Act." These are owned by the Black Head Mining and Development Company, Limited.

Although there was no production of placer gold from this district during 1922, the owners did some prospecting by surface-stripping and sinking test-pits and recorded work to a value of \$3,791.50.

It was the intention of the writer to visit this section during 1922, but westerly gales rendered it impossible to make landings. He intends, however, to make such examinations during the year 1923.

TATLAYOKO LAKE SECTION.

Tatlayoko Lake Gold Mining Co.—The property owned by this company and the operations carried on up to 1921 were all fully described in the Annual Report for 1921, pages 215 to 217; the company continued operations during 1922. The district is so far from the coast and is so difficult of approach that it was not deemed advisable to go in last summer. It is hoped, however, that such a trip can be made during 1923.

JUMP CREEK SECTION.

The Jump Creek section comprises the area in which Jump creek, a tributary to the Nanaimo river, has its source. This section is reached from Nanaimo by the wagon-road to the city dam; thence by trail up the Nanaimo river to the mouth of Jump creek; thence by trail up the Jump creek to the vicinity of Buttle mountain. Another trail is from the north side of Cowichan lake near the mouth of Cottonwood creek to the headwaters of Jump creek in the vicinity of the *Silver Leaf* and *Mountain Ash* mineral claims. The first route is about 30 miles long and was used considerably some years ago when development-work was being done on the *Jubilee* and *Patterson* groups. Later the trail was extended to the *Allies* group on the north slope of Buttle mountain near the head of Green river, where the trail ends.

This section has many indications that mineralized zones occur within its boundaries, so it would seem to be advisable to cruise the area between the *Allies* group and the *Silver Leaf* and *Mountain Ash*. This section is in the Esquimalt & Nanaimo Railway land grant and thorough prospecting has not been done, except in the immediate vicinity of the group referred to above.

This group contains the *Britain*, *France*, *Japan*, and *Serbia*, owned by Archie **Allies Group.** Cowie and associates, of Nanaimo. The prevailing mineral occurring on the

Allies group is molybdenite, which was so much in demand during the late war that the owners of this group pushed development-work energetically with the hope that the property could be placed on a producing scale, but since the close of the war and the decrease in the demand for this mineral the owners have confined themselves to doing the regular annual assessment-work preparatory to applying for Crown grants. The claims will be surveyed in 1923.

It is also proposed to cruise a route for a trail to connect the *Allies* group with Cowichan lake and the line of the Canadian National Railway near the mouth of Shaw creek in order to make the property more easy of access.

This group contains the *Silver Leaf* and *Mountain Ash*, owned by the Silver **Silver Leaf** Leaf Syndicate, of Duncan. The group was located by Thomas Service, of **Group.** Cowichan Lake, previous to the opening of the Great War, but no attempt to

develop the discovery of an ore-body, other than by assessment-work, was made until after Mr. Service's return from overseas. The ore-bodies on the *Silver Leaf* and *Mountain Ash* occur as quartz veins carrying gold, silver, and copper values. The most promising of these veins occurs on the *Silver Leaf* at the base of a high bluff, and its continuity has been determined by trenching up the face of the bluff to a height of about 50 feet, where there is a terrace, or flat, on the side of the mountain, and the vein has been traced along its line of strike on the surface for approximately 100 feet. This work was followed up by driving a drift-adit near the base of the bluff, in which the vein is shown to maintain its continuity for about 80 feet, at which point there is about 70 feet of backs.

The width of this quartz vein averages about 3 feet, and samples taken from it assayed as follows: (1.) Gold, 0.32 oz.; silver, 2.2 oz.; copper, 14.5 per cent. (2.) Gold, 0.66 oz.;

silver, 2 oz.; copper, 3.7 per cent. (3.) Gold, 0.2 oz.; silver, 1.2 oz.; copper, 4.7 per cent. (4.) Gold, 0.2 oz.; silver, 0.4 oz.; copper, 11.2 per cent. (5.) Gold, 0.8 oz.; silver, 1.6 oz.; copper, 5.5 per cent. (6.) Gold, 0.66 oz.; silver, 1 oz.; copper, 5 per cent. (7.) Gold, 0.86 oz.; silver, 1.4 oz.; copper, 5.1 per cent.

During 1922 development-work was continued on the *Silver Leaf* claim by extending the drift-adit, but this work has not yet been examined or sampled; the owners, however, reported that results were very satisfactory. Further prospecting in the vicinity of the *Silver Leaf* during 1922 resulted in the discovery of other quartz veins, samples from which taken by the owners are reported to have good assay values.

The Jump Creek section of the interior of Vancouver island is of considerable extent and embraces a mountainous area which separates the watershed of the Nanaimo river on the north from the streams which empty into Cowichan lake on the south. Roughly, this area is about 20 miles long and from 4 to 6 miles wide. The mountain range through this section is the southerly part of the Beaufort range, which forms the backbone of Vancouver island and extends from Mount Sicker section near Duncan in a north-westerly direction to the north-westerly part of Vancouver island, and in which there are several peaks which attain an altitude of from 4,000 to 6,000 feet.

The country-rock in this section is described by Clapp as being chiefly meta-andesite and granodiorite, with limestone lenses and Sicker schist. When it is considered that the ore-bodies in the Sicker schist have been, up to the present time, the most productive on Vancouver island, this section, together with the Arrowsmith section north-westerly from the head of Jump creek, presents a favourable section for prospectors to work in, more especially if an arrangement is made in the matter of the dual control with regard to title to the minerals that at present exists between the Provincial Government and the Esquimalt & Nanaimo Railway, so that that part of Vancouver island now in the Esquimalt & Nanaimo Railway Belt will be opened for prospecting under the same conditions as in other portions of British Columbia.

To the south-west is the divide between this section and Cowichan Lake section, in which the prevailing country-rock belongs to the Vancouver series of volcanics. In some places lenses of rocks belonging to Clapp's "Sicker series" (andesite-flows, tuff, etc.) occur as inclusions in the Vancouver volcanics. The occurrence of deposits of manganese ore in shear-zones in these rocks of the "Sicker series" created a good deal of interest in this section between 1918 and 1920, when about 1,000 tons of manganese ore was shipped from the *Hill 60* group near the outlet of Cowichan lake. Other discoveries of manganese ore were also made about the same time near the head of Cowichan lake under similar geologic conditions.

Copper sulphide and silver-lead-zinc ores are also known to occur on the Little Nitinat river about 10 to 12 miles westerly from the head of Cowichan lake. These occurrences are noted here to draw attention to the attractiveness of the section from a prospecting point of view, and because with the completion of the Canadian National Railway on the north shore of Cowichan lake and along the Little Nitinat valley transportation will be provided.

VANCOUVER MINING DIVISION.

The Vancouver Mining Division adjoins, on the east, that part of the Nanaimo Mining Division situated on the Mainland, the common boundary extending from the coast, west of the entrance to Jervis inlet, to the junction of the Lillooet-Clinton Mining Divisions, about 80 miles in a northerly direction. The north-easterly boundary of the Vancouver Mining Division is the south-westerly boundary of the Lillooet Mining Division, and follows the divide or summit of the Coast range in a south-easterly direction between the waters which flow south-westerly into Jervis inlet and the Squamish river and those which flow northerly into the upper Lillooet and Green rivers. This boundary crosses the Pacific Great Eastern Railway between Green and Alta lakes, near which it turns to a southerly direction and follows the divide between Pitt and Indian rivers; thence north of the Fraser river to Point Grey. The westerly boundary follows the coast-line from Point Grey to the corner of the Nanaimo Mining Division, Jervis inlet.

The mining industry in the Vancouver Mining Division during 1922, so far as production is concerned, would seem to have been disappointing until the reason for this lack of production is considered. The only metalliferous-mining property in the Division that has been developed to a producing stage is the *Britannia*, which has been non-productive during 1922 owing to the construction of a new concentrating-mill to replace the old one burned down in the fall of 1921.

Britannia Mining and Smelting Co. The operations of this company are of the greatest importance to British Columbia, because when the new concentrating-mill commences operations early in 1923 it will mean that the production of copper will be increased by about 30,000,000 lb. more than during 1922. The capacity of the new mill is 2,500 tons of ore a day, and, as the bulk of the ore treated will be mined from the new *Victoria* mine, carrying considerably higher values in copper than either the *Jane*, *Empress*, *Fairview*, or *Bluff* mines, it is practically certain that the production of copper for 1923 will reach the figures mentioned.

The company has set an example to other corporations and established a precedent by reason of the courage and persistence practised by the company, not only since the disastrous fire and flood during 1921 and consequent closing-down of the mill, but also during years gone by when the late G. B. Schley, of New York, the then president of the company, insisted on expending large amounts monthly for development-work in the mines contrary to the advice of technical advisers, also in being the first company in British Columbia to adopt the oil-flotation concentration process on a commercial scale in 1912, when that method was in the experimental stages.

These continuous efforts of the company have resulted in the development of one of the most important and extensive copper-mining propositions in British Columbia, instead of a failure such as it would have undoubtedly proved in the hands of less far-seeing and enterprising men. Since the death of Mr. Schley the management has consistently followed the example and precedent set by him. During 1922 all claims for damages caused to employees or others by the flood were settled amicably out of Court.

The work done by the Britannia Company during 1922, in addition to building the new concentrating-mill and the mining town at Britannia Beach, has been principally devoted to fully developing the *Victoria* ore-deposit from the surface down to the 2,200-foot level, about 2,100 feet elevation above the sea and corresponding with the 2,200-foot or present main haulage level in the main mine-workings.

In February, 1922, C. P. Browning, formerly general mine superintendent, succeeded E. J. Donohue as general manager of the Britannia Company, and James I. Moore, who had been assistant under Mr. Browning, was promoted to the position of general mine superintendent. W. A. Mathieson is still secretary-treasurer, to which position he was promoted at the time when E. J. Donohue was promoted to general manager after the resignation of J. W. D. Moody in 1920.

The *Victoria* section of the Britannia Company's property is east from the *Empress* section, and at present the mine-workings on the *Victoria* are connected with the portal of the adit on the 1,600-foot level on the *Empress* by an aerial tramway, but eventually the mine-workings on the *Victoria* section will be connected with those in the other sections of the property by underground drifting, possibly on the 2,700-foot level at the top of the ore-raise, which connects that level with the 4,100-foot level, the recently completed main haulage-adit. The portal of that adit is on the same level as and near to the grizzly floor at the top of the new concentrating-mill. The length of such an underground connection would be about 12,000 feet, or from the face of the adit on the 2,700-foot level, which is 3,500 feet from the portal, to the *Amy* winze in the *Victoria* section. This would practically be a drift along the line of strike of the *Britannia* mineral-zone, all on the company's property, and traversing the *Daisy*, *Jane*, *Bluff*, and *Empress* sections to the *Victoria*.

The first prospecting-work done on the *Victoria* section was in the fall of 1918, after Dr. S. J. Schofield had made progress in his examination of the *Britannia* mineral-zone for the Geological Survey of Canada. He advised that such prospecting ought to result in exposing an ore-body in that section.

Owing to the overburden of gravel being as much as 150 feet deep, prospecting with diamond-drills was slow and very expensive work, because casing had to be used in the drill-holes. Ore was struck at bed-rock as Dr. Schofield had predicted. Prospecting-work was continued on a rather limited scale until June, 1921, when it was decided to push the development in a most energetic manner.

Because of the wet soft nature of the schistose rock it was apparent that the underground workings in the *Victoria* section would require timbering, unnecessary in the other sections of the *Britannia* mines. The *Victoria* is the only wet section on the property.

On June 23rd, 1921, a site for a mining camp on Furry creek was selected in the virgin forest near the portal of the *Victoria* crosscut adit on the 1,800-foot level, which was the original prospect adit driven after the location of the ore-body had been determined by diamond-drilling. Clearing was commenced and logging operations started. A saw-mill with a capacity to cut about 30,000 feet B.M. a day was built. Afterwards lumber was cut for camp buildings, including two bunk-houses (one for white employees, the other for Japanese), two dining-rooms, recreation-hall, snow-sheds, and all other necessary buildings sufficient to accommodate 100 employees, all completed at the end of November, 1922.

As the ore from the *Victoria* section has at present to be conveyed from the mine-workings in that section to the portal of the adit on the 1,600-foot level in the *Empress* section, an aerial tramway has been constructed to form the connection, the lower terminal being near the portal of the *Amy* adit on the 1,900-foot level on *Victoria* ground, and the upper terminal near the portal of the *Empress* adit on the 1,600-foot level. Large storage-bunkers have also been built at the lower terminal of the aerial tramway, as well as a shaft-house over a shaft started on the 1,800-foot *Victoria* level. An air-compressor plant was also erected. All the buildings are constructed with lumber sawn from logs cut in the immediate vicinity. In future the sawmill will be employed in cutting mine timbers that are framed at the mill and sent into the mine ready to be set up.

The route by which ore from the *Victoria* section will be conveyed to the concentrating-mill at Britannia Beach is from the *Amy* adit, 1,900-foot level, to the 1,600-foot level, *Empress* adit, by aerial tramway; from there in large ore-cars along the 1,600-foot adit to rock-raises connecting the 1,600-foot level in the main mine-workings with the crushers on the 1,700-foot and 1,800-foot levels. The ore is dumped down these rock-raises to the crushers and from the crushers to the 2,200-foot haulage level, where it is loaded into ore-cars from chutes and conveyed over the switchback electric railway, about $3\frac{1}{2}$ miles long, to the 2,700-foot level, which is connected with the face of the 4,100-foot main haulage level by a rock-raise 1,500 feet deep on an incline of 65°. The ore is drawn from chutes at the bottom of the raise into cars propelled by electric motor to the ore-bins at the top of the mill. The distance or length of the haulage-adit is three-quarters of a mile, with a $1\frac{1}{2}$ -per-cent. underground grade.

During 1922 there have been 9,100 feet of working-openings driven in the *Victoria* section, also 1,500 feet of diamond-drilling. The working-openings are all drifts and crosscuts, except the *Amy* winze sunk from the 1,800-foot level to the 2,200-foot, with a station on the 2,100-foot level, two upraises from the 1,900-foot to the 1,800-foot level, and the *Victoria* shaft about 100 feet deep at the time of examination.

The mineralized zone formation in the *Victoria* section has its line of strike N. 70° W. and dips at an angle of 70° in a S. 20° W. direction, or practically similar to the strike and dip in other sections of the *Britannia* mines.

On the 1,900-foot level in the *Victoria* there are seven zones of concentration, or so-called veins, within the main *Britannia* mineral-zone, which is about 200 feet wide. These are designated by letters A to G. These veins vary in width from a few feet to a maximum of 40 feet of ore of commercial grade. On the 2,000-foot level the seven veins or zones of concentration appear to converge into four and are stronger towards the west from the *Amy* winze than in the opposite direction.

The adit on the 1,900-foot level known as the *Amy* adit in the *Victoria* section has its portal about 50 feet above the bed of Furry creek on the northerly side and 100 feet below the *Victoria* on the 1,800-foot level. Both adits are crosscutting the formation and were driven through accumulated gravel for long distances—about 550 feet on the 1,800-foot level and 650 feet on the 1,900-foot level—before bed-rock of the mineralized zone was reached. Drifts in both directions were driven from the crosscutting in ore, but these drifts have not been yet driven far enough to determine the length of the mineralized zone.

On the 1,900-foot level, or *Amy* adit, an upraise has been made to the 1,800-foot in ore for 60 feet high, when hard-pan was exposed. The upraise is on the hanging-wall side of the first vein exposed in the crosscutting. A second raise has been made in ore from the 1,900-foot to the 1,800-foot level, and a winze known as the *Amy* winze has been sunk from the 1,800-foot to the 2,200-foot level in ore; at present this winze is used for hoisting ore from the levels below the 1,900-foot, but this will be discontinued when the *Victoria* shaft under construction at the present time connects with the winze.

The *Victoria* ore-body has been sufficiently developed on the 1,800-, 1,900-, 2,000-, and 2,200-foot levels to warrant the statement that there are 1,000,000 tons of "positive" or "actual" ore blocked out. The Britannia Company in making estimates of tonnage only deals with "positive" ore.

The mine-workings in the *Jane*, *Bluff*, *Fairview*, and *Empress* sections of the *Britannia* mines have been described in the Annual Reports for several years past.

During 1922, because of practically confining the work in the mines to the development of the *Victoria* section, the fact that no ore was being shipped, and that there are nearly 2,000,000 tons of broken ore in the stopes in the *Fairview* and *Empress* sections awaiting transportation, the development-work done in these older sections was restricted to extending some of the working-openings an aggregate of about 1,000 feet and prospecting with diamond-drill about 1,000 feet. There are about 6,000,000 tons of "positive" ore blocked out in the *Bluff*, *Fairview*, and *Empress* sections in addition to the quantity of broken ore in the stopes.

In a paper written by C. P. Browning, general manager of the company, and read before the annual general meeting of the British Columbia Division, Canadian Institute of Mining and Metallurgy, in February, 1922, entitled "General Mining and Milling Practice at the Britannia Mine, Howe Sound, B.C.," he describes in a brief but comprehensive manner the ore-bodies in the *Britannia* mines; the system of mining; the development; the explosives used; the steel and bits; the system of transfer raises for conveying ore by gravity from the various levels above the 1,700-foot and 1,800-foot, on which the ore-crushers are located, to the crushers, and from those to the 2,200-foot haulage level; the transportation system between the 2,200-foot haulage level and the concentrating-mill at Britannia Beach; the milling and power plant.

This paper is published in the bulletin of the Canadian Institute of Mining and Metallurgy, January, 1922, pages 50 to 61. This paper is of such an instructive and interesting character as to make it a desirable addition to the library of any mining engineer. Lack of space is the only reason why the paper is not republished in this report.

In his description of the ore-bodies the author states: "The *Jane* deposit is roughly diamond-shaped and mineralized for a length east and west of 300 feet and over a width of 250 feet, also that the greatest depth at which commercial ore is found is less than 300 feet below the surface. The ore in the *Jane* section contains pyrite, zinc-blende, chalcopyrite, galena, and possibly barite, with scattered gold and silver values.

"The *Bluff* ore-deposit is 900 feet north-east of the *Jane*, having a maximum length on the 1,200-foot level of 500 feet east and west and a width of 250 feet north and south. This body extends to a known depth of 1,600 feet below the surface. It is very massive, highly silicified, and extremely hard. The average dip is 60° to the south, with a general pitch of 20° to 25° to the west. The ore-minerals are pyrite, chalcopyrite, zinc-blende, galena, and argentite, with a gangue of quartz. Gold and silver values are persistent, but lower than in the *Jane* body.

"To the east of the *Bluff* deposit is a transition zone to the *Fairview* deposit. This latter is a much softer formation, with a maximum mineralized area of 1,500 feet in length and 500 feet in width. The occurrence has a known depth of 2,200 feet, with a strike of S. 80° E. and an average dip of 72° to the south. The schist is extensively mineralized with pyrite and massive chalcopyrite, in lodes varying in width from 10 to 70 feet. Between these lodes, locally called veins, there are zones of barren or very low-grade schist which also vary in width. The foot and hanging walls of the zone are not clearly defined, lack of mineralization in the schist giving the demarkation.

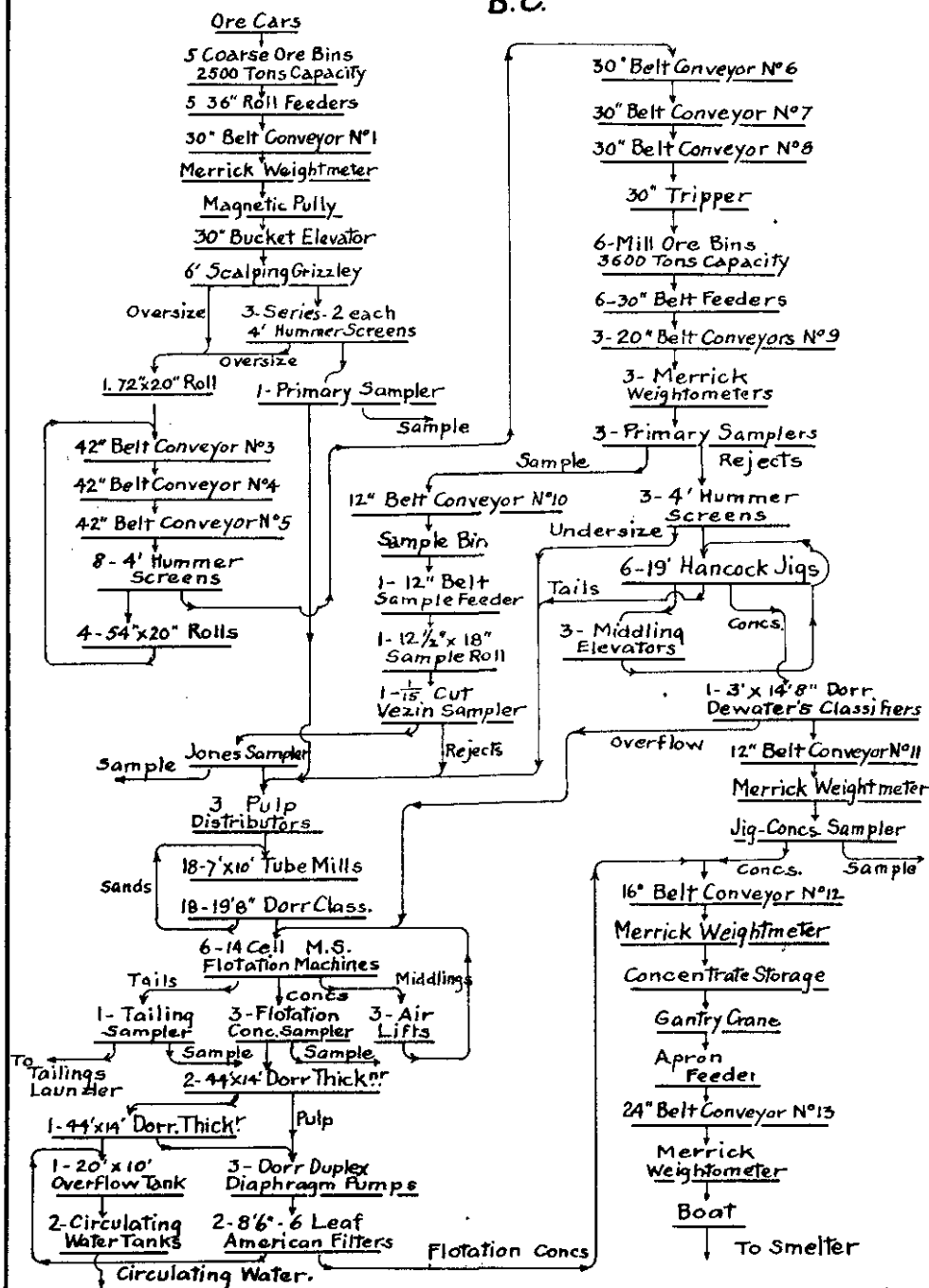
"The *Empress* ore occurrence is about 1,000 feet east of the *Fairview* and on the west side of Furry Creek valley. Its maximum length is 1,000 feet, with a width of 100 feet. The general strike is S. 70° E., with a varying dip, averaging 63° to the south. Pyrite, chalcopyrite, and chalcocite are the ore-minerals, the surrounding rocks being soft and much weathered. Leaching has therefore taken place in the upper portions of the veins and secondary enrichments occur.

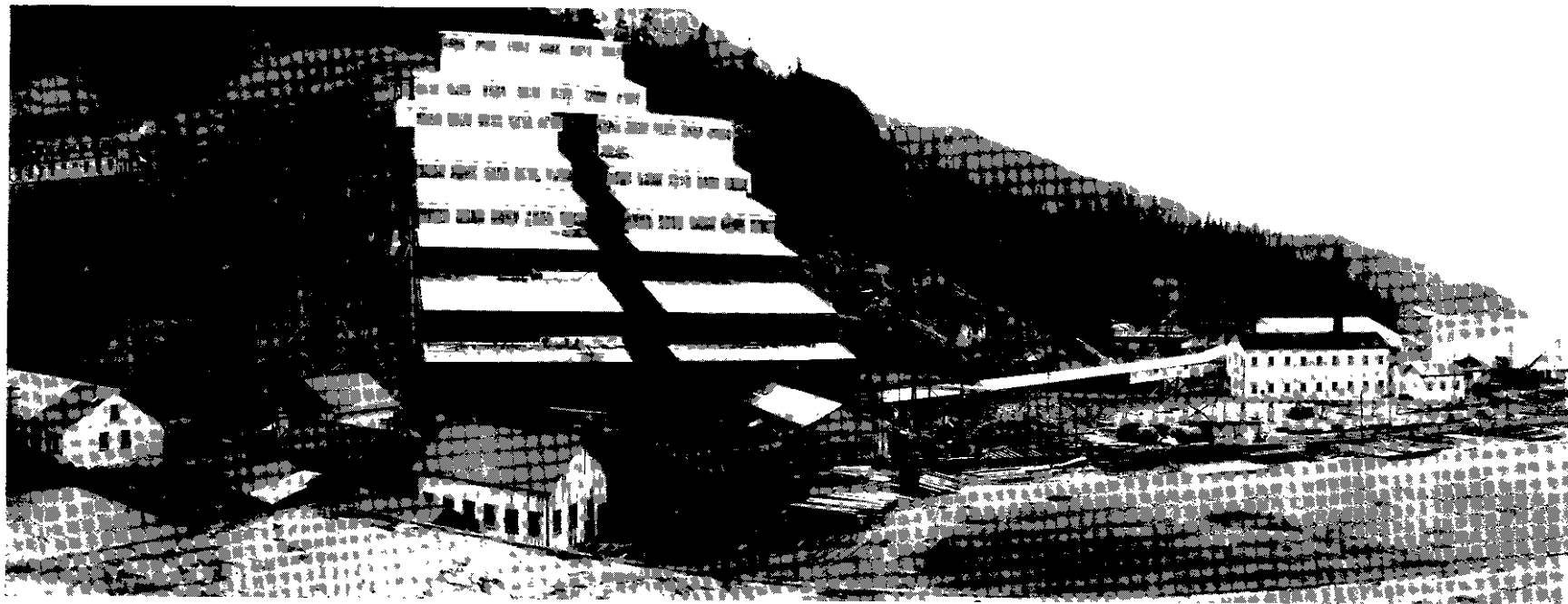
"East of the *Empress* ore-body is the so-called *Victoria* deposit, in which the schist-zone is heavily mineralized with pyrite and chalcopyrite. Neither the boundaries nor the dimensions of this ore-body have yet been determined, but no doubt it will prove to be of considerable size. It is badly broken and very much crushed in parts and is overlain by a depth of 150 feet of surface wash, making it difficult to prospect rapidly."

Britannia Beach Mill and Camp.—The new concentrating-mill erected at Britannia Beach during 1922 was started up the beginning of February, 1923. It was fully described in the Annual Report for 1921, pages 225 to 229.

FLOW SHEET - N°3 BRITANNIA MILL.

BRITANNIA BEACH, B.C.





Britannia Concentrator, Howe Sound, Vancouver W.D.

Power.—The power employed in the *Britannia* mines is electric and is developed from *Britannia* and *South Valley* creeks on the *Britannia Mining and Smelting Company's* own property. The series of five storage-dams of reinforced concrete (four on *Britannia* creek and one on *South valley*) act as reservoirs to hold the supply of water for the dry season. There are two power-houses, one at an elevation of 2,100 feet and the other at *Britannia Beach*, and by these means some of the water is made to serve for power twice before it reaches sea-level. The upper power-house develops about 1,950 horse-power, while the beach power-house has a capacity of 8,490 horse-power. Additional power is also developed when necessary by a 3,000-kw. steam plant located at the beach, which is, however, only used in cases of emergency.

Because of the greater capacity of the new mill, and in order to eliminate entirely the auxiliary steam plant, a contract has been entered into between the *Britannia* company and the *British Columbia Electric Railway Company*, under the terms of which additional electric power will be furnished from the *British Columbia Electric Railway Company's* plant at *North Vancouver*.

Work has commenced on this project, which necessitates a high-tension line, transmitting 4,500 to 6,000 horse-power at 34,000 volts, being built from *North Vancouver* to *Britannia Beach*. This line will follow the coast on the east side of *Howe sound* from *North Vancouver* for 30 miles to *Britannia Beach*. The current will be carried over the high-tension line at 34,000 volts to a sub-station at *Britannia Beach*, from which it will be distributed.

New Townsite.—Since the disastrous flood on the night of October 28th, 1921, which destroyed a large number of the houses at the *Britannia Beach* townsite, the company selected a new townsite on the elevated plateau on the north side of *Britannia* creek near its mouth, and during 1922 erected a large number of houses of the bungalow type for members of the staff and other employees who work at *Britannia Beach*. These residences are all built on modern lines and equipped with all necessary conveniences, such as hot and cold running water, electric lights, and heat.

JERVIS INLET SECTION.

During 1922 that portion of the *Vancouver Mining Division* described as the *Jervis Inlet* section, which comprises the mountainous country adjacent to both sides of *Jervis inlet*, has been receiving some attention from prospectors, especially in the vicinity of *Britain river*, which flows into the west side of *Jervis inlet* at the south-west end of *Princess Royal reach*, from which point *Thomas Lillie* and his partner, of *Pender Harbour*, travel to their group of claims situated about 6 miles from the mouth of *Britain river*.

Prospecting-work in this section was badly handicapped during the summer of 1922 by numerous forest fires which were burning and the dense pall of smoke which hung over the mountains and the inlet. The writer proposed to make an examination of the *Lillie* group, but was compelled to postpone the trip in the early part of the summer owing to the forest fires and later because *Mr. Lillie* and his partner both met with an accident by falling from a cliff.

It is proposed during the coming season to have a new trail cruised to the *Lillie* group from the head of *Hotham sound*, an arm of *Jervis inlet* near its entrance from *Malaspina strait*, as cruisers and prospectors who have been in the district claim that a trail from this point would be shorter than from the mouth of *Britain river*, the route that has been heretofore used.

A new trail via the route suggested would also serve to make the section beyond the *Jolley* and *Baramba* groups near the head of *Hotham sound* more accessible. This section has never been prospected to any extent owing to its inaccessibility, but some prospectors report good indications of mineralized formations.

This group contains seven mineral claims, known as the *Elraño*, *Colorado*,

Copper Group. *Portland*, *Columbia*, *Beaver*, *Coon*, and *Otter*, situated about 1½ miles from

the east shore of *Jervis inlet* on the southerly slope of a prominent mountain-peak known as *Treasure mountain*, near the head of *Beaver creek*, which enters into *Prince of Wales reach* in *Jervis inlet* about 5 miles south from *Vancouver bay*. The group is owned by the estate of the late *H. W. Treat*, of *Seattle*, *Washington*, and was described in the *Annual Report* for 1917, page 283, but was examined again on July 14th, 1922, because the development-work had been considerably extended since 1917.

On the southerly side of *Treasure mountain* there occurs a large area made up of rocks belonging to the *Texada* group, consisting, as classified by *O. E. LeRoy*, of a great variety of rocks of igneous origin forming a great basic complex along with a few interstratified and now

highly altered sediments, the rocks being agglomerates, breccias, tuff, porphyrites, diabases, lava, schists, slates, chert, and crystalline limestones. These rocks have been sheared, fractured, and fissured to such an extent that in some places the shearing approaches schistosity. Some of the fissures in this country-rock are of considerable width and are filled with wide bodies of pyrrhotite and magnetite ores, with which is associated a little chalcopryite.

The southerly slope of Treasure mountain is quite steep, on the *Copper* group in places being almost precipitous. The erosion has been quite pronounced and in consequence several outcroppings of mineral are exposed on the mountain-side. These outcroppings indicate a series of more or less parallel deposits of ore with lenticular structure. The lines of strike of these bodies appear to be nearly east (true) and the dip almost vertical towards the north.

Development of this group of claims has been done evidently to attempt to prove the continuity of ore-bodies at depth, as there are series of levels opened by surface open-cuts and adits at varying elevations between about 1,500 feet above sea-level and 2,000 feet, with the cabin camp about 25 feet higher elevation than that of the lowest adit and crosscut.

Sampling of various faces in the adits and open-cuts has demonstrated that on the *Copper* group of mineral claims there occurs apparently a very extensive body of ore, the mineralization of which is made up of pyrrhotite, magnetite, some chalcopryite, epidote, garnet, and other minerals. The grade of this ore so far shown by a hand-sampling is low, but when mined *en masse* will probably prove high enough to be treated by the oil-flotation process of concentration.

The apparent extent of the ore-bodies and the possibilities for mining by quarrying are such as to warrant the statement that mining costs would be down to a minimum. Transportation facilities are unusually good by means of aerial tramway about a mile in length from the mine-workings to the beach, where there is ample water supply, as well as a good site for a wharf at deep water. There is also a good opportunity to develop water-power on the property from Beaver creek, which drains a very considerable area and carries quite a volume of water, while the grade of the bed-rock of the creek is almost precipitous.

The development-work on the *Copper* group was started on an outcropping at about 2,000 feet elevation above sea-level, which, for convenience, may be designated as the No. 1 level. On this level there is a long open-cut approach to an adit driven 30 feet under cover, most of this length being through gravel overburden. At the face of this adit there is exposed a solid body of magnetite and pyrrhotite, the dimensions of which have not been determined.

On the No. 2 level, about 70 feet lower than the No. 1, there is an open-cut about 30 by 18 feet, with its face 7 feet high. The face of this open-cut exposed almost solid magnetite associated with some pyrrhotite and chalcopryite. Two short drifts, one 18 feet long and the other 8 feet, have been driven in the face of the open-cut evidently with the intention of attempting to determine some fact relative to the dimensions of the ore-body, but this work has not been carried far enough to enable one to form any reliable estimate as to the extent and continuity of the mineral-bearing ground.

No. 3 level is about 50 feet below the No. 2, and the development-work on that level consists of an open-cut 20 feet long to the portal of an adit 67 feet long, with a crosscut drift 10 feet long driven nearly at right angles from the left side of the main adit. All of these works show ore except the 10-foot crosscut. On this level there is another adit driven from a point about 50 feet westerly from the one just described.

This second adit on the No. 3 level is driven 60 feet in a N. 70° E. direction; at a point 42 feet in, the course of the adit has been changed towards the left a few degrees and driven 27 feet; then the course is again changed to the right for 25 feet, and from the second point where the course of the main adit has been changed a drift has been driven 20 feet long. This work has exposed very little ore.

The No. 4 level is about 100 feet lower elevation than the No. 3. The development-work on the No. 4 level consists of an open-cut approach 20 feet long to the portal of an adit about 50 feet long, with a short drift to the right from the adit about 10 feet long. This adit has been driven through overburden and at the time of the examination had only just reached solid bed-rock, while there is no ore in sight in the adit or the drift, although the appearances of the faces showed indications that the work was approaching mineral.

Other Prospects.—During the visit of the writer to Jervis inlet a side-trip was made into Seechelt inlet and Narrows arm, where P. J. Sanson and other prospectors, with their head-

quarters at Pender Harbour, have been doing assessment-work on the *Rock* and *Herres* groups of mineral claims situated on the Tzoonie river.

In this section about seventy claims were staked a few years ago by a group of prospectors, but on several of these claims no thorough prospecting had been done, and the writer was informed by Mr. Sanson that he was making arrangements to visit Vancouver, where most of the owners of these groups of claims reside, in order to arrive at some understanding as to doing further prospecting-work.

The Salmon Arm section of Seechelt inlet has been receiving some attention from prospectors during the last year, but all attempts to extend the development-work were badly handicapped because of the forest fires and the high elevation at which the mineral had been found.

This section is particularly attractive because of the occurrence of bornite ore discovered in the vicinity of the head of Seechelt (Siwash) creek, which empties into Salmon arm on the easterly side near the head.

In the early seventies a group of eight mineral claims was staked by old-time prospectors and later acquired by the Howe Mining Company, Limited, of Victoria. These mineral claims were Crown-granted and are known to-day as Lots Nos. 353, 421, 422, 423, 424, 452, and 454.

In the same vicinity the Cuprite Mining Company, of North Yakima, Washington, owns six mineral claims, on which some prospecting-work has been done.

NEW WESTMINSTER MINING DIVISION.

The western boundary of the New Westminster Mining Division is the eastern boundary of the Vancouver Mining Division, and it extends from near the mouth of the Fraser river northerly along the summit east of the Indian river to the neighbourhood of the foot of Lillooet lake, where the New Westminster Mining Division adjoins the Lillooet Mining Division, and from which point a line to a point a short distance east of Duffey lake between that lake and the town of Lytton on the Fraser river forms the northern boundary of the New Westminster Mining Division and the southern boundary of the Lillooet Mining Division. The eastern boundary of the New Westminster Mining Division follows an irregular line southerly from the point near Duffey lake to the International Boundary near the head of Chilliwack lake. This line nearly parallels the west side of the Fraser river between Lytton and Ruby creek.

Geology.—The New Westminster Mining Division has received much less attention during the past few years from prospectors than most of the Mining Divisions in British Columbia. Possibly this is accounted for by both the geologic and geographic conditions found in this Division.

When the geologic conditions are considered, the fact that this Mining Division is made up almost entirely of the granodiorite batholith of the Coast range, and that the Canadian Pacific Railway is the only route at present open to travel which crosscuts the Coast range north of the Fraser river in this Mining Division, it is not surprising that there has not been more prospecting done within its boundaries.

Until the report made by Charles Camsell after his reconnaissance along the Pacific Great Eastern Railway in 1917 was published, practically all of the maps showing the geology of the Coast range pictured it as an area of massive granitic rocks, and when one travels on the Canadian Pacific Railway from Vancouver to Ruby creek, the idea that he is crossing a mountain range made up entirely of granite or granodiorite rocks strikes one as being correct, and if he happens to be a prospector the conditions are very apt to be discouraging.

Geography.—From a geographic standpoint a prospector is to a great extent excusable for not looking on this section with enthusiasm, because, as already noted, with the exception of the Canadian Pacific Railway, there are no routes of travel open through that portion of the Division lying north of the Fraser river, and, so far as the portion of the Mining Division lying south of the Fraser river and east of the head of the Fraser delta about the neighbourhood of Sumas lake is concerned, the Canadian National Railway, which parallels the Fraser on the southerly side, a wagon-road paralleling the railway and the wagon-road paralleling the Chilliwack river to Chilliwack lake for about 15 miles from the town of Chilliwack, and the horse pack-trail from that point to Chilliwack lake, are practically the only routes open, with the exception of a trail from Laidlaw Station, on the Canadian National Railway, up Wahleach (Jones) creek, and another trail from the Chilliwack river up Slesse creek.

However, the easterly portion of the Division north of the Fraser has been made accessible for water transportation for about 40 miles by means of Harrison lake, which is fed by the Lillooet river and its tributaries, none of which are navigable. It is interesting, though, to note that the first travelled route from the lower Fraser river to the Cariboo placer-mining country was via Harrison lake to its head at Port Douglas; thence by wagon-road to the foot of Tenas lake; up that lake by boat, portaging by road to Lillooet lake; up Lillooet lake to Pemberton Meadows at its head; thence north-easterly to Lillooet via wagon-road on the Pemberton Portage, along Anderson lake; thence by short portage to Seton lake; down Seton lake, then by road to Lillooet.

There is no record, however, of any discoveries of minerals of note having been made by the placer-miners of the early days en route to the Cariboo. About twenty-five and thirty years ago, though, prospectors discovered gold-bearing quartz on what is known as the *Providence* mine on the western side of Harrison lake, and about the same time also discovered gold-bearing quartz in the Fire Mountain section near Fire lake at the head of Fire creek, which empties into the Lillooet river near the head of Harrison lake. Some prospecting has also been done on the easterly side of Pitt lake near its outlet at the southerly end, and also on Stave river about 5 miles above its confluence with Stave lake.

During the past two years a Vancouver syndicate has been prospecting in the vicinity of Fire lake in an attempt to determine the possibilities of resuming development-work on some of the properties which were partially prospected in 1897 and 1898.

During 1922 there has been but little prospecting-work done in this Division in the vicinity of Chilliwack lake or in the Cheam range of mountains, in which Wahleach creek and lake have their source.

When the Canadian National Railway was opened for travel about 1917 it was hoped that mining operations would be carried on on an extensive scale on the *Lucky Four* group in the Cheam range at the head of Wahleach creek, about 14 miles by trail from the railway; but up to the present time no work beyond annual assessment-work has been done on this property, which was fully described in the Annual Report for 1919, pages 284 to 286.

The fact that the Lillooet river and Harrison lake traverse the New Westminster Mining Division practically along the strike of the rock formations has in all probability been responsible to some extent for the lack of interest shown by prospectors in the north-westerly part of the Division, because naturally it is easier to prospect a country when the formations are crosscut by lines of travel than when those conform with the general strike of the country. It did appear as though about 1898 there would be considerable prospecting done in this Mining Division, for the reason that discoveries of gold-bearing quartz were made by Indians on several of the streams tributary to the Lillooet, in addition to the discoveries in the vicinity of Fire lake and Fire mountain, but such has not been the case, and to-day the mountainous district between the Lillooet river as its eastern boundary and the line of the Pacific Great Eastern Railway as its western boundary remains practically unexplored.

Prospecting-work has been done during the last three years in the high mountains about Cheakamus lake, the source of the Cheakamus river, tributary of the Squamish river, which empties into Howe sound, where two prospectors, Jack Findlay, of Alta Lake, and William Bailliff, of Mons, have located mineral claims.

In this mountainous section these prospectors and others report occurrences of metamorphosed sedimentaries and igneous rocks very similar in appearance to those occurring in the *Britannia* mineral-belt. These are illustrations of undestroyed "roof-pendants" as described by Camsell and Schofield, of the Geological Survey of Canada, and the probability that intensive prospecting may result in the discovery of ore-bodies of greater or lesser extent presents itself.

Lack in transportation facilities, though, presents a handicap which will be very difficult to overcome because the mountain ranges in this section reach high altitudes, and the construction of trails and wagon-roads will be both difficult and expensive, although the distance to the Pacific Great Eastern Railway does not exceed a few miles.

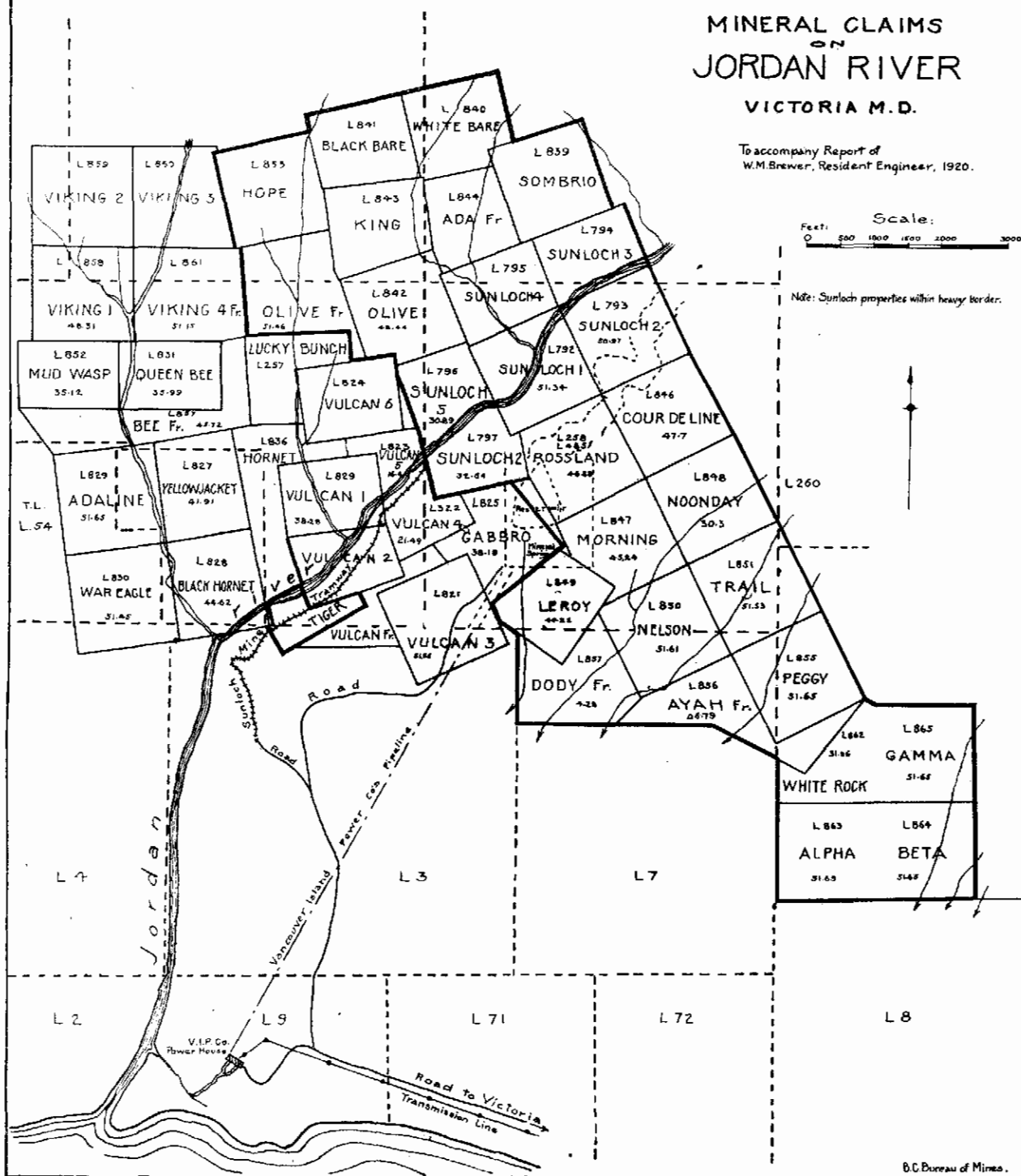
AGASSIZ SECTION.

The Agassiz section of the Division includes the area westerly from Harrison river and lake on the northerly side of the Fraser easterly to Ruby creek. This is a mountainous section, with quite rugged topography, which has been prospected considerably since about 1898, and in which is located the *Empress* group of mineral claims, from which some shipments of ore have been

MINERAL CLAIMS ON JORDAN RIVER

VICTORIA M.D.

To accompany Report of
W.M. Brewer, Resident Engineer, 1920.



made during 1917. This is the property of the estate of the late Barclay Bonthron, and no active mining has been done since his death.

This group contains four mineral claims recorded as the *Anna No. 1*, *No. 2*, *Anna Group*, *No. 3*, and *No. 4*, owned by M. D. Martinson and associates, of North Vancouver. The group is located on the southerly side of the mountain, north of the Canadian Pacific Railway track and about 5 miles east of the town of Agassiz. It is at an elevation of about 500 feet above the Fraser river, and is the same group described under the name *Contact* in the Annual Report for 1918, page 290. The property was re-examined December 4th, 1922, as there was a change in the ownership since the examination made in 1918 and also some extension of the development-work.

The prevailing country-rock on the *Anna* group is crystalline limestone and granodiorite. The contact between these rocks occurs near the boundary-line of the *Anna No. 1* and *No. 2* claims, a short distance from where the development-work has been done.

The ore occurrences on the *Anna* belong to the contact-metamorphic type of ore-deposits. The mineralization is made up of gossan, copper carbonates, chalcopyrite, some chalcocite, garnet, and tremolite. The copper ore occurs in bunches or lenses enclosed in crystalline limestone. The line of strike of the ore appears to be about N. 15° W. (mag.).

At one point it appears as though the ore filled a fissure in the limestone about 3 feet wide. This is exposed in the floor of the main working, which is a glory-hole or quarry about 28 feet long, 18 feet wide, and about 18 feet high at the face, and comprises the development-work since 1918.

No general samples were taken from the workings because the lenses were so scattered through the limestone that any hand-sampling, unless thoroughly and systematically done, would be misleading, and even then it is at present impossible to give any idea of the quantity of ore that could be mined in proportion to the quantity of limestone that would have to be broken down with the ore.

One sample was taken from a dump of ore mined during development in the quarry; this sample assayed: Gold, 0.02 oz.; silver, 5.6 oz.; copper, 15 per cent. In the report referred to, the samples taken assayed: (1.) Gold, trace; silver, 4 oz.; copper, 19 per cent. (2.) Gold, trace; silver, 4 oz.; copper, 10.2 per cent.

When the grade of the ore is taken into consideration, as well as the transportation facilities, it would appear quite advisable for the owners to continue development-work in order to determine the extent of the mineral-bearing formation, together with the possibilities of the ore-bodies maintaining continuity at depth.

In that portion of the Division lying southerly from the Fraser river and east from Sumas lake there was not much activity reported in mining during 1922, except in the mountains near the heads of Slesse and Nesakwach creeks, where on the north side of the rugged range of mountains just north of the International Boundary some prospecting was done in an endeavour to discover gold-bearing quartz ledges on Pierce mountain.

This section is northerly from the Red Mountain mine, situated near to but on the south side of the International Boundary, which has been operated on a more or less extensive scale for several years past. A report was published in Annual Report for 1915, pages 305 to 307.

The prospecting-work done in this section was not brought to the writer's attention until too late in the fall of 1922 to make any examinations.

VICTORIA MINING DIVISION.

The Victoria Mining Division comprises that part of Vancouver island lying southerly from a line drawn across the island, starting from near Ladysmith on the east coast, passing north of Cowichan lake around to the head of Nitinat river; thence southerly paralleling the Nitinat river and lake on the westerly side to near the outlet in Juan de Fuca strait, together with Galliano, Maine, Saltspring, Saturna, and other small islands in the gulf of Georgia.

The mineral resources of the Victoria Mining Division comprise copper-gold-silver ores; gold-bearing quartz ores; talc; material for manufacturing cement; ochre; limestone and clay suitable for pottery and brick-making.

The most important part of the Division so far developed is the Jordan River section, where the *Sunloch* and *Gabbro* groups are located.

JORDAN RIVER SECTION.

The geology of the Jordan River section is described very comprehensively but briefly by Victor Dolmage in the Summary Report of 1919, Part B, Geological Survey, under the title of "Sunloch Copper District, B.C." as follows:—

"The geology of the district surrounding the *Sunloch* mineral-deposit is similar to that of the western half of the Sooke sheet, which lies not more than 2 miles east of the workings on the *Sunloch* claims. The geology of the Sooke sheet has been worked out in detail and fully described by C. H. Clapp and H. C. Cooke.

"According to these authors, three formations comprise the geology of this part of Vancouver island, the Metchosin volcanics of Lower Tertiary, the Sooke gabbros of Middle Tertiary, and the Sooke formation of Upper Tertiary age. The *Sunloch* and adjacent mineral-deposits are at or near the contacts of a mass of Sooke gabbro which intrudes the Metchosin volcanics.

"The Sooke formation, which consists of partly consolidated, finely bedded sediments unconformably overlying the other two formations, does not outcrop on the area described in this report. It does, however, outcrop a few hundred yards to the south of Sinn Fein creek, which crosses the *Black Hornet* claim and enters Jordan river just below the *Vulcan* claims.

"The gabbro-mass extends eastward, probably beyond the boundary of the Sooke sheet, and it is highly probable that it may be connected, at no great distance below the surface, with one of the gabbro-masses which outcrop a short distance east of the Sooke sheet boundary. This is an important consideration with reference to the probable size of the *Sunloch* ore-bodies, because this small mass of gabbro, which is concluded to be the source of the ore, might be expected to produce a much larger quantity of ore if it were an offshoot of some near-by larger mass of gabbro and not a small independent and isolated mass."

This group of mineral claims, the controlling ownership of which is vested **Sunloch Group.** in the Consolidated Mining and Smelting Company of Canada, Limited, has been the most fully developed of any group of mineral claims in the Division, but during the past two years development-work has been suspended, awaiting the erection of a concentrating-mill which the Consolidated Company proposes and which may be erected during the coming year. The *Sunloch* group was quite fully described in the Annual Reports for 1917, pages 265 to 267; 1918, pages 300 to 303; 1919, page 235; and 1920, pages 220 and 221. The group contains thirty mineral claims and fractions having an area of approximately 1,300 acres.

The *Sunloch* group of mineral claims adjoins the *Gabbro* group on the north-easterly side of the last named, and in order that the conditions surrounding both of these groups shall be thoroughly understood it is necessary to draw attention to some of the facts relative to the ore-deposits on the *Sunloch* group in order that the description of the *Gabbro* group, later in this report, may be understood.

According to Dolmage's report the ore-bodies on the *Sunloch* group occur on or near the contact between the intrusive Sooke gabbro rocks and the Metchosin basalts. In his report he also notes that the country-rock on the *Sunloch* group practically all belongs to the Metchosin basalts and tuff, while the prevailing country-rock on the *Gabbro* group belongs to the Sooke gabbro class, but there are enclosed in this rock some small stocks of the Metchosin basalts, and the main south-westerly contact between the gabbro and basalts occurs near Sinn Fein creek on the *Black Hornet*, one of the *Gabbro* group of mineral claims.

There are three principal deposits of copper ore on the *Sunloch* group, which are known as the "River," "Archibald," and "Cave" zones, which occur almost paralleling each other from north-east to south-west in the order named. The outcroppings of these three deposits occur within a distance of about 500 feet; the lines of strike of the deposits are from north-westerly to south-easterly. In this report it is not necessary to refer further to the *Sunloch* group.

This company owns the *Gabbro* group of twenty-three mineral claims, which **Gabbro Copper** adjoins the *Sunloch* group on the south-west, and contains twenty-three **Mines, Ltd.** mineral claims and fractions located *en bloc*. The *Gabbro* group was partially described in the Annual Report for 1921 on page 232, but during 1922 the prospecting-work that had been started in 1921 had been very much extended when the property was examined on October 8th last.

Ore-deposits.—Deposits of copper-gold-silver ores occur on the *Gabbro* group of mineral claims in zones or belts with their lines of strike nearly parallel in a north-westerly direction. So far there have been four distinct ore-zones exposed by the prospecting-work; these are known as the "Stewart" and "Pat" on the *Vulcan No. 3* mineral claim, situated near the south-eastern boundary of the *Gabbro* group and traversed by the main wagon-road; the "Turnbull" zone on the *Vulcan No. 6* mineral claim, which adjoins the *Sunloch No. 5* on the south-westerly side; and the "Caulfield" zone on the *Black Hornet* mineral claim near the mouth of Sinn Fein creek, and also near the south-westerly contact between the Sooke gabbro and Metchosin volcanics. It is possible that the Cave zone, developed on the *Sunloch No. 6* mineral claim, may maintain continuity on to the *Vulcan No. 5* mineral claim, but no work to determine such continuity has yet been done. There are indications, though, that such continuity is maintained, because on the *Vulcan No. 5* an ore-body in line with the Cave zone has been opened up about 10 feet wide at a point on the Jordan river, a sample from which work assayed: Gold, trace; silver, 0.2 oz.; copper, 1.8 per cent.; and at another point about 200 feet above the river apparently this same zone has been opened up by trenching 9 feet wide, a sample from which assayed: Gold, trace; silver, 0.5 oz.; copper, 5.2 per cent.

In describing the mine-workings on the *Gabbro* group it is well to start at those on the *Vulcan No. 3* mineral claim, because that claim is traversed by the main wagon-road and an automobile can be driven to within a short distance of the open-cuts in which are exposed portions of the ore-deposit known as the "Stewart" zone.

Open-cuts Nos. 1 and 2, which are the most easterly on the Stewart zone, have been made along the strike of the ore-body from south-east to north-west. In these the ore-body is exposed for 132 feet in length along the upper wall, which is apparently the hanging-wall. The dip is nearly vertical towards the north-east. In these open-cuts the lower or apparently the foot-wall is not so well defined as the upper wall; a maximum width between the walls is 42 feet, and the open-cuts are made sufficiently deep to expose bed-rock or solid ore.

Grab samples from the dumps of No. 1 and No. 2 open-cuts assayed as follows: (1.) Gold, trace; silver, 1 oz.; copper, 0.5 per cent.; nickel, 0.3 per cent. (2.) Gold, trace; silver, 0.4 per cent.; copper, 2.7 per cent.; nickel, 0.05 per cent.

The ore-body exposed in the No. 1 open-cut is principally composed of pyrrhotite; the ore-body exposed in the No. 2 open-cut, while being composed to a large extent of pyrrhotite, shows a greater content in copper than the ore exposed in the No. 1 open-cut. These ore-bodies occur in gabbro country-rock and belong apparently to the replacement type of ore-deposits developed in a fissure in a shear-zone.

There are altogether twelve open-cuts along the lines of strike of the Stewart zone, but, as the ore from each of these open-cuts is apparently so similar, it was not considered necessary to take samples unless a thoroughly systematic sampling was done for purposes of purchase. For this reason only the two samples referred to were taken at the time of the examination.

On the *Vulcan No. 3* mineral claim the ore-zone known as the "Pat" has been exposed by open-cuts totalling between 50 and 60 feet in length. The Pat zone nearly parallels the Stewart zone on the easterly side of the last named a short distance up the hill.

After examining the *Vulcan No. 3* mineral claim a trail was followed in a north-westerly direction down the mountain-side to the *Vulcan No. 2* mineral claim to the tram-track along the south-easterly bank of the Jordan river, which connects the *Sunloch* mining camp to the end of a wagon-road, a branch of the main wagon-road that was travelled to reach the *Vulcan No. 3* claim. This tram-track was followed to the *Sunloch* camp, where, on the *Sunloch No. 6* claim, there is a bridge which crosses the Jordan river on to the *Sunloch No. 5* mineral claim, from which point a trail has been made to the *Gabbro* cabin camp on the *Vulcan No. 6* mineral claim, adjoining the south-west boundary of the *Sunloch No. 5* mineral claim, and the *Cliff Fraction*.

On the *Sunloch No. 6* mineral claim the ore-zone known as the "Turnbull" is exposed by a series of open-cuts about 50 feet higher elevation than the *Gabbro* cabin. The Turnbull zone at this point is apparently low grade, the mineralization being made up of pyrrhotite, pyrite, and some chalcopyrite. In the open-cuts there is an average of about 6 feet in width of solid ore at present exposed.

About 40 feet higher elevation than the Turnbull zone other occurrences of mineral outcroppings occur with the lines of strike nearly paralleling the Turnbull zone. Open-cuts which have been made exposed a width of ore in shear-zone of about 20 feet, and in this 20 feet there

are two portions, one on the hanging-wall side and the other on the foot-wall side, in which mineralization shows higher-grade ore than is usually found on the property. This mineralization is made up chiefly of chalcopyrite and some bornite. A sample taken assayed: Gold, trace; silver, 0.4 oz.; copper, 8.8 per cent. This sample was a general one at the point sampled and was not taken to represent an average of the ore-body. About 50 feet in a north-westerly direction from where the sample just mentioned was taken there is a long open-cut in which apparently a continuation of the ore-zone is exposed, showing solid ore 6 feet wide in the open-cut about 60 feet long.

From the *Vulcan No. 6* mineral claim a trail was followed in a south-westerly direction to the *Black Hornet* mineral claim, which is traversed by a portion of the Sinn Fein creek that flows into the Jordan river at the southerly boundary of the claim.

The south-westerly contact between the Sooke gabbro and Metchosin volcanics is well defined at the point mentioned where the mineralization occurs that is known as the "Caulfield" zone. This mineralization occurs near the bank of the Jordan river on the westerly side about 150 feet above the river in a shear-zone and is exposed in the open-cut where the ore-body is 6 feet wide. A general sample from the work assayed: Gold, trace; silver, 0.14 oz.; copper, 3 per cent.

About 75 feet lower elevation, practically on the bank of the river, in an open-cut, apparently the Caulfield zone is again exposed for a width of 12 feet, but in this exposure the mineralization is not as solid as in the cut at the higher elevation. A selected sample taken from the open-cut at the lower elevation assayed: Gold, trace; silver, 0.4 oz.; copper, 2.8 per cent.

From this point on the *Black Hornet* mineral claim the examination was continued to a point on the *Vulcan No. 5* claim, which adjoins the *Vulcan No. 6* claim on the south-east, where the ore-exposures in a series of open-cuts already referred to as possibly belonging to an extension of the Cave zone on the *Sunloch No. 6* mineral claim were examined; the assay results from these samples have been already given.

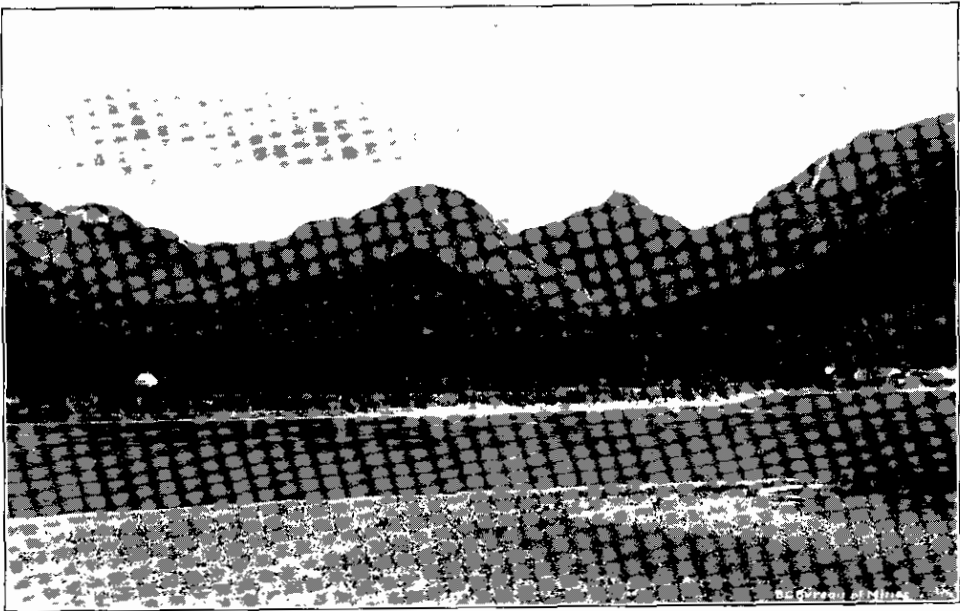
It is interesting to note that some of the pyrrhotite ore on the *Gabbro* group of mineral claims carries low values in nickel, as shown by the assays of the samples from the *Vulcan No. 3* mineral claim; also in an ore-body which outcrops on the *Vulcan No. 2* mineral claim, which was found in the spring of 1921 at a point about 250 feet higher than the level of the *Sunloch* tramway. This last-mentioned occurrence of ore may prove to be an extension of either the Stewart or Pat mineral-zone described as occurring on the *Vulcan No. 3* mineral claim, but, as there has been so far no determination of this fact, the ore occurrence on the *Vulcan No. 2* is known as the "Winkler" zone. Four open-cuts have been made in this so-called Winkler zone, the ore exposed in which has proven to be nickelliferous. The character of the ore is pyrrhotite, carrying, in addition to low nickel values, about 2 per cent. in copper.

Results obtained from the work that has been done on the *Gabbro* group show that further development-work will probably prove that the ore-bearing zones on the *Gabbro* group are very similar to those on the *Sunloch* group, notwithstanding the fact that on the former the mineralization occurs in the gabbro country-rock rather than in the Metchosin volcanics in which it occurs on the *Sunloch* group. On both groups, though, it is noticeable that the ore-bodies occur, if not at the contact between the two formations, very near to it.

The owners of the *Gabbro* group, the Gabbro Copper Mines, Limited (N.P.L.), propose to continue development-work on these properties during the coming year.

This company owns a deposit of talc on Wolf creek, a tributary of the Sooke river, described in the Annual Report for 1920, page 222, as being owned by W. G. Dickenson, of Victoria. Since that description was published Mr. Dickenson has organized the Eagle Talc and Mining Company and Crown-granted the mineral claim known as the *Eagle* claim, now known as Lot 77. The property was re-examined on October 5th, 1922, because considerable development-work as well as the construction of a mill on the property has been done since the earlier examination was made.

Mr. Dickenson has established a new industry on a commercial scale in British Columbia through the development of this deposit of talc, and is supplying the demand from two paint-factories, paper-mills, and for roofing material. Three grades are produced from the mill; the finest grade goes to paint-factories, the second grade, which is ground to about 150-mesh, goes to paper-mills, and the coarser material to the Sidney Roofing and Paper Company, Limited, for wall-paper.



Hope, Town of, and Coquihalla Valley.



B.C. Alluvials—Hydraulic Pit, Bridge River, Lillooet M.D.

The development-work in the mine has been extended by driving an adit into the bank of Wolf creek 60 feet long, with a drift in a north-westerly direction at the face which exposes a body of quite pure talc 14 feet wide. At a point a few feet easterly from the adit there occurs a second body of talc separated from the one on which the adit is driven by a narrow belt of badly contorted slate. This second deposit of talc had not been developed to any great extent when examined, but from the surface showing it would appear to be nearly, if not quite, as wide as the deposit on which the adit has been driven, and from information from Mr. Dickenson it is expected that this second body of talc will produce bricks for furnace-linings and for purposes that will withstand a much higher degree of heat than the fire-brick generally used, but up to the present time there has been no commercial production made of talc brick.

There has not yet been sufficient development-work done on these talc-deposits to warrant any definite statement as to tonnage available. Above the adit already described there are about 75 feet of backs at the face of the adit, and, judging from surface indications, the talc-deposits may possibly extend for a considerable distance north-westerly beyond the face of the adit along the strike. So far as the geology and structure of these talc-deposits are concerned, it is unnecessary to repeat here the description relating to those facts, which were published in the Annual Report for 1920.

The most important feature with regard to the talc industry has been the erection of a mill of the Forrester type. This mill has been erected on the mineral claim and is connected with the portal of the adit by an incline hoist, the power for which is supplied by a 30-horse-power automobile-engine.

The mill is equipped with a Williams hammer-bar crusher with 12-inch jaws which crushes the talc rock to $\frac{1}{2}$ inch diameter and less. From this crusher the talc rock is fed into a bucket elevator which discharges into the Forrester mill, the product from which gives about 8 per cent. to a fineness of 200-mesh and 92 per cent. to a fineness of 150-mesh. The power to drive the mill is furnished by a 15-horse-power gas-engine.

The finest-crushed material is delivered into cloth screens, from which about eight sacks a day of the finest grade of talc is produced. The coarser-crushed material is delivered into a cyclone dust-collector, with which is connected a 45-inch Sheldon fan operated by a 10-horse-power gas-engine. The dust-collector is 8 feet 6 inches in diameter, and 11 feet high. An 18-inch pipe carries the air into the dust-collector and a 30-inch pipe carries the air out into cloth machines having 4,000 feet of screening area. There are two of these cloth machines which are agitated by a system of cams to shake the dust off of them. All of the product is delivered from the bottom of the mill into the hoppers, from which sacks are filled for shipment.

Possibly the most interesting feature in this treatment is the introduction of air into the bottom of the mill, which forces the mill-feed upwards instead of the air being introduced on the top and forcing the mill-feed down. The air is the force which carries the mill-feed through the entire treatment. The crushing capacity of the mill is 4 tons a day to 150-mesh.

As a proof that the industry has been successful is the fact that, although the mill only ran about ninety days during 1922, the shipments of the product amounted to 277 tons.

This mineral claim is located on the South fork of Deception creek about 1,000 feet above the junction of the fork with the main creek, which empties into the Sooke river on the westerly side between a quarter and a half mile westerly from the Victoria City dam at the foot of Sooke lake. The *Inverreck* mineral claim is owned by J. R. Carmichael and associates, 2374 Cookman Street, Victoria. In the bank of the South fork of Deception creek there occurs a deposit of talc which is apparently about 18 feet wide as shown by blasting in the creek-bank.

This property was examined on November 12th, 1922, and, judging from the limited prospecting-work that has been done on it, the showing is sufficiently promising to warrant more thorough prospecting and more extensive development-work.

A sample taken from the face of the open-cut in the creek-bank assayed: Gold, trace; alumina, 5.8 per cent.; iron, 2.8 per cent.; magnesia, 30.4 per cent.; lime, *nil*; silica, 39.5 per cent. When heated the loss at 110° C. equals *nil*, while at red-heat the loss equalled 17 per cent. The sample showed about 16 per cent. magnesite.

This deposit of talc occurs in the Leech River formation under very similar conditions to the deposits owned by the Eagle Talc and Mining Company. As to commercial value of the

product, that will be decided in the market when the deposit is further developed and the product enters the market on a commercial scale.

Ochre-deposits.—These deposits, which were described in the Annual Report for 1921, pages 232 and 235, as occurring on Demaniel and Stony creeks near the Sooke Post-office, have been during 1922 further developed, and it is claimed by the owners that markets have been found for the product for the manufacturer of paint, also for refining gas, and connection by auto-road with the track of the Canadian National Railway is only awaited before shipping will be commenced.

ALBERNI DISTRICT.

ALBERNI MINING DIVISION.

REPORT BY A. G. FREEZE, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Alberni Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—ALBERNI MINING DIVISION.

Mineral claims recorded	10
Certificates of work recorded	22
Free miners' certificates issued	40
Bills of sale recorded	2

Revenue.

Mining receipts (general)	\$236 00
Free miners' certificates	150 50
Total	\$386 50

CLAYOQUOT MINING DIVISION.

REPORT BY WALTER DAWLEY, MINING RECORDER.

I have the honour to submit the office statistics of the Clayoquot Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—CLAYOQUOT MINING DIVISION.

Mineral claims recorded	14
Certificates of work issued	10
Free miners' certificates issued	20
Bills of sale and transfers recorded	3

Revenue.

Mining receipts (general)	\$ 75 25
Free miners' certificates	93 25
Total	\$168 50

QUATSINO MINING DIVISION.

REPORT BY ED. EVENSON, MINING RECORDER.

I have the honour to submit the office statistics of the Quatsino Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—QUATSINO MINING DIVISION.

Mineral claims recorded	17
Certificates of work recorded	58
Bills of sale recorded	15
Free miners' certificates	62
Total revenue collected	\$575 50

NANAIMO DISTRICT.

NANAIMO MINING DIVISION.

REPORT BY L. A. DODD, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Nanaimo Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—NANAIMO MINING DIVISION.

Free miners' certificates issued	255
Mineral claims recorded	140
Certificates of work ("Mineral Act")	195
Certificates of work ("Placer Act")	15
Bills of sale; powers of attorney, etc., recorded .../.....	70
Placer leases issued/.....	4

Revenue.

Free miners' certificates	\$1,053 50
Mining receipts (general)	2,374 90
Total	\$3,428 40

VICTORIA DISTRICT.

VICTORIA MINING DIVISION.

REPORT BY R. J. STEENSON, GOLD COMMISSIONER.

I have the honour to submit the office statistics of the Victoria Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—VICTORIA MINING DIVISION.

Free miners' certificates issued	367
Free miners' certificates (special) issued	7
Mineral claims recorded	12
Placer claims recorded	1
Placer claims rerecorded	1
Certificates of work recorded/.....	48
Abandonment recorded/.....	1
Grouping notices filed/.....	3

Revenue.

Free miners' certificates	\$3,246 00
Mining receipts (general)	367 70
Total	\$3,613 70

VANCOUVER MINING DIVISION.

REPORT BY A. P. GRANT, MINING RECORDER.

I have the honour to submit the office statistics of the Vancouver Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—VANCOUVER MINING DIVISION.

Free miners' certificates issued	2,175
Free miners' certificates issued (special)	17
Free miners' certificates issued (company)	52
Quartz claims recorded	38
Certificates of work issued	188
Surveys recorded as work	1
Receipts issued for money in lieu of work	8
Grouping notices filed	28
Conveyances recorded	16
Certificates of improvements recorded	4
Placer claims recorded	2
Placer leases issued	1
Powers of attorney recorded	2

Revenue.

Free miners' certificates	\$14,242 30
Mining receipts	1,536 00
Total	\$15,778 30

NEW WESTMINSTER MINING DIVISION.

REPORT BY IRVING WINTEMUTE, MINING RECORDER.

I have the honour to submit the office statistics of the New Westminster Mining Division for the year ending December 31st, 1922.

OFFICE STATISTICS—NEW WESTMINSTER MINING DIVISION.

Free miners' certificates issued	193
Mineral claims recorded	104
Certificates of work issued	40
Conveyances, etc., recorded	17
Grouping notices filed	5
Certificates of improvement issued	5
Leases of reverted mineral claims	5

Revenue.

Free miners' certificates	\$ 808 00
Mining receipts	631 80
Total	\$1,439 80

INSPECTION OF MINES.

REPORT BY JAMES DICKSON, ACTING CHIEF INSPECTOR OF MINES.

I have the honour to submit my annual report as Acting Chief Inspector of Mines for the Province for the year 1922.

Appended are 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 and metalliferous mines, the tonnage of coal mined, lists of fatal accidents and prosecutions, and the reports of the Instructors in Mine-rescue and First-aid Work.

PERSONNEL OF STAFF OF INSPECTORS AND INSTRUCTORS.

Inspectors.

James McGregor	Chief Inspector.
Robert Strachan	Senior Inspector, Fernie (Kootenay and Boundary Districts).
John McDonald	Inspector, Fernie.
H. H. Johnstone	Temporary Inspector, Rossland.
Henry Devlin	Inspector, Nanaimo.
Thomas 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 Chief Inspector of Mines.

Harry E. Miard, member of Board and Acting Inspector of Mines.

Messrs. Dickson and Miard and the District Inspector of 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.

There have been no changes in the inspection staff and no new appointments made during the year.

TONNAGE OF COAL PRODUCED.

The gross tonnage mined by the coal-mines of the Province for the year 1922 amounted to 2,580,915 tons, being an increase of 11,276 tons as compared with the output of the year 1921. This was attained in spite of the fact that the miners in the East Kootenay District were on strike from April 1st to August 22nd.

The Coast District, which includes Nicola-Princeton, Vancouver island, and Telkwa coalfields, produced 2,026,554 tons, an increase of 216,670 tons as compared with the previous year.

The Vancouver Island collieries produced during the year 1,754,656 tons, an increase of 128,725 tons as compared with the previous year.

The Aveling mines in the Northern District produced 1,008 tons for the year, being an increase of 208 tons.

The Nicola-Princeton District produced 270,890 tons during the year, being an increase of 87,737 tons as compared with the previous year.

The Crowsnest Pass District produced during the year 554,361 tons, a decrease of 205,394 tons compared with the previous year. This decrease is a direct result of the labour trouble mentioned above.

ACCIDENTS IN COAL AND METALLIFEROUS MINES.

The compilation of tables showing number and character of accidents in coal 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 tonnage 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 thirty-one. There were 6,644 men employed in and around the coal-mines.

The ratio of accidents per 1,000 persons employed was 4.66, compared with 1.45 in 1921; in 1920 the ratio was 2.67, in 1919 the ratio was 2.10, in 1918 the ratio was 5.15, and in 1917 it was 8.51. The ratio for the last ten years was 4.74.

The following table shows the collieries at which fatal accidents occurred during 1922, and their relation to accidents which occurred in 1921:—

Name of Company.	Name of Colliery.	1922.	1921.
Canadian Collieries (D), Ltd.	Comox, No. 4 Mine.	18	4
" " "	Extension	..	1
Western Fuel Corporation of Canada	No. 1 Mine.	1	..
" " "	Wakesiah	2	..
" " "	Reserve.	1	..
Middlesboro Collieries, Ltd.	Middlesboro.	3	..
Crow's Nest Pass Coal Co., Ltd.	Coal Creek.	1	2
Granby Mining, Smelting & Power Co.	Cassidy.	5	3
Totals		31	10

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.	1922.		1921.	
	No.	Per Cent.	No.	Per Cent.
Asphyxiation.	1	3.23	..	.....
" Blow-outs " (outbursts of coal and gas).	2	6.45	..	.....
Falls of roof and rock.	4	12.90	6	60.00
Falls of coal.	3	9.68	..	.....
Mine-cars and haulage	1	3.23	4	40.00
Explosions.	20	64.51	..	.....
Totals.	31	100.00	10	100.00

The number of tons of coal mined for each fatal accident during the year 1922 was 83,255 tons, compared with 256,963 tons in 1921.

FATAL ACCIDENTS IN METALLIFEROUS MINES.

There were six fatal accidents in the metalliferous mines of the Province during the year 1922, being an increase of three compared with the year 1921.

There were 2,110 persons employed in and around the producing metalliferous mines, an increase of eleven compared with the previous year.

The ratio of fatal accidents per 1,000 persons employed was 2.84, compared with 1.43 in 1921. The ratio for the last ten-year period was 3.02.

The mines at which fatalities occurred are:—

Mining Division.	Mine.	No. of Accidents.
Slocan	Standard	1
"	Slocan Star	1
Portland Canal	Premier	2
Nass River	Rambler	1
"	Hidden Creek	1
Totals		6

The following table gives the cause and percentage to the whole of the fatal accidents in metalliferous mines, with corresponding figures for 1921:—

Cause.	1922.		1921.	
	No.	Per Cent.	No.	Per Cent.
Falls of ground	2	33.33	2	66.67
Mine-cars and haulage	1	16.67	1	33.33
Powder-explosions	1	16.67	..	.....
Crushed by skip in shaft	1	16.67	..	.....
Miscellaneous	1	16.66	..	.....
Totals	6	100.00	3	100.00

The output from the metalliferous mines for the year 1922 was 1,573,186 tons, compared with 1,562,645 tons in 1921, showing an increase of 10,541 tons.

The number of tons of ore mined for each fatal accident in 1922 was 262,197 tons, compared with 520,881 tons in 1921, a decrease of 258,684 tons.

EXPLOSIVES USED IN COAL-MINES.

The following table shows the quantity of explosives used in the coal-mines of the Province during the year 1922, together with the number of shots fired, how shots were fired, tons of coal produced by one 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.	Tons of Coal per Pound of Explosive.	Average Pounds of Explosive per Shot fired.
Vancouver Island and Telkwa	540,962	1,755,664	725,210	3.24	0.74
Nicola-Princeton	80,717	270,890	94,932	3.35	0.85
East Kootenay	24,844	554,361	32,256	22.31	0.77
Totals	646,543	2,580,915	852,398	3.99	0.76

The following list of explosives is permitted for use in the coal-mines of the Province:—

Monobel A1	British List.
Monobel No. 1	"
Dynobel No. 4	"
Polar Permitite	"
Coalite "E" L.F.	United States List.
Monobel	" "
Coalite "A" L.F.	" "
Coalite "Y"	" "
Monobel No. 4	" "
"Giant" Coal-mine Powder No. 5	" "

"Giant" Coal-mine Powder No. 6	United States List.
"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	" "

SAFETY-LAMPS.

The following table shows the distribution of lamps by districts, method of locking, and illuminant used:—

District.	Magnetic Lock.	Screw or Automatic Clip.	Naphtha.	Electricity.
Crowanest Pass	155	1,262	155	1,262
Vancouver Island	319	3,477	319	3,477
Nicola-Princeton	56	499	56	499
Totals	530	5,238	530	5,238

Of the above electric lamps, 4,885 are of the Edison type and 353 are of the Wheat double-bulb type. The continued use of the electric lamp for lighting has been highly successful.

MINE-AIR SAMPLING.

The same system of taking air samples has been followed as in the past year throughout the Province. Careful checking has been continued between the chemical analysis received from the Mines Branch laboratory at Ottawa and the results shown by the Burrell gas-detector in use in the different mines of the Province. The difference between the test made at the laboratory at Ottawa and the readings of the Burrell gas-detector with reference to the amount of CH_4 contained in the mine atmosphere does not vary more than one-tenth of 1 per cent.

The Inspector of each coal-mining district is supplied with the Burrell gas-detector, also each of the coal-mining companies use them for making its own tests.

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 $2\frac{1}{2}$ per cent. methane. This chart was compiled from actual tests covering nearly two years.

EXPLOSIONS IN COAL-MINES.

Two explosions occurred during 1922; the first, involving the loss of eighteen lives, happened on August 30th in No. 20 East long-wall, No. 2 slope, of No. 4 mine, Comox Collieries. This is fully dealt with in another part of this report. The second explosion occurred in the Wakesiah mine of the Western Fuel Corporation of Canada on November 24th and resulted in the death of two men.

In the first case, that of the Cumberland explosion, the ignition was supplied by the arc formed when an electric-power cable was broken by debris from a brushing shot.

According to the evidence submitted at the inquest held on the bodies of the men who were killed, the shotfirer had examined the place where the shot was fired, and the vicinity, as required by the general and special rules, sections 91 and 92, of the "Coal-mines Regulation Act," and did

not find any inflammable gas shown by means of his safety-lamp. However, the fact that this explosion occurred immediately the shot was fired is sufficient proof that inflammable gas was present, and in considerable quantity, as the explosion travelled from this point to the return end of the long-wall section, traversing some 600 feet.

The explosion and its results, as far as fatalities were concerned, were almost wholly confined to the face-line. Three of the deceased were white men and fifteen were Orientals.

The explosion at Wakesiah occurred in a long-wall section, and as near as can be learned was caused by a fireboss, who was killed, attempting to dislodge inflammable gas from the brushing-face of a long-wall place by means of compressed air.

He had, apparently, set his flame safety-lamp in such a position that the inflammable gas, moving at a high velocity due to the compressed-air being discharged into it, had caused the flame of the safety-lamp to be passed through the gauzes and so ignite the outside atmosphere.

This explosion occurred during the night shift, when comparatively few men were employed in the section, otherwise the loss of life would in all probability have been greater.

These two explosions emphasize the need of recognition of the danger attendant on the presence of so-called small bodies of inflammable gas, and also the danger due to air-currents which may be charged with CH_4 to the extent of showing a "small cap," or " $\frac{1}{4}$ -inch cap," as is sometimes seen in the report-books at different mines.

When conditions of this nature prevail it requires only a small increase in the amount of inflammable gas given off or some temporary derangement of the ventilation system to produce explosive conditions.

BLOW-OUTS.

Outbursts of coal and gas were responsible for two deaths in 1922. Both fatalities occurred in the Cassidy mine of Granby Consolidated Mining, Smelting and Power Company.

This mine since 1921 had over 100 "blow-outs," which displaced large amounts of coal in addition to large volumes of CH_4 . Several of the larger "blow-outs" have projected over 1,000 tons into the workings, and, in addition to the number given above, there were numerous movements of the faces which are not recorded as "blow-outs." Some of the larger "blow-outs" gave off more than 1,000,000 cubic feet of CH_4 in ten hours.

As a precaution no explosives are allowed in this mine below No. 4 level, except for rock-work, and all working-faces are drilled with at least three holes that are kept 20 feet in advance of the face. Drill-holes are also put into the ribs every 20 feet at an angle of 30° with the line of the roadway.

The "blow-outs" appear to have lessened both in number and magnitude since this system of drilling was inaugurated, but its value can only be determined when results are available over an extended period. The "blow-outs" do not produce any perceptible effect on the floor or roof, and in some cases, where the violence of the "blow-out" was sufficient to either displace or break all the props for a considerable distance from the seat of the occurrence, no roof material fell.

With a view to minimizing the danger due to the above conditions, the management at this mine has installed a very elaborate system of dust-barriers in all main airways and levels, and on the main intake there is a humidifying system consisting of two units; one, an arrangement of steam-pipes which raises the temperature of the air entering the mine, and finally discharges the exhaust steam into the air-current it has heated; and the second, an automatic spraying system, with atomizing nozzle, discharges every few hundred feet.

"BUMPS."

A number of "bumps" occurred in Coal Creek Colliery, fortunately unaccompanied by any serious accident. These occurrences are more fully dealt with in the report of Inspector Strachan.

LEGISLATION.

During the year the following rules concerning the use of electrical power were put into force pursuant to the "Coal-mines Regulation Act":—

"COAL-MINES REGULATION ACT."

Pursuant to the provisions of the "Coal-mines Regulation Act," chapter 160, R.S.B.C. 1911, as amended by section 15, chapter 58, Statutes of 1919, the following rules governing the use of electrical power in coal-mines are hereby established, viz.:—

- (1.) No terminals of main feed-lines shall be located nearer any coal-face than 50 feet.

(2.) When blasting is being done the current shall be cut off and the cables made dead in that vicinity, and the current shall not be switched on again until blasting is finished and the places are examined and pronounced safe, and the cables have been examined and found free from any defects which may cause accidents or other damage.

(3.) All permanent electrical installations and transforming stations underground shall be made fire-proof.

(4.) All switches and terminal connections shall be protected or enclosed so as to prevent accidental contact by persons, and danger from arcs or short circuits, fire or water; and where there may be risk of igniting gas, coal-dust, or other inflammable material all parts shall be so protected as to prevent open sparking.

(5.) All cables used underground shall be covered with insulating material, and where high-pressure voltage is in use properly armoured cables of standard thickness shall be used.

(6.) All trailing cables shall be of properly armoured construction, whatever voltage is used.

The above rules (1), (2), and (3) shall come into force forthwith; and rules (4), (5), and (6) shall come into force on the 1st day of January, 1923.

WILLIAM SLOAN,
Minister of Mines.

Victoria, B.C., October 3rd, 1922.

"COAL-MINES REGULATION ACT."

Pursuant to the provisions of section 119 of the "Coal-mines Regulation Act," chapter 160, R.S.B.C. 1911, as amended by section 15, chapter 58, Statutes of 1919, the following rules are hereby established, viz. :—

(1.) Every percussive air-drill used for the drilling of holes in coal shall be equipped with a water-jet or spray, or other appliance equally efficient, to prevent the escape of coal-dust, and of a type approved by the Inspector of Mines.

(2.) The use of a compressed-air jet for forcibly removing accumulations of gas is strictly prohibited.

(3.) When accumulation of gas is being removed, the official in charge shall see that no person or persons or lights of any description are allowed on the return side of the gas being removed, unless at a sufficient distance away to allow of a proper diffusion of the gas to a percentage lower than the withdrawal point having taken place before it reaches them.

(4.) The term "properly fenced," as quoted in General Rule No. 6, shall mean a fence 4 feet high built of not less than three boards, 1 by 6, spaced so as not to obstruct the ventilation, and nailed securely to posts, or where there are no posts on the ribs, then the ends of the boards shall be hitched into the coal at least 3 inches and securely wedged.

(5.) All places fenced off as required under the terms of General Rules and Special Rules shall have securely attached to such fence in a conspicuous place a danger-signal properly worded, with the lettering at least 4 inches high; the lettering to be stencilled in white on a dark background, both to be of durable material that will not easily become obliterated.

The above rules will come into force forthwith.

WILLIAM SLOAN,
Minister of Mines.

Victoria, B.C., February 16th, 1923.

FIRST-AID AND MINE-RESCUE WORK.

The mine-rescue work is well organized in all the mining centres and the more important operating companies are each keeping several teams in readiness to meet any emergency. Those teams undergo a two-hour period of training each week in the use of the rescue apparatus and have become very proficient in this work.

The training period is generally carried out in the men's own time; the individual companies each paying their men for the extra work and time involved.

The trained first-aid men in and around the mines continue to prove of great value to themselves and all other employees.

Interest and instruction is maintained in both mine-rescue and first-aid work by the various Mine Safety Associations on Vancouver island and in the interior of British Columbia.

The Vancouver Island Mine Safety Association and the East Kootenay Mine Safety Association are both very energetic in this work, and in addition to carrying on regular training in first-aid and mine-rescue work, each association holds an open competition once each year, which is somewhat international in scope as well as interprovincial, as occasionally Washington and Alberta teams are competitors.

The larger companies all hold first-aid competitions annually and there is much rivalry between the competing teams.

The Mines Department first-aid cups in Vancouver Island District and East Kootenay District are always looked on as the premier prize, closely followed by the Coulson cup, while the presentation shield is awarded to the most successful team using the mine-rescue apparatus.

In 1922 this shield was won by No. 1 team of the Western Fuel Corporation of Canada, Nanaimo—A. Newbury (captain), J. Sutherland, M. Broderick, Francis John, Wm. Gillies, and James Hodgson. Second place was awarded to No. 3 team, Canadian Collieries, Extension; and third to the No. 2 team, Nanaimo.

The Department of Mines cup was won by Joseph Barton's team, which was closely followed by J. Delaney's team from Extension.

Teams from Ladysmith, Nanaimo, and Cumberland also compete annually for the Coderre and Montizambert trophies, emblematic of the championship of Canada in first aid.

The Wallace-Nesbit trophy competed for by junior teams in Canada was won by a Nanaimo team under the leadership of C. Wharton.

The Provincial Department of Mines maintains four rescue-stations with fully qualified instructors at each. Rescue apparatus and supplies are kept ready for emergency work in each station.

LIST OF PERSONS WHO HAVE RECEIVED MINE-RESCUE CERTIFICATES DURING 1922.

Name.	Where Trained.	Name.	Where Trained.
Alexander Ronald Gillis.....	Nanaimo.	John James Wright.....	Nanaimo.
William Thorpe.....	"	Carlton J. Tyler.....	"
David Stobbart.....	"	Charles Nicholls.....	"
Andrew Kostyniuk.....	"	William Morgan.....	"
Ludwig Samann.....	"	Seth E. Norris.....	"
John Ledward.....	"	James Milligan.....	"
Eronim Police.....	"	Arthur Goulding.....	"
Cornelius Morgan.....	"	Owen Dabb.....	"
Frederick Eaton.....	"	Paul Parta.....	"
William Wakelem.....	"	John Waugh.....	"
Harry Hughes.....	Fernie.	Fred Irving.....	Fernie.
Joe Kozler.....	"	Thos. J. Shea.....	"
Thos. Wilson.....	"	Oliver Winstanly.....	"
Frank Yates.....	"	Wm. Cockburn.....	"
Harry Corrigan.....	"	Jos. G. Haile.....	"
John H. Parker.....	"	Robert Bonar, Jr.....	"
Thos. Branch.....	"	Robt. Taylor.....	"
Ernest H. Ward.....	"		

The following table shows the number, distribution, and type of mine-rescue apparatus maintained at the coal-mines of the Province during the year 1922:—

Company.	Draeger Apparatus.	Gibbs Apparatus.	Paul Apparatus.	Total.
B.C. Government, Fernie.....	..	6	5	11
Crow's Nest Pass Co. —				
Coal Creek.....	..	6	..	6
Michel.....	6	..	..	6
Corbin Coal & Coke Co.....	2	..	..	2
B.C. Government, Merritt.....	..	4	..	4
Middlesboro Collieries.....	2	..	..	2
Fleming Coal Co.....	2	..	..	2
Coalmont Collieries.....	3	..	..	3
B.C. Government, Nanaimo.....	..	4	6	10
Western Fuel Corporation of Canada.....	..	6	..	6
Canadian Collieries—				
South Wellington.....	..	..	2	2
Extension.....	..	..	4	4
Comox.....	..	..	4	4
Granby Consolidated M.S. & P. Co.....	..	6	..	6
Nanoose Collieries.....	2	..	..	2
B.C. Government, Cumberland.....	..	..	6	6
Totals.....	17	32	27	76

MACHINE-MINED COAL.

During the year mining-machines produced 118,650 tons of coal, or 4.59 per cent. of the whole. This is a decrease compared with the amount of machine-mined coal in 1921, when the percentage of machine coal was 5.16. Of the total machine-mined coal, the Western Fuel Corporation of Canada, Limited, produced 43,267 tons, or 36.46 per cent.; the Canadian Collieries (D.), Limited, produced 61,621 tons of machine-mined coal, or 51.93 per cent.; the Princeton Coal and Land Company produced 10,000 tons of machine-mined coal, or 8.43 per cent.; Nanoose-Wellington Collieries produced 3,762 tons of machine-mined coal, or 3.18 per cent.

The following table gives the district, number of machines, how driven, tons of coal produced, and type of machine:—

District.	TYPES OF MACHINE IN USE.		TONS OF COAL PRODUCED.		Total Tons.
	Compressed Air.	Electricity.	Electricity.	Compressed Air.	
Vancouver Island	16	5	61,621	47,029	108,650
Nicola-Princeton	6	..	.....	10,000	10,000
East Kootenay .....	..	..	.....	.....	.....
Totals	22	5	61,621	57,029	118,650

Classified according to make, the coal-cutting machines in use are as follows:—

Electrically driven.		Air-driven.	
Sullivan (C.E. 7)	3	Pick-quick	5
Sullivan (C.E. 9)	2	Siskol	9
Total	5	Rand radialox	5
		Hardy Puncher	1
		Ingersoll-Rand puncher	2
		Total	22

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:

“(c.) If a candidate for a certificate of competency as a mine surveyor, that 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.

“For the purpose 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 1922 seventy-three examinations were held for candidates for certificates of competency as coal-miners in the various coal-mining districts of the Province and 438 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, 1922.

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—

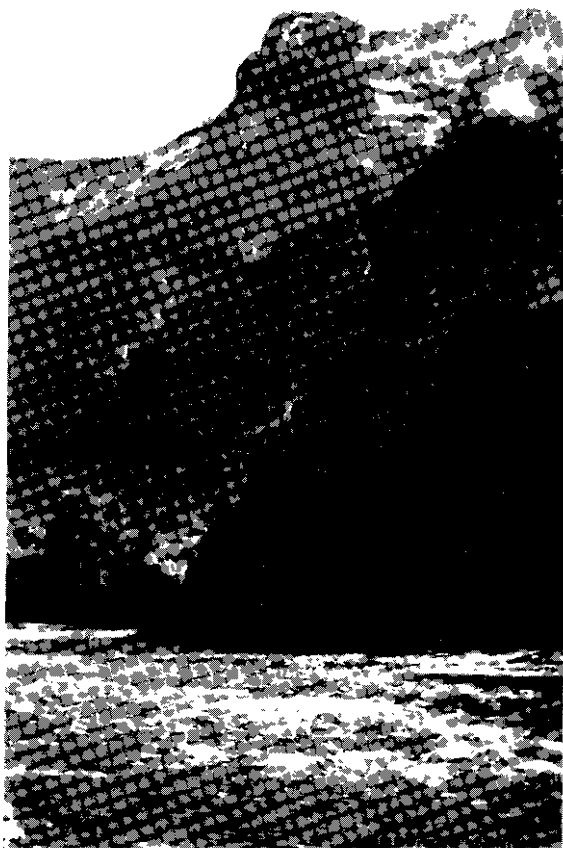
(1.) In actual practical work at the working-face and other parts of the underground workings of a coal-mine:

(2.) In direct supervision of such work; or

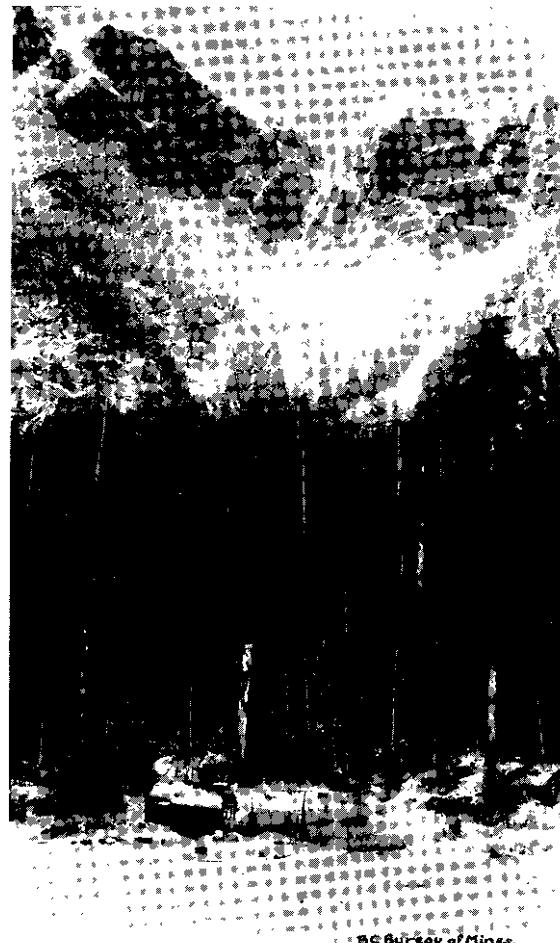
(3.) In both (1) and (2); or

(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.



Coquihalla River, near Hope.



BC Bureau of Mines.

Silver Lake, 10 Miles from Hope.

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 Surveyor's 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.

Pursuant to the provisions of this Act, the Lieutenant-Governor in Council has been pleased to make regulations as follows:—

1. That the regulations approved on the 2nd day of August, 1919, and published in the Gazette of August 14th, 1919, be amended by striking out the figures and words "1st day of December, 1919"; said date being the date before which any person without written examination might apply for and, on the favourable report of the Board of Examiners, be granted a certificate authorizing him to act as mine-surveyor. And substituting therefor the figures and words "1st day of February, 1922."

Department of Mines.

Victoria, B.C., December 15th, 1921.

Two examinations for candidates for certificates of competency were held during 1922; the first being held on May 17th, 18th, and 19th, and the second on November 21st, 22nd, and 23rd.

The total number of candidates at these examinations was as follows: For First-class Certificates, 9 (3 passed and 6 failed); for Second-class Certificates, 11 (7 passed and 4 failed); for Third-class Certificates, 36 (22 passed and 14 failed); for Mine Surveyor Certificates, 5 (2 passed and 3 failed).

The following is a list of the candidates who successfully passed the examination in the various classes:—

First-class Candidates.—William Ewart, Hugh G. MacKinnon, and Eustace S. F. Huntrods.

Second-class Candidates.—Robert McFegan, John Hynds, Clement Stubbs, Frank Yates, Daniel W. Thomas, William Archibald, and Robert K. Smart.

Third-class Candidates.—Frank Yates, Oliver Winstanley, Wilfrid Bradley, Daniel M. Hart, Frank Lester, Joseph Scales, John Sweeney, Hugh Clarkson, Joseph Hall, Joseph G. Halle, George Y. Linn, Robert C. Walker, Ernest P. Gabriel, Thomas Lloyd, John Watson, John H. C. Davies, Robert Winstanley, George Carroll, William Weaver, James Bainbridge, James Phillips, and Thomas C. Vincent.

Mine Surveyor Candidates.—Douglas D. Wilton and Harry C. Anderson.

In addition to above, applications were received from persons that they be granted certificates of competency as mine surveyors, under the regulations made by the Lieutenant-Governor in Council, December 15th, 1921, without written examination.

This regulation provided that persons having sufficient surveying experience might apply, and, on the favourable report of the Board of Examiners, be granted a certificate of competency as a mine surveyor without a written examination, provided application was made before February 1st, 1922.

The Board of Examiners recommended that certificates of competency as mine surveyors be granted to the following applicants: Elijah Priest, Thomas A. Spruston, Bernard Caufield, William Rafter, Thomas R. Jackson, Harry N. Freeman, Archibald Howden, Charles Graham, William Stewart Drewry, Garnett S. Corbett, Richard Cox, Robert Strachan, John MacDonald, Henry Devlin, and Frank J. George.

INSPECTION OF METALLIFEROUS MINES.

NOTE.—Inspections of metalliferous mines are made under the “Metalliferous Mines Inspection Act,” and under the terms of such Act the duties of the Inspector are limited to matters relating to or having an influence on the health or safety of the workman employed in any metalliferous mine.

Under section 3 of such Act, the Inspector is prohibited from revealing any information in regard to ore-bodies or character of underground workings, or to give any information or opinion respecting any mine, obtained or formed by him in making such inspection.

NORTHERN INSPECTION DISTRICT.

EXTRACTS FROM 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 Division was not visited by me during the current year, as arranged by the Department; I therefore have no report for this section.

PORTLAND CANAL MINING DIVISION.

SALMON RIVER SECTION.

Premier.—In this section is situated the *Premier* mine, operated by the Premier Gold Mining Company, Limited. D. L. Pitt, general manager; B. Smith, assistant manager; D. McDonald, mine superintendent. Three hundred and seventy men were employed in and about the mine. There were five accidents in the mine during 1922, of which two were fatal. Generally, in all my inspections made during the year, I have found the property in a fairly satisfactory condition and in accord with the “Metalliferous Mines Inspection Act.”

B.C. Silver Mine.—Owned by B.C. Silver Mines, Limited; manager, C. A. Banks; mine superintendent, C. B. North. Thirteen men employed. In all my inspections I have found the management to be ever ready to co-operate in the carrying-out of the “Metalliferous Mines Inspection Act” and the whole operation to be in strict keeping with such Act.

Indian Mines.—G. B. Turner, general manager; Roy Clothier, mine superintendent. I found very comfortable bunk-houses and mess-house provided for employees. The mine was ventilated by a small exhaust-fan. All arrangements on the surface and in the workings I found to be most satisfactory.

Swamp Point.—A limestone-quarry, operated under contract by Granby Company, mined for furnace flux. No accident this past year.

NASS RIVER MINING DIVISION.

OBSERVATORY INLET.

At the head of this inlet is situated the mines of the Granby Consolidated Mining, Smelting, and Power Company, the *Hidden Creek* and *Rambler*, in the locality of Anyox.

Hidden Creek.—H. S. Munroe, general manager; L. R. Clapp, assistant manager. On all occasions of inspection I have found the most encouraging assistance by the management in the rigid enforcement of the Act and effort to prevent accident.

Rambler.—This mine is situated about $1\frac{1}{2}$ miles directly west of the smelter-site and the product is quartz used for fluxing. Twelve men were employed. No accident occurred under contractors, but a fatal accident occurred under company management on January 3rd, 1922. I found the work carefully performed in all my inspections and the “Metalliferous Mines Inspection Act” obeyed.

Golskeish.—Work on this property was closed down after three months. Ten men employed. All matters relating to safety, ventilation, and other requirements of law I have always found carefully provided for.

ALICE ARM.

Esperanza.—This mine is situated on west side of the Kitsault river and is operated by J. Armstrong and partners, James Peacock being manager. I found fair accommodation in bunk-houses, cook-house, etc., for the comfort of employees, and that the condition of the mine was in conformance with the Act.

OMINECA MINING DIVISION.

SKEENA SECTION.

Silver Standard.—This mine, situated on Glen mountain in the vicinity of Hazelton, only operated a short time, employing twelve men. Operations found to be in accord with "Metalliferous Mines Inspection Act."

HUDSON BAY MOUNTAIN.

Aldridge Mine.—Property held by J. F. Duthie, of Seattle, and managed by J. Turner. I have found on all visits of inspection to this mine a readiness on part of officials to comply with the rigid observance of the "Metalliferous Mines Inspection Act."

QUEEN CHARLOTTE MINING DIVISION.

As there were not any properties operating in this Division it was not visited by the Inspector in 1922.

SKEENA MINING DIVISION.

Surf Inlet and Pugsley.—Situated at Surf inlet, Princess Royal island. Owned by Belmont-Surf Inlet Mines, Limited, employing 214 men at *Surf Inlet* and 12 at *Pugsley*, of whom two were injured during the year. The resident doctor (Dr. Beach) is to be credited with training some seventy employees in first-aid work, an essential matter in such a remote place. In all my inspections I have had the co-operation of the management in the carrying-out of the law.

Drum Lummon.—This mine is situated on Douglas channel, 25 miles from Hartley Bay. I found conditions very fair, both in the mine and upon the surface, and operations being carried on in accord with the "Metalliferous Mines Inspection Act."

KOOTENAY AND BOUNDARY DISTRICTS.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit my annual report on the inspection of metalliferous mines in the Kootenay-Boundary District during the year 1922.

For the purpose of inspection this district is divided into two—the East Kootenay District in charge of John MacDonald, Inspector of Mines, Fernie, and the West Kootenay and Boundary District in charge of H. H. Johnstone, Temporary Inspector of Mines, Nelson.

While there has been a fairly good increase in the reopening of small mines and in granting of leases to workmen who operate on a small scale, no great progress has been made in developing the larger mines. In the Nelson District five mines were in operation at some portion of the year, and only the *Nugget* worked during the entire time.

In the Greenwood District four mines were in operation; the *Sally* and *Bell* at Beaverdell working the year through. At Kaslo the *Utica*, *Florence*, and *Cork-Province* were being worked all the year.

In the Slocan District the *Slocan Star* and the *Bosun* were in operation, while the *Wonderful*, *Ruth-Hope*, and *Standard* were worked during a part of the year.

In the Revelstoke District the *Lanark* was worked during a part of the year.

In the Rossland District the *Centre Star* and the *Le Roi* operations were carried on during the whole year, but the working forces were gradually reduced and at present no ore is being shipped.

In the East Kootenay District the *Sullivan* was the principal producer, being worked the whole year with a force of over 400 men. The production of ore from this mine, over 300,000 tons, was shipped to Trail and forms about 75 per cent. of the ore treated there.

In the entire district only six mines shipped over 1,000 tons of ore during the year, two shipped between 500 and 1,000 tons, five between 300 and 500 tons, and six between 100 and 300 tons.

At the *Slocan Star* mine (Silversmith Mines, Limited) considerable improvement was made in the concentrator, providing for a larger output of ore and its more economical treatment.

At the *Sullivan* mine a great many improvements have been made and are being extended, including the erection of a concentrator at Kimberley, where the ores will be treated instead of at Trail as at present. Two new compressors are being installed and the track in the lower workings is being relaid at a wider gauge to provide for larger trams, with a capacity of about 8 tons, which are already on the ground. More accommodation has been provided for the workmen, including bunk-houses and cook-houses on an elaborate scale.

Twenty-one mines were inspected during the year and 132 visits of inspection were made. In the larger mines frequent visits were made; in the smaller mines less frequently. Fourteen out of the twenty-one mines visited had over twelve workmen employed in or around the mines.

While only twenty-one separate mines were inspected, many more small properties are in operation—about eighty—and of these it is very hard to define the status. Some go under the name of prospects, some are leases, and many operators of such properties seem to be under the impression that the "Metalliferous Mines Inspection Act" does not apply to them, with the result that no notice of the opening, reopening, or closing of the workings is sent to the office of the Inspector. Even accidents are not reported to him.

The case of the *Standard* at Silverton illustrates this point. Here we have a mine where work has been discontinued by the company. A lease is granted to workmen to mine, and although a fatal accident occurs, no notice is sent to the District Inspector of Mines. In the *Standard* mine some fifteen to eighteen men have been working under two separate leases.

The time seems to have arrived when provision should be made in the "Metalliferous Mines Inspection Act" requiring proper notice within a reasonable time of the opening, reopening, or closing-down of any mine, of the shipment of ore, and of accidents, and that a copy of an extract from the Act be posted at every mine.

Provision or clauses covering inquests should also be added, as at present we receive no notice from the Coroner regarding either the inquest or adjourned inquest. Such provisions, found in the "Coal-mines Regulation Act," have been invaluable in assisting us to find the causes of and therefore prevent future accidents in coal-mines.

The general conditions in and around the metalliferous mines have been very good, especially in the larger mines. In many of the smaller, however, I should like to see greater precaution taken with explosives. Explosives are generally taken in at the commencement of the shift, and proper provision should be made to provide temporary storage until required for use, and a competent party appointed to issue such explosives.

ACCIDENTS.

Eleven accidents have been reported to this office during the year, nine of which were from the East Kootenay District and in or connected with the *Sullivan* mine. The other two were from the *Slocan* District, and the only two fatal accidents reported during the year. Both of these fatal accidents were due to falls of ground; one in the *Standard* at Silverton, operated by leasers; the other in the *Slocan Star*, operated by the Silversmith Mines, Limited. Four of the non-fatal accidents were due to the explosion of powder in the handling of the broken ore, two to machinery, one to haulage, and two to other causes.

The first fatal accident, which occurred at the *Standard*, Silverton, was due to a comparatively small piece of rock striking a workman (who was also one of the leasers) on the stomach, causing considerable pain. A few days afterwards he was taken to Nelson to undergo an operation, during which he died. In the other case, at the *Slocan Star*, a large piece of rock fell, instantly killing the workman. It seems as if greater precautions were needed, the rock being within easy reach, and if "sounded," either by the workman or the officials in charge, would have been detected as unsafe.

The four non-fatal accidents, due to explosives, in common with the other non-fatal accidents, occurred in the *Sullivan*, and the first three of these seem to have been due to the use of defective fuse, the failure of which allowed the unexploded powder to mix with the broken ore. A change in the fuse used seems to have eliminated these troubles at that time, and the last accident, which occurred at the end of the year, seems to have been due to one of the workmen striking an unexploded detonator which had become mixed with the broken ore.

The two non-fatal accidents resulted from machinery. Both occurred outside the mine; one in the rock-house, where the foreman got his arm caught between a pulley and belt; the other to the drill-sharpener, who while leaning across his machine must have moved the control-lever, allowing the hammer to come down, smashing his fingers. In both of these cases the accident was avoidable, and with the exercise of more care should not have occurred.

One haulage accident occurred, where the workman got caught between a post and the moving car at a loading-chute, and with a little more care this should not have occurred.

The two other accidents were due to the use of an axe; in one case, inside the mine, while cutting a piece of timber the axe glanced, cutting his hand; the other, outside the mine, when a branch caught the axe, causing it to glance and cut his ankle.

Six samples of mine-air were taken during the year, with fairly good results in some cases; in others the conditions were very far from satisfactory. While no great amount of inflammable gas was reported in these samples, in one case the oxygen contents fell as low as 16.83 per cent., which is far too low for men to have to work in. In other two cases the oxygen contents fell well below 20 per cent. and very close to the border-line, which is about 19.5 per cent.

The lack of interest in either first aid to the injured or mine-rescue is very disappointing, and, especially in the case of the larger mines, some effort should be made to maintain classes in first aid. In the case of many of the small mines, prospects, and leases there is neither first-aid men nor first-aid equipment, and in such cases, generally situated far from medical aid, these are almost a necessity.

We wish to thank the workmen and officials for their assistance in carrying out our duties during the year, and look forward for a continuation of their co-operation in the year 1923.

Attached to this report is a list of the accidents reported during the year.

NICOLA-PRINCETON INSPECTION DISTRICT.

EXTRACTS FROM 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 1922.

Metal-mining in this inspection district has not been as active during the present year, which may be attributed to mining costs and the unsettled state of the world's markets.

During the early part of the year the Horn Silver Mining Company ceased operations, while the Hedley Gold Mining Company again commenced operations during the early spring. During August the Kamloops Copper Company commenced operations at the *Iron Mask* mine after a shut-down of two and a half years. The Canada Copper Company has not operated at the *Copper Mountain* mines, which are the largest and most important mines in this district.

I have generally found the conditions prevailing at the different operating mines to be very good and the provisions of the "Metalliferous Mines Inspection Act" well observed. I always find the superintendents of the mines showing a desire to conform with the requirements of the Act, and it is gratifying to report that there have been no serious accidents reported during the year, which can only be attributed to the care that is taken both by the workmen and officials.

The following is a brief description of the inspections of the mines operating in this district during the present year:—

Nickel Plate.—Gomer P. Jones, manager; Wallace Knowles, superintendent. Situated on Nickel Plate mountain, adjacent to and some 3,800 feet higher than the town of Hedley, where the mill is located. During the year I have found the working conditions of this mine to be very good and the provisions of the "Metalliferous Mines Inspection Act" well adhered to, while it is gratifying to report that there has been no serious accident.

Iron Mask.—Situated about 7 miles south-east of Kamloops. Has two shafts connected for ventilation purposes, both being well provided with ladder-ways. The *Iron Mask* shaft and

stations have been practically retimbered this year. New offices, storehouse, and changing-rooms have been erected and the bunk-house repaired and enlarged, with installation of steam-heating plant, assuring comfort of employees. The mine commenced operations in September, and on my inspections I found the provisions of the "Metalliferous Mines Inspection Act" well adhered to.

Emancipation.—Situated on the line of Kettle Valley Railway about 15 miles above Hope. Overhead tramway and mill installed this year. Thirty men employed. I found the conditions of the mine to be good and the provisions of the "Metalliferous Mines Inspection Act" well carried out.

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, 1922.

Early in the year E. J. Donohue resigned the position of general manager and **Britannia.** was succeeded by C. P. Browning, mining engineer, who had been in the service of this company for a number of years. W. A. Matheson was appointed secretary-treasurer, succeeding G. Nettleton, resigned. The mines, which are situated several miles inland, are under the direct charge of James Moore, assisted by W. Batten and T. McCulla.

The construction of a new mill to replace and improve on the mill which was destroyed by fire in 1921 was begun in the spring of 1922 and will be in operation early in 1923. As no ore could be milled during the year the underground operations were almost wholly confined to development, and this mostly in the new Victoria district which this company is opening.

About 100 men were employed during the early part of the year, but this number was much increased towards the end of the year as the mill neared completion. There were no fatal accidents at this property during the year 1922 and but very few serious ones. The above mines were found to be well ventilated and well timbered where timbering was necessary and the provisions of the "Metalliferous Mines Inspection Act" appear to be fully observed.

The mines operated by this company are situated at Sidney inlet, on the west coast of Vancouver island. The general manager of the company is Silas **Tidewater** Silverman; resident superintendent, Charles J. Abrams; and mine superintendent, Jas. Coulter. The mill is situated on sea-level and the mine is at **Copper Co.** an elevation of 1,700 feet. The ore is carried from the mine to the mill by means of a gravity aerial. The bunk-house in connection with the mine is built a little below the elevation of the mine and has accommodation for fifty men.

This mine was shut down during the summer owing to the failure of the water-power, due to the exceptionally dry season. The mine was found to be in a safe condition and well ventilated.

These mines are owned and operated by the Clayburn Brick Company and **Clayburn.** are situated about 50 miles from Vancouver and may be reached by Canadian Pacific Railway or British Columbia Electric Railway lines. A number of different seams of clay are worked, the material from each seam being used for the particular purpose for which it is best suited, so that work in the different mines is intermittent and is governed by the nature of the products required at the time. All the seams are worked on the pillar-and-stall system and are ventilated by natural means.

The general manager of this company is Mr. Ball and the mining operations are in charge of Elijah Priest, certificated mine manager. From twelve to twenty men are employed in the underground operations. There were no serious accidents at these mines during the year 1922.

LIST OF ACCIDENTS IN THE METALLIFEROUS MINES, 1922.

KOOTENAY-BOUNDARY DISTRICT.

No.	Mine.	Date.	Name.	Occupation.	Details.
1	Sullivan (C.M. & S. Co.)	Feb. 1	J. McConnel	Mucker.....	Severely injured on hand by picking into loose powder in muck-pile.
2	Sullivan (C.M. & S. Co.)	April 20	Ben. Kozah	"	Severely injured about face while picking into loose or unexploded powder in muck-pile.
3	Sullivan (C.M. & S. Co.)	" 20	L. O'Brien	Miner	Severely injured about face; same accident as above.
4	Sullivan (C.M. & S. Co.)	May 7	J. Holland	Foreman, rock-house	Fractured arm through getting it caught between driving-belt and pulley in rock-house.
5	Sullivan (C.M. & S. Co.)	June 7	E. James	Miner	Hand badly cut by axe while splitting a piece of wood.
6	Sullivan (C.M. & S. Co.)	July 14	R. Heffron	Axe-man....	Chopping a log, when axe caught on a branch, causing the axe to glance and cut his left ankle.
7	Sullivan (C.M. & S. Co.)	Oct. 31	H. Sorensen	Mucker.....	Head severely injured by being caught between car and a post.
8	Standard..... (S.M.L. Co.)	Nov. 14	E. A. Patrequin...	Timber-man.	Fall of rock caused internal injuries, which proved fatal.
9	Slocan Star..... (S.M., Ltd.)	Dec. 18	A. McKenzie	Miner	Fall of rock in stope; fatal.
10	Sullivan (C.M. & S. Co.)	" 30	B. Rodio	Blacksmith..	While leaning across drill-sharpener his body accidentally opened throttle, when hammer came down on his fingers.
11	Sullivan (C.M. & S. Co.)	" 30	C. Confrey	Mucker.....	Injured about face when accidentally picked into a detonator when loosening up some fine muck.

NORTHERN INSPECTION DISTRICT.

12	Surf Inlet..... (Belmont-Surf Inlet M. Co.)	Mar. 23	Joe Jukes.....	Barman.....	Struck with falling rock about head, hands, and arms.
13	Pugsley.....	Sept. 22	Charles Palmberg..	Shiftboss....	Injured by explosion of dynamite in muck, while making a trail across the stope; injured in arms, hands, and eyes.
14	Premier, Salmon River	May 24	Louis Porter.....	Mill-grizzly- man	Injured on eyes, hands, and body by explosion of piece of dynamite in a piece of ore he was breaking with a hammer.
15	Ditto.....	July 10	Donald McLeod....	Trammer....	Right leg broken, caused by sudden derailling of loaded car, which caught his leg between the car and side of tunnel.
16	"	Oct. 10	Gus Leaf .....	.....	He put his head into shaft and a descending cage caught him.
17	"	Dec. 3	G. T. Thomas	Trammer....	An explosion of dynamite moved a car which struck Thomas, fracturing his skull in front.
18	"	" 3	Carl Booy	"	Killed by an explosion of dynamite in the mine.
19	Rambler, Anyox...	Jan. 3	G. Chighridge.....	"	Loading car at chute, killed by being struck by a steel bar on the head, fracturing the side of his head. Died January 7th.
20	Hidden Creek	June 24	O. E. Evans.....	Brakesman on mine- train	Two trains collided, breaking Evans's legs; both legs having to be amputated, death resulted.
21	Ditto	Oct. 30	Neil MacBeth.....	Timberman..	Right leg broken by falling rock.
22	"	Dec. 13	G. L. Munroe.....	Nipper.....	Fell into pocket, resulting in fractured skull.

COAL-MINING IN BRITISH COLUMBIA.

BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

During the year 1922 there was mined in the various collieries of the Province 2,580,915 tons (2,240 lb.) of coal, an increase over the preceding year of 11,276 tons, equivalent to about 0.40 per cent.

The output of coke was 45,835 tons as compared with 59,435 tons in 1921, a decrease of 13,600 tons, or 22.8 per cent.

The following table shows, for the past eleven 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 Under-ground in Producing Collieries.	Tons of Coal mined per Underground Employee for Year.
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
1921	East Kootenay District	759,755	1,774	428	1,207	629
	Coast District.....	1,809,884	5,111	354	3,515	515
	Whole Province.....	2,569,639	6,885	373	4,722	544
1922	East Kootenay District	554,361	1,538	360	1,063	521
	Coast District.....	2,026,554	5,106	396	3,649	551
	Whole Province.....	2,580,915	6,644	388	4,712	547

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.

The *per capita* production for 1920 shows a substantial increase over that of 1919, particularly in the East Kootenay District, but in 1921 the *per capita* production dropped back again, although a slight increase has taken place in 1922.

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, diminished to some extent owing to increased prices of fuel-oil during 1920 and 1921, but during 1922 the quoted price for fuel-oil dropped to \$1.25 a barrel, and as it takes 4 barrels of oil to equal 1 ton of coal, it means it takes \$5 to do the work of a ton of coal. The competition is more than serious, if not prohibitive.

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 65 per cent. of the product, while 35 per cent. was exported to the States mentioned.

As regards 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, this year produced 1,008 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 Western Fuel Corporation of Canada, Limited (formerly Canadian Western Fuel Company), at Nanaimo, and the Canadian Collieries (Dunsmuir), Limited, the latter 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, also Community Coal and Coke Company, of Normandale; 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, all operating on Vancouver island, near Nanaimo; and by Granby Colliery No. 1 at Cassidy and the Old Wellington mines. Telkwa Collieries Company, of Telkwa, and the Aveling Colliery mined and sold locally 1,008 tons between them.

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 1922 about 64.72 per cent. of the coal, sold as such by the collieries of the Province, was consumed in British Columbia; and the remainder, 35.28 per cent., was exported to the United States, including Alaska. Of the coke sold, about 65 per cent. was consumed in British Columbia, and the remaining 35 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 1922 was 2,026,554 tons (2,240 lb.) of coal actually mined, while some 11,100 tons was taken from "stock," making the actual consumption of coal 2,037,654 tons.

Of this gross consumption, 1,687,850 tons was sold as coal, 163,749 tons was consumed by the producing companies as fuel, and 175,719 tons was lost in washing; 7,575 tons was converted into coke, producing 4,435 tons of coke. 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 the coal they sold, but later these conditions changed very much, as is shown by the following table:—

TABLE SHOWING PERCENTAGE SALES DISTRIBUTION OF COAST DISTRICT COAL.

Year.	Used in Canada.	Exported to U.S.	Exported to other Countries.
	Per Cent.	Per Cent.	Per Cent.
1910.....	71.30	24.50	....
1911.....	76.10	21.60	2.30
1912.....	71.25	21.25	7.47
1913.....	89.80	10.20	....
1914.....	77.30	22.70	....
1915.....	67.00	33.00	....
1916.....	63.00	37.00	....
1917.....	60.00	37.00	3.00
1918.....	66.00	30.00	4.00
1919.....	72.00	28.00	....
1920.....	79.00	20.00	1.00
1921.....	78.47	21.53	....
1922.....	74.60	25.40	....

COLLIERIES OF THE EAST KOOTENAY DISTRICT.

The gross output of the collieries of the East Kootenay District for the year 1922 was 554,361 tons (2,240 lb.) of coal actually mined, while 21,102 tons was taken from stock, making the actual consumption of coal 575,463 tons. Of this gross consumption of coal, 472,186 tons was sold as coal, 41,780 tons was consumed as fuel by the producing companies, while 61,497 tons was converted into coke, producing 41,400 tons of coke; 134 tons of coke was added to stock, making the coke sales for the year 41,266 tons.

The East Kootenay collieries exported to the United States about 70 per cent. of the coal sold and about 37 per cent. of the coke.

The following table gives complete details of the coal and coke production of the Province for 1921, with the output figures for each colliery and district totals:—

COLLIERIES OF BRITISH COLUMBIA—PRODUCTION, 1922.

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 1922.
	In Canada.	In U.S.	Other Countries.						First of Year.	Last of Year.	Added to.	Taken from.	
<i>Vancouver Island.</i>													
Canadian Colliery (D.), Ltd.—	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
South Wellington.....	60,549			60,549	21,780		5,019	26,799					87,348
Extension.....	126,200	47,150		173,350	32,951	1,129	17,767	51,847	3,342	2,099		1,243	223,954
Cumberland.....	271,557	23,120		294,677	53,481	6,446	11,337	71,264	6,387	7,283	896		366,837
Canadian Western Fuel Co.—													
No. 1, Nanaimo.....	212,715	102,751		315,466			28,816	28,816	2,523	475		2,048	342,234
Harewood.....	23,603	11,401		35,004			11,313	11,313	8,434	5,912		2,522	43,795
Reserve.....	132,127	63,823		195,950			29,851	29,851		56			225,857
Wakesiah.....	42,768	20,959		63,727			16,081	16,081	435	442	7		79,515
Nanoose-Wellington Collieries, Ltd.—													
Wellington.....	62,784	15,765		78,549	10,335		8,405	18,740	655	2,415	1,760		99,049
East Wellington Coal Co.—													
East Wellington.....													
Pacific Coast Coal Mines, Ltd.—													
Morden.....	3,963			3,963			789	789	4,752			4,752	NIL
Squash.....													NIL
Old Wellington (King & Foster).....	9,121			9,121			27	27					9,148
Granby Cons. M. S. & P. Co., Ltd.—													
Cassidy.....	129,502	71,419		200,921	57,172		19,092	76,264	1,377	1,111		266	276,919
Totals, Vancouver Island.....	1,074,889	356,088		1,430,977	175,719	7,575	148,497	331,791	27,905	19,793	2,719	10,831	1,754,656
<i>Nicola-Princeton District.</i>													
Middlesboro Collieries, Ltd.....	64,339			64,339			4,959	4,959	504	536	32		69,330
Fleming Coal Co., Ltd.....	36,859			36,859			1,666	1,666	120	80		40	38,485
Princeton Coal & Land Co.....	16,669	308		16,977			2,670	2,670	318	89		229	19,418
Coalmont Collieries, Ltd.....	64,653	72,271		136,924			5,877	5,877					142,806
Community Coal & Coke Co., Ltd.....	233			233						10	10		233
Chu Chua.....	538			538			80	80					618
Totals, Nicola-Princeton District.....	183,296	72,579		255,865			15,252	15,252	942	715	42	269	270,890
<i>Telkwa District.</i>													
Telkwa Collieries, Ltd.....	339			339									339
Aveling Coal Property.....	669			669									669
Totals, Telkwa District.....	1,008			1,008									1,008
Grand Totals, Coast District.....	1,259,193	428,667		1,687,850	175,719	7,575	163,749	347,043	28,847	20,508	2,761	11,100	2,026,554
<i>Crowsnest Pass District.</i>													
Crow's Nest Pass Coal Co., Ltd.—													
Coal Creek.....	80,680	191,566		272,246			26,339	26,339	7,076	112		6,964	291,671
Michel.....	44,000	102,453		146,453		61,497	12,171	73,668	3,453			3,453	216,668
Corbin Coal & Coke Co., Ltd.—Corbin.....	14,055	39,432		53,487			3,220	3,220	10,685			10,685	46,022
Totals, Crowsnest Pass District.....	138,735	333,451		472,186		61,497	41,730	103,277	21,214	112		21,102	554,361

<i>Coal.</i>													
Total Coal for Province	1,397,918	762,118	.....	2,160,036	175,719	69,072	205,529	450,320	50,061	20,620	2,761	32,202	2,580,319
<i>Coke.</i>													
Vancouver Island—Canadian Collieries-Comox	4,127	.....	.....	4,127	.....	.....	33	33	.. ..	275	275	.....	4,435
East Kootenay—Crow's Nest Pass-Michel.....	25,742	15,524	.....	41,266	.....	.....	.....	.....	44	173	134	.....	41,400
Total Coke for Province.....	29,869	15,524	.....	45,393	.....	.....	33	33	44	453	409	.....	45,835

COLLIERIES OF BRITISH COLUMBIA—MEN EMPLOYED, 1922.

The following table shows the men employed at each colliery in the Province during 1922 and district totals:—

Mine.	WHITE MEN.															INDIANS.			JAPANESE AND CHINESE.												Total Men employed.		
	Super- vision 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.	U.	A.	T.
Vancouver Island.																																	
Canadian Collieries (D.), Ltd.—																																	
South Wellington.....	10	4	14	145	..	145	..	..	..	48	14	62	9	9	18	..	61	6	..	..	..	5	..	5	..	..	..	22	22	212	55	267	
Extension.....	30	19	49	290	..	290	11	..	11	109	35	144	27	48	72	..	24	24	..	..	..	..	..	..	..	..	..	60	60	469	186	655	
Cumberland.....	43	26	69	116	..	116	1	..	1	106	82	188	63	112	175	17	12	29	..	..	157	..	157	65	..	65	268	41	309	836	273	1,109	
Canadian Western Fuel Co.—																																	
No. 1, Nanaimo.....	27	24	51	215	..	215	..	..	..	161	66	227	97	35	132	48	24	72	..	..	..	..	..	..	..	..	..	68	68	548	217	765	
Harewood.....	4	5	9	45	..	45	..	..	..	21	13	34	3	10	13	4	9	13	..	..	..	..	..	..	..	..	..	18	18	77	55	132	
Reserve.....	15	16	31	162	..	162	..	..	..	84	43	127	15	31	46	29	17	46	3	..	3	..	..	..	..	..	..	53	53	308	160	468	
Wakesiah.....	8	6	14	82	..	82	..	..	..	30	22	52	14	13	27	10	8	18	..	..	..	..	..	..	..	..	..	15	15	144	64	208	
Nanoose-Wellington Collieries, Ltd.—																																	
Wellington.....	10	6	16	133	..	133	64	..	64	35	16	51	1	22	23	..	..	..	..	..	..	..	..	..	..	..	..	19	19	243	63	306	
East Wellington Coal Co.—																																	
East Wellington.....	4	1	5	18	..	18	..	..	..	..	..	..	..	10	10	..	1	..	..	..	..	..	..	..	..	..	..	10	10	22	22	44	
Pacific Coast Coal Mines, Ltd.—																																	
Morden.....	..	3	3	..	..	..	..	..	..	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	5
Suquash.....	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	1
Old Wellington (King & Foster).....	2	..	2	15	..	15	16	..	16	..	5	5	..	2	2	..	1	1	..	..	..	..	..	..	..	..	..	..	..	33	8	41	
Granby Cons. M. S. & P. Co., Ltd.—																																	
Cassidy.....	15	12	27	232	..	232	..	..	..	87	87	111	41	152	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	358	140	498	
Totals, Vancouver Island.....	168	123	291	1453	..	1453	92	..	92	594	385	979	337	333	670	108	102	210	3	..	3	162	..	162	65	..	65	268	306	574	3250	1249	4,499
Nicola-Princeton District.																																	
Middlesboro Collieries, Ltd.....	12	5	17	52	..	52	28	..	28	45	17	62	..	15	15	..	10	10	..	..	..	..	..	..	..	..	..	..	..	137	47	184	
Fleming Coal Co., Ltd.....	6	2	8	35	..	35	5	..	5	8	16	24	2	8	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	56	26	82	
Princeton Coal & Land Co.....	4	2	6	12	..	12	5	..	5	16	10	26	..	6	6	..	2	2	..	..	..	..	..	..	..	..	..	..	..	37	20	57	
Coalmont Collieries, Ltd.....	7	7	14	82	..	82	..	..	..	52	74	126	1	15	16	1	1	2	..	..	..	..	..	..	..	..	..	..	1	1	143	98	241
Community Coal & Coke Co., Ltd.....	1	..	1	3	..	3	..	..	..	..	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	2	6	
Chu Chua Mine Syndicate.....	..	2	2	10	..	10	4	..	4	..	9	9	..	3	3	..	..	..	..	..	..	..	..	..	..	..	..	1	1	14	15	29	
Totals, Nicola-Princeton District.....	30	18	48	194	..	194	42	..	42	121	128	249	3	47	50	1	13	14	..	..	..	..	..	..	..	..	..	..	2	2	391	208	599
Telkwa District.																																	
Telkwa Collieries, Ltd.....	..	..	..	2	..	2	2	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	4	
Aveling Coal Property.....	..	..	..	2	..	2	2	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	4	
Totals, Telkwa District.....	..	..	..	4	..	4	4	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	8	
Grand Total, Coast District.....	198	141	339	1651	..	1651	138	..	138	715	513	1228	340	380	720	109	115	224	3	..	3	162	..	162	65	..	65	268	308	576	3649	1457	5,106

NOTE.—U=underground; A=above ground; T=total.

INSPECTION OF COAL-MINES, 1922.

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.

Western Fuel Corporation of Canada (formerly 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).

Western Fuel Corporation of Canada (formerly 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; and the Aveling Colliery, also on Telkwa river.

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, 1922, on the various coal-mines in my inspectorate, consisting of the Reserve, Harewood, and Wakesiah mines of the Western Fuel Corporation of Canada, Limited, Nanaimo (formerly Canadian Western Fuel Company); 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; Lantzville mine of the Nanoose-Wellington Collieries, operating at Nanoose; and the Old Wellington Colliery, Wellington, operated by King & Foster.

Western Fuel Corporation of Canada, Ltd.

(UNTIL JUNE 1ST, 1921, KNOWN AS THE CANADIAN WESTERN FUEL COMPANY.)

Head Office—Nanaimo, B.C.

Capital, \$1,500,000.

Officers.

H. J. McClung, President,
G. W. Bowen, Vice-Chairman,
Mark Bate, Jr., Secretary-Treasurer,
John Hunt, General Superintendent,
Robert Laird, Mine Manager, No. 1 Mine,
Robert Henderson, Mine Manager, Reserve Mine,
Arthur Newbury, Harewood Mine,
William H. Moore, Wakesiah Mine.

Address.

Flagstaff, Arizona.
Nanaimo, B.C.
Nanaimo, B.C.
Nanaimo, B.C.
Nanaimo, B.C.
Nanaimo, B.C.
Nanaimo, B.C.
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 WESTERN FUEL CORPORATION'S MINES FOR YEAR 1922.

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	411,213	.....	.....	.....
" export to United States.....	198,634	.....	.....	.....
" " other countries.....	.....	.....	.....	.....
Total sales.....	.....	609,847	.....	.....
Used in making coke.....	86,061	.....	.....	.....
Used under colliery boilers, etc.....	.....	.....	.....	.....
Total for colliery use.....	.....	86,061	.....	.....
Stocks on hand first of year.....	11,392	695,908	.....	.....
" last of year.....	6,885	.....	.....	.....
Difference taken from stock during year.....	.....	4,507	.....	.....
Output of colliery for year.....	.....	691,401	.....	.....

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.....	54	.....	51	.....	105	.....
Whites—Miners.....	504	.....	.....	.....	504	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	296	.....	144	.....	440	.....
Mechanics and skilled labour.....	129	.....	89	.....	218	.....
Boys.....	91	.....	58	.....	149	.....
Japanese.....	.....	.....	.....	.....	154	.....
Chinese.....	.....	.....	154	.....	.....	.....
Indians.....	3	.....	.....	.....	.....	.....
Totals.....	1,077	.....	496	.....	1,573	.....

NANAIMO COLLIERY.

REPORT BY THOS. R. JACKSON, INSPECTOR.

NO. 1 AND PROTECTION SHAFTS.

Robert Laird, Manager; Edward A. Courtney, Overman, Protection Mine. Robert Adam, Shift-boss; John Sutherland, Overman, No. 1 Shaft. Matthew Brodrick, Shiftboss; William Johnson, John Hamilton, James McMeakin, James Dudley, Joe Dean, Thomas Blenkhorne, Joshua Norris, Thomas J. Woods, George Perry, Andy Bennett, George Moore, Neil McMillan, J. M. Brown, Wm. Bradley, Fred Nash, William Halliday, George Jardine, Robert McArthur, John McArthur, George B. Bradshaw, William Neave, Frank Green, John Weeks, Jack Devlin, Alex. Coombs, Andy Dean, and John Marrs, Firebosses.

NO. 1 SHAFT, ESPLANADE.

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—namely, No. 1 and Protection shafts. The latter is situated on Protection island. The third opening is Newcastle shaft. A ladder extends from top to bottom of this shaft, so that one can enter or leave the mine. It is used only for inspection and necessity; it also forms the exit for the return air of Newcastle airway. The men working in Protection are conveyed by scow to and from there. No. 1 shaft provides passage-way for men employed in the South side of mine.

Electric lamps are now used. Douglas and Newcastle seams are worked. On the South side of mine the Douglas seam is worked exclusively; on the North side of 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 are the endless haulage-rope and Diagonal slope engines; all of them situated at the shaft-bottom. Endless haulage-rope now discontinued.

The North side haulage system consists of heavy steel rails and copper trolley-wire on the Main level, approximately 3 miles in length, extending from No. 1 shaft to the foot of Lamb's incline. A new motor-road has been made in No. 3 level, where a 5-ton Jeffrey motor operates.

The South side system of haulage consists of motor, direct, and main and tail ropes. The workmen are supplied with cars similar to the North side of mine. The Diagonal engine picks up coal on the two Main slopes from four different points and delivers it in the shaft-bottom.

Development-work done in South Side of No. 1 Mine.

During the year drifting has been continued in No. 5 North level, off the Main slope, and has been driven in a distance of 1,100 feet, but only small pockets of coal have been found so far. Another level known as No. 5 South has been started off the Main slope and a piece of very good coal has been struck.

Active operations have been continued in No. 3 level with very good results; a large area of good coal was struck on the North side of No. 3 dip. No. 2 dip was also started at a point 2,000 feet in the level, and this has proved an exceptionally good strike as a large area of good coal was found.

Another place known as No. 1 dip, off No. 3 level, has been started, and so far is proving good. In No. 4 South level, off Diagonal slope, prospect-work has been continued and some good coal has been found in the old explosion area at the face of old No. 2 South level.

Prospect-work has been carried on in Hanlon's level, but so far any coal found has been thin and of poor quality. Development-work has also been continued in No. 1 slope, off the main and tail roadway, and a fairly large area of good coal found.

Development-work done in North Side of No. 1 Mine.

A prospect known as No. 2 slope has been driven down a distance of 500 feet on the East side of No. 1 level, at a point about 1,000 feet beyond No. 3 wall. The coal found here is about 2 feet 9 inches in thickness and is worked on the long-wall system. At the same point another section known as No. 5 wall was opened up on the West side of the level. The coal here is 2 feet 4 inches thick and is worked on the long-wall system with Pick-quick machines. The large fault beyond Lamb's incline has also been drifted, and the coal found in this area is about 3 feet 6 inches in thickness and is being opened up on the long-wall method. Reopening is still being continued in Protection and some good coal has been obtained.

In the Diagonal slope reopening-work has been slow owing to some of the ground being heavily caved and water troubles. Nos. 1 and 2 inclines have also been opened up with good results. A rock tunnel has been driven through the large fault at the top of No. 2 incline and good coal found. This will be worked on the pillar-and-stall system.

A rock tunnel has also been driven into the large fault in No. 5 South level, No. 3 long-wall, to recover the lower seam, which is showing good so far.

Treatment of Coal-dust.

During the year a large number of dust-barriers have been built, especially in the South side of the mine; stone dusting is done in places where it is considered necessary. All the main haulage-roads have regular spraying systems which are in constant use to suppress the dust. In places where water would injure the roadway the timbers are swept by air or brush to prevent dust from collecting on them. Wherever it is necessary to get rid of coal mixtures it is loaded into cars and sent out of the mine.

North Side of 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 is 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 give good results. Compressed air is the motive power. Both machines undercut the coal to a depth of 6 feet, after which it is drilled and shot down. The brushing is taken off 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 of the North side of mine: No. 1 wall, No. 2 wall, Protection slope, and Lamb's incline. Some solid work is being carried on in new dips and No. 1 Left road.

The ventilation of these districts is produced by a Gulbal fan, 9 by 18 feet, rope-driven, at 70 revolutions a minute, against a 2-inch water-gauge. During my last inspection I found 48,000 cubic feet of air a minute passing up Protection slope, divided into four splits.

Protection Level Section.—There was 7,500 cubic feet of air a minute passing for the use of thirty men and five mules. A little gas found in Cunliff place. Section fairly free from coal-dust and general conditions good.

No. 3 Motor Level Section.—There was 11,200 cubic feet of air a minute passing for the use of thirty-two men and six horses. No gas; fairly free from coal-dust and general conditions good.

Lamb's Incline Section.—There was 8,900 cubic feet of air a minute passing for the use of thirty men and six horses. No gas; free from coal-dust and general conditions good.

Nos. 3 and 4 Long-wall Sections.—There was 14,500 cubic feet of air a minute passing for the use of sixty men and ten horses. No gas; free from coal-dust and general conditions good.

Nos. 1 and 2 Walls, Upper Seam Sections.—There was 11,200 cubic feet of air a minute passing for the use of thirty-five men and seven horses. In No. 2 there was 10,500 cubic feet of air a minute passing for the use of thirty men and six horses. In both sections there was no gas found; fairly free from coal-dust and general conditions good.

Burrell gas-detector tests made in the return airways of the North side of the mine showed methane percentages from nothing to 0.3 per cent. Quantity of air entering upcast shaft from North side of mine was 72,000 cubic feet a minute; methane equals 0.2 per cent. Quantity of air entering upcast shaft from South side of mine was 69,300 cubic feet a minute; no methane.

South Side of No. 1 Shaft.

The workings are all in the Douglas seam and consist of pillar-and-stall work and extraction of pillars.

The ventilation is produced by a 72- by 90-inch double-inlet Sirocco fan, rope-driven, ratio 3.5 to 1, capable of producing 195,000 cubic feet of air a minute at a 4-inch water-gauge, driven by an engine of 350 horse-power. Another fan capable of producing the necessary ventilation of the mine stands ready to substitute should necessity require.

During my last visit I measured 38,000 cubic feet of air a minute passing at overcast down the Diagonal slope, divided into two splits.

No. 4 South Level Section.—There was 9,360 cubic feet of air a minute passing for the use of twenty-five men and nine horses. Found a little explosive gas in High Level crosscut at face of stopping. Fairly free from coal-dust and general conditions good.

No. 7 Slope Section.—There was 5,625 cubic feet of air a minute passing for the use of eight men and two horses. No gas; free from coal-dust and general conditions good.

Inside Split Section.—There was 10,000 cubic feet of air a minute passing for the use of thirty-five men and six horses. Found no gas; fairly free from coal-dust and general conditions good.

I examined all report-books as required under section 91, subsections (4) and (36), of the "Coal-mines Regulation Act" and found them being complied with.

Burrell gas-detector tests made by me in all the South side airways of the mine showed from 0.1 to 0.4 per cent. of methane.

The following are the official returns for the Nanaimo Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		CORE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	212,715	.....	.....	.....
" export to United States	102,751	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	315,466	.....	.....
Used in making coke .....	.....	.....	.....	.....
Used under colliery boilers, etc.	28,816	.....	.....	.....
Total for colliery use .....	.....	28,816	.....	.....
.....	.....	344,282	.....	.....
Stocks on hand first of year	2,523	.....	.....	.....
" last of year	475	.....	.....	.....
Difference taken from stock during year	2,048	2,048	.....	.....
Output of colliery for year .....	.....	342,234	.....	.....

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.....	27	.....	24	.....	51	.....
Whites—Miners.....	215	7.58	.....	.....	215	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	161	4.71-5.25	66	4.78-5.23	227	.....
Mechanics and skilled labour.....	97	5.35-5.92	35	5.32-6.58	132	.....
Boys.....	48	2.48-4.71	24	1.84-3.79	72	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	68	2.27-3.05	68	.....
Indians.....	.....	.....	.....	.....	.....	.....
Total.....	548	.....	217	.....	765	.....

REPORT BY HENRY DEVLIN, INSPECTOR.

RESERVE MINE.

Robert Henderson, Manager; Francis John, Overman; James McGrath and George Frater, Shiftbosses; Benjamin Cheetham, James West, Albert Manifold, Joseph Thompson, Fred. Bell, James E. Knowles, Richard Rallison, Fred. Hilley, Henry A. Meikle, Ernest Kelly, John McCourt, Jacob Stobbart, Henry Allsopp, and William Neilson, 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, from which a rock tunnel 8 by 10 feet in section is driven across the measures on a 1-per-cent. grade to the rise. The tunnel tapped the seam at a distance of 180 feet.

The seam worked in this mine is the Douglas, the thickness of which varies from 1 to 26 feet. The pitch varies from 10° to 50° and is generally dipping north or north-east. The coal is mostly of a soft nature, with a fairly strong roof.

The coal in No. 1 West heading varies in thickness from 3 to 26 feet, and is of very good quality and fairly hard. This heading is connected to the shaft 108 feet above the original shaft-bottom and forms the main haulage-road in the mine. In fact, 90 per cent. of the output comes from this heading. Levels are being driven to the right and left off this heading, from which places are turned off.

The output of this mine has been considerably increased during the year and is the second largest producer of the Western Fuel Corporation of Canada, Limited.

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 air is carried along the Main levels of the mine and up the Main headings, and maintained by permanent stoppings of 12 by 12-inch timbers bedded in cement between the intake and return airways; these stoppings are being well kept up to the face of the workings. The Main haulage-roads and working-places are very damp and very little explosive gas is found at any time in the workings.

The mechanical haulage is all carried on by means of compressed-air hoists, of which there are twelve in use. The pillars have all been extracted from the East and West levels and also from the East side heading. Prospecting is being carried on on the West side by means of a pair of headings which are about 3,500 feet from the shaft-bottom. These headings are being driven up the full pitch of the seam and are in coal of good quality. The Edison electric head-lights are being used in this mine and are giving good satisfaction; the Wolf-type safety-lamp being used only by the firebosses for testing purposes.

The surface plant consists of four return-tubular boilers, 16 by 24 each, 908 horse-power, with a steam-pressure of 125 lb.; one hoisting-engine, 30 by 60 inches, built by Barclay & Sons,

Kilmarnock, with a drum 12 feet in diameter and a 1½-inch galvanized steel-wire rope (the hoisting-engines are fitted with an automatic overwinding device); one cross-compound Canadian Rand compressor with a capacity of 25,000 cubic feet of air a minute at 90 revolutions; one Ingersoll-Rand compressor with a capacity of 22,000 cubic feet of air a minute; one 14- by 14-inch single engine built by Robt. Armstrong, which supplies the light above and below ground, coupled by means of belt drive to d.c. generator, 250 volts, 120 amperes. Screens: One self-dumping tippie with shakers consisting of two screens, 1½ inches and ¾ inch respectively, and nut and dross conveyors driven by a small compound engine.

On my last inspection of this mine I measured 55,700 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 1 West split there was 21,500 cubic feet of air a minute passing for the use of forty-eight men and six horses.

In No. 2 West split there was 23,000 cubic feet of air a minute passing for the use of sixty men and seven horses.

In the East side split there was 10,000 cubic feet of air a minute passing for the use of twenty men and two horses.

No explosive gas was found in this mine. Timbering and roadways were in good condition and the mine practically free from coal-dust.

Burzell gas-detector tests in this mine were as follows: No. 1 West split showing 0.4 per cent. methane in 22,500 cubic feet of air a minute; No. 2 West side split showing 0.3 per cent. methane in 24,600 cubic feet of air a minute; East side split showing 0.2 per cent. methane in 12,000 cubic feet of air a minute; Main return showing 0.5 per cent. methane in 60,000 cubic feet of air a minute.

The following are the official returns from the Reserve Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	132,127	.....	.....	.....
" export to United States	63,823	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	195,950	.....	.....
Used in making coke .....	.....	.....	.....	.....
Used under colliery boilers, etc.	29,851	.....	.....	.....
Total for colliery use .....	.....	29,851	.....	.....
.....	.....	225,801	.....	.....
Stocks on hand first of year .....	.....	.....	.....	.....
" last of year	56	.....	.....	.....
Difference added to stock during year .....	.....	56	.....	.....
Output of colliery for year .....	.....	225,857	.....	.....

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	15	.....	16	.....	31	.....
Whites—Miners	162	7.85			162	
Miners' helpers						
Labourers	84	4.71 - 5.25	43	4.78 - 5.23	127	
Mechanics & skilled labour.	15	5.35 - 5.92	31	5.32 - 6.58	46	
Boys	29	2.48 - 4.71	17	1.84 - 3.79	46	
Japanese						
Chinese			53	2.27 - 3.05	53	
Indians	3				3	
Totals	308		160		468	

WAKESIAH MINE.

William H. Moore, Manager; Thomas Jordan, Overman; Charles F. Webber, Shiftboss; Isaac Nash, George W. Nash, John F. Webber, George Gray, Samuel K. Mottishaw, Clifford Dickenson, and John Hynd, Firebosses.

This mine is situated on the Western Fuel Corporation's farm, about 2 miles from Nanaimo, and is connected by railway 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 in a south-westerly direction about 1,400 feet, at which the coal-measures are tilted and thrown up at varying angles and finally cut off by what is known locally as the "Little mountain."

About 700 feet from No. 2 shaft a pair of slopes have been driven, which cut the large fault to the south-east at about 1,400 feet. New slopes are being driven to further exploit the measures to the south and east.

The pair of headings driven towards the Old Jingle Pot mine, after encountering many disturbances, at last got into an area of good coal which is now being exploited. The coal varies a great deal in thickness—namely, from 2 to 20 feet. The floor is uniformly hard, but there is a very poor roof, which requires careful timbering. The coal itself is of very good quality and is somewhat friable, but is improving with depth. The contour of the field is very irregular, which makes haulage both difficult and costly. Haulage is carried on by means of five winches driven by compressed air, supplemented by horses.

The output from this mine now is from 425 to 475 tons a day. A considerable amount of water has been encountered on the line of fault and is handled by seven pumps, six of which are run by compressed air, and a large Cameron pump at the shaft-bottom, which is run by steam.

Ventilation is produced by means of a single-inlet Murphy fan, which is belt-driven, but can be changed to direct drive in a few minutes, an auxiliary engine being kept ready for the purpose. The mine is damp and free from coal-dust. Electric head-lamps of the Edison and Wheat types have been installed during the year and are proving very satisfactory.

Another and larger compressor was installed early in the year to provide power for further developments. Coal is being hoisted from No. 2 shaft by a 14- by 16-inch first-motion engine supplied with steam at 120 lb. pressure from two boilers of 160 and 140 horse-power respectively, a $\frac{7}{16}$ 1½-inch diameter plough-steel wire rope being used in hoisting.

A Pick-quick mining-machine has been installed during the latter part of the year, greatly improving the product. Another slope has been practically completed, which will simplify the haulage.

The first serious accident to occur in this mine resulted in the death of two men—Alfred Odgers, fireboss, and Gilbert McBroom, pumpman. An explosion of gas occurred at 6 a.m. on November 24th, 1922. It would appear from the evidence at the inquest that Fireboss Odgers, in trying to clear out some gas in at the top end of the long-wall section, had turned on a compressed-air "blower," which had the effect of clearing the gas too rapidly, thus creating an explosive mixture, into which he advanced with his lamp (a safety-lamp of the Wolf type),

and at the high velocity which the "blower" created his lamp failed to reduce the products of combustion below the temperature of ignition and passed the flame through the gauzes. Odgers was found about 80 feet from his lamp; he had apparently run into a loaded car which stood on the siding and he fell and was asphyxiated. McBroom, who was on the slope about 250 feet away, was caught by the force of the explosion and was killed. His lamp (an Edison electric head-lamp) and tools were found some distance from his body.

Fireboss Odgers was the only man who carried a Wolf-type safety-lamp, the other men all using the Edison electric head-lamp. As a result of this the management has decided that all firebosses must carry two lamps—a Wolf safety-lamp, the light of which is set very low and used only for gas-testing purposes, and an electric head-light for illuminating purposes.

Odgers's lamp was in perfect order when found, but showing the effect of intense heat in the upper half of the gauzes. The three places on this level had been using a jack-hammer for drilling holes, which made some fine dust, a small portion of which was found adhering to the timbers, and its presence no doubt contributed materially to the severity of the explosion. These machines have since been taken out. The mine being generally wet had the effect of localizing the explosion.

On my last inspection of this mine I measured 32,000 cubic feet of air a minute passing into the mine, divided into two splits.

In the East side split there was 16,000 cubic feet of air a minute passing for the use of sixty-six men and five horses.

In the West side split there was 13,500 cubic feet of air a minute passing for the use of thirty-eight men and six horses.

No explosive gas found. Timbering and roadways were in good condition and the mine practically free from coal-dust.

Tests made with the Burrell gas-detector: East side split showing 0.4 per cent. methane in 17,400 cubic feet of air a minute; West side split showing 0.3 per cent. methane in 14,500 cubic feet of air a minute; Main return airway showing 0.5 per cent. methane in 34,000 cubic feet of air a minute.

The following are the official returns from the Wakesiah Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR.	COAL.		CORE.	
	Tons.	Tons.	Tons.	Tons.
Tons of 2,240 lb.				
Sold for consumption in Canada.....	42,768			
" export to United States.....	20,659			
" " other countries.....				
Total sales.....		63,427		
Used in making coke.....				
Used under colliery boilers, etc.....	16,081			
Total for colliery use.....		16,081		
		79,508		
Stocks on hand first of year.....	435			
" last of year.....	442			
Difference added to stock during year.....		7		
Output of colliery for year.....		79,515		

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		6		14	
Whites—Miners	82	8.16			82	
Miners' helpers						
Labourers	30	4.71 - 5.25	22	4.78 - 5.23	52	
Mechanics and skilled labour	14	5.35 - 5.92	13	5.32 - 6.58	27	
Boys	10	2.48 - 4.71	8	1.84 - 3.79	18	
Japanese						
Chinese			15	2.27 - 3.05	15	
Indians						
Totals	144		64		208	

HAREWOOD MINE.

Arthur Newbury, Manager; John White, Overman; James Handlen, Fireboss.

This mine was closed down until the latter part of June, 1922, owing to the slackness of the coal trade, the output coming from pillar-extraction entirely. This mine was practically worked out at the end of the year.

On my last inspection of the mine I measured 12,500 cubic feet of air a minute passing into the mine for the use of twenty men and three horses.

No explosive gas found. Timbering and roadways were in good condition and the mine entirely free from coal-dust.

Tests made with the Burrell gas-detector showed no methane present in the mine-air.

The following are the official returns from the Harewood Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR.	COAL.		COKE.	
(Tons of 2,240 lbs.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	23,603			
" export to United States	11,401			
" " other countries				
Total sales		35,004		
Used in making coke				
Used under colliery boilers, etc.	11,313			
Total for colliery use		11,313		
		46,317		
Stocks on hand first of year	8,434			
" last of year	5,912			
Difference taken from stock during year ..		2,522		
Output of colliery for year		43,795		

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	.....	9	.....
Whites—Miners.....	45	9.75	.....	.....	45	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	21	4.71 - 5.25	13	4.78 - 5.23	34	.....
Mechanics and skilled labour.....	3	5.35 - 5.92	10	5.32 - 6.58	13	.....
Boys.....	4	2.48 - 4.71	9	1.84 - 3.79	13	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	18	2.27 - 3.05	18	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	77	.....	55	.....	132	.....

NOTE.—This mine in operation from June 28th, 1922.

The Nanoose-Wellington Collieries, Co., Ltd.

Head Office—Wellington, B.C.

Capital, \$3,000,000.

Officers.

J. A. Coleman, President and Managing Director,
 Russel H. Phinney, Secretary,
 M. N. Olsen, Treasurer,
 James W. Jemson, Superintendent,

Address.

Seattle, Wash.
 St. Paul, Minn.
 Wellington, B.C.
 Wellington, B.C.

Value of plant, \$335,112.

LANTZVILLE MINE.

John A. Coleman, Managing Director; James W. Jemson, Mine Manager; Joseph Neen, Overman; Hugh M. Davidson, Ralph Smith, John Michek, Charles Simister, William Angell, George Oswald, Henry Carroll, and John Shipley, Firebosses.

This mine is situated at Nanoose bay, about 9½ miles north of Nanaimo, and is working in the Old Wellington seam. The seam is reached by a shaft 8 by 16 at a depth of 133 feet and is used to hoist coal, and also acts as a downcast. Another opening by rock-drift is used as a fan-drift and return airway, and is also used as a travelling-road for the workmen and horses.

The main portion of the mine is worked on the pillar-and-stall system, though where the seam has thinned out long-wall has been resorted to, the coal being mined by a coal-cutting machine of the radial-axe type. There is considerable refuse matter in the seam, which with the aid of cogs built on the roadside fills the gob fairly well. The roof is generally good, being sandstone and hard sandy shale. The prop and cap-piece system of timbering is generally sufficient for all purposes.

Several important improvements have been made during the year to the haulage system. The Main slope has been graded and an electric hoist installed at the top of No. 2 slope. Considerable work has been done on the Main level preparing for a main- and tail-rope haulage system, which will replace horses and handle a considerably larger output. This work is nearly completed and the new system will be in operation in a short time. The hoisting-engine has been remodelled and two cages are running in the shaft; therefore the mine is capable of handling a much larger output, which is anticipated by the opening of No. 3 slope, which has been shut down during the past year. The mine is equipped with the electric safety-lamp of the Wheat type; this lamp gives a good light and is quite satisfactory.

One hundred new cars have been put into the mine equipped with the Hadfield self-oiling wheel. On the surface there has been several important additions. A new compressor of 1,300 cubic feet capacity has been installed. A new washer of the Elmore type has been installed and several additions to the machine-shop and blacksmith-shop; also a new Ran coal-elevator.

The loading facilities have been greatly improved, which enables the company to load two scows or small vessels at one time. A complete new wing 280 feet long equipped with a chain-drag conveyor-chute for loading, has been added; this wing is at an angle from the old wharf and acts as a breakwater; therefore vessels can load at almost any time in safety.

Fourteen new houses have just been completed and the village is gradually growing. A small ice plant provides ice for the community, which proved a great boon during the hot weather.

A new ambulance-car has been provided and appears to be very satisfactory. First-aid classes have been conducted and have been most successful; one of the teams from this mine had the honour of winning the second prize in the Department of Mines competition for the Department of Mines trophy in the V.I.M.S. meet on last Labour Day.

On my last inspection of Lantzville mine I measured 33,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 14,500 cubic feet of air a minute passing for the use of forty-six men and six horses.

In No. 2 split there was 16,400 cubic feet of air a minute passing for the use of fifty men and seven horses.

No explosive gas found. Timbering and roadways were in good condition and the mine entirely free from coal-dust.

Tests made with the Burrell gas-detector showed no methane present in the mine-air.

The following are the official returns from the Lantzville Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	62,784	.....	.....	.....
" export to United States	15,765	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	78,549	.....	.....
Used in making coke .....	.....	.....	.....	.....
Lost in washing	10,335	.....	.....	.....
Used under colliery boilers, etc.	8,405	.....	.....	.....
Total for colliery use .....	.....	18,740	.....	.....
Stocks on hand first of year	655	.....	.....	.....
" last of year	2,415	.....	.....	.....
Difference added to stock during year .....	.....	1,760	.....	.....
Output of colliery for year .....	.....	99,049	.....	.....

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	\$ 6.54	6	\$ 5.06	16	\$ 5.98
Whites—Miners	133	5.88	.....	.....	133	5.88
Miners' helpers	64	5.10	.....	.....	64	5.10
Labourers	35	4.69	16	3.79	51	5.51
Mechanics and skilled labour	1	4.88	22	5.30	23	5.27
Boys .....	.....	.....	.....	.....	.....	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	19	2.75	19	2.75
Indians .....	.....	.....	.....	.....	.....	.....
Totals	243	.....	63	.....	306	.....

Name of seams or pits—Lantzville mine, Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—One hoisting-shaft; one tunnel, which acts as fan-drift; four levels, three in use. Seam: Sandstone roof, 1 foot cap-rock, 14 inches coal, 18 inches shale; 1 foot coal, 6 inches shale, 29 inches coal.

Description and length of tramway, plant, etc.—Plant described in Minister of Mines' previous reports. Length of tramways: Main level, 2,500 feet; No. 2 West level, 1,000 feet; No. 3 East level, 1,400 feet; No. 3 West level, 700 feet; Main slope, 1,800 feet; No. 1 slope, 600 feet; No. 2 slope, 900 feet; track in working-places, etc., approximately 12,900 feet; a total of about 4.13 miles.

Granby Consolidated Mining, Smelting and Power Co. Colliery at Cassidy.

Officers.

W. L. Nichols, President,
J. T. Crabbs, Vice-President,
Edward Everett, Secretary,
Valentine Quinn, Treasurer,
H. S. Munroe, General Manager,
C. M. Campbell, Superintendent,

Address.

52 Broadway, New York.
52 Broadway, New York.
52 Wall Street, New York.
813 Birks Blds., Vancouver.
Anyox, B.C.
Cassidy, B.C.

GRANBY No. 1 COLLIERY.

Charles M. Campbell, Resident Superintendent; James Touhey, Mine Manager; William P. Touhey, Overman; John Bennett, Thomas Bullen, Henry Mitchell, John Wright, John Newman, Alex. McLachlan, Owen Dabb, Robert Houston, Albert Radford, Matthew Meek, and Joseph Lavin, Firebosses.

This mine is situated at Cassidy and is opened up in the Douglas seam, which averages some 10 feet in thickness. It was acquired mainly to secure a supply of coke for the company's smelter at Anyox. Operations were continuous in this mine during the year. The surface arrangements are similar to what they were at the last report, with the exception of the installation of a new compressor and two new boilers, more power being required for development-work underground.

(For description of townsite, rooming-house, change-house, mine buildings, tippie, and washery and power-house equipment see Minister of Mines' Report for 1919.)

Underground development has been pushed ahead in the several slopes and levels, the slopes being about a mile from the surface, with levels turned off north and south, which are in good coal, but friable. The seam continues irregular in thickness, subject to rolls in the roof and floor, and a number of silted areas have been encountered, particularly on the north side.

Outbursts of gas and coal have occurred in this mine with regular frequency during the year. Since January, 1922, about sixty outbursts have taken place. These outbursts sometimes give a lot of warning, but at other times the warning is only slight.

No shots are allowed to be fired in the coal in the region affected by the outbursts. Except shots for rock-brushing, the miners have to dig the coal by hand. Unfortunately two miners met their death by suffocation, caused by being buried under the fine coal blown out by the gas-pressure. In both cases the outbursts were very small, only about 8 or 9 tons being displaced, and the warning did not give the men sufficient time to get clear from the flying coal.

The displacement of coal varies from 50 to 1,000 tons, with sometimes as many as twelve sets of timbers knocked out and broken. The largest outburst displaced about 1,500 tons of coal and gave off approximately 1,000,000 cubic feet of methane in the first ten hours, and continued to flow at a reduced rate for the next seventy-two hours.

While an outburst is taking place a number of short hard cracks may be distinctly heard sometimes as far as 500 feet away from the place where the outburst is occurring. These sharp cracks resemble a jack-hammer working and will continue sometimes for three minutes. This would seem to indicate that the gas was pent up in a large number of small pockets under enormous pressure, and the sounds, as a jack-hammer, are caused by each small pocket being liberated and their combined pressure causes the outbursts. The advancing coal-face offers a resisting pressure until the two forces are equal, and from that moment there is warning of gas-pressure by the coal cracking and falling from the face; at the same time there is a slight increase in the amount of gas given off by ordinary working. Places reaching this stage have been stopped and allowed to stand for a few days, but in no case has a blow-out occurred while the place is idle, and on several occasions within a few hours of the place being restarted outbursts have occurred.

After the two fatal accidents it was decided that all places in the affected area should be operated on two shifts only, and each place should at least have three boreholes in advance of the face 20 feet ahead—one hole in the centre of the place and a flank hole on each side at an angle of 35°.

This exploratory drilling is now being carried out, and while drilling ahead does not entirely eliminate the outbursts, it seems to lessen their violence materially, there being considerable gas given off from the boreholes.

By a system of signalling by pull-bells (no electric bells are allowed in the affected area) all the men are quickly notified of a blow-out, and they are daily instructed to get to fresh air by the nearest route. Firebosses have small districts and are enabled to get to an outburst within a few minutes of its occurrence. Miners are constantly warned to get back from the face at the least sign of warning. A great deal depends on the miners themselves, and they are in most cases very careful, although some of them do take chances owing to familiarity with danger.

The management is fully alive to the dangerous condition that exists after a blow-out, and very careful inspections are made before the miners are allowed to go back to work.

Automatic sprays spaced 100 feet apart on the Main slope and using clean water from the surface take care of what otherwise would be dust on the Main slope. The sprays are so arranged by automatic valves and cistern floats in large tanks that they work steadily throughout the twenty-four hours, spraying a very fine fog-spray for fifteen minutes in every hour. This time can be changed to suit conditions.

There have been three men engaged since July erecting Taffanal barriers and spreading inert dust on the roof, floor, sides, and timbers. The benefit of inert dust is that once applied it does not lose its efficiency, and is unlike water, which will dry up if not steadily applied. Three of these Taffanal barriers are erected, one above the other at every stopping between the Main and counter levels. Also on the Main levels they are placed across the roadway 3 feet apart 6 feet above the rail, and where height will permit several barriers one above the other, so that there are about thirty barriers in 100 feet of roadway.

Each barrier contains 5 cubic feet of flue-dust. The floors of the roadway are cleaned periodically and fresh dust applied. The application of the dust to roof, sides, and timbers is carried right into the working-places.

This dust is taken daily from the bottom of the large chimney, which takes away the smoke and hot gases from the boilers. It is allowed to cool and is then put into sacks and sent into the mine. The flue-dust before being adopted as an inert dust was first tested for fineness and

combustible matter. It was found that by treating it in an electric furnace at 1,600° F. for three hours it only lost 8 per cent. of its weight, showing that it was practically incombustible.

It is expected that when the coal is reached by a rock-tunnel at present being driven from No. 6 South level there will not be any outbursts in the new seam, as its geological position points to the possibility that there has not been any disturbance and the coal will be of a much better quality.

On my last inspection of this mine I measured 125,000 cubic feet of air a minute passing into the mine, divided into three splits.

In No. 1 North split there was 27,000 cubic feet of air a minute passing for the use of forty-five men.

In No. 2 North split there was 24,000 cubic feet of air a minute passing for the use of forty-six men.

In the South side split there was 22,000 cubic feet of air a minute passing for the use of twenty men.

I found a small quantity of explosive gas in the face of No. 7 South level, crosscut off counter-slope, and in No. 6 room off No. 1 slope, No. 6 North level. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Burrell gas-detector tests: Return from No. 1 North split showing 0.6 per cent. methane in 32,000 cubic feet of air a minute; return from No. 2 North split showing 0.7 per cent. methane in 29,000 cubic feet of air a minute; return from the South side split showing 0.4 per cent. methane in 30,000 cubic feet of air a minute; Main return showing 0.8 per cent. methane in 135,000 cubic feet of air a minute.

I regret to state that there were five fatal accidents in Granby No. 1 Colliery during the year 1922—two due to suffocation by outbursts of gas and coal, one by a fall of coal at the face, one on the haulage, and one by asphyxiation.

The following are the official returns for the Granby Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	129,502			
" export to United States.....	71,419			
" " other countries.....				
Total sales.....		200,921		
Used in making coke.....				
Lost in washing.....	57,172			
Used under colliery boilers, etc.....	19,092			
Total for colliery use.....		76,264		
Stocks on hand first of year.....	1,377	277,185		
" last of year.....	1,111			
Difference taken from stock during year.....		266		
Output of colliery for year.....		276,919		

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.....	15	\$ 7.39	12	\$ 5.73	27	\$ 6.65
Whites—Miners	232	7.27	.....	.....	232	7.27
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	.....	.....	87	4.02	87	4.02
Mechanics and skilled labour	111	4.91	41	4.96	152	4.92
Boys .....	.....	.....	.....	.....	.....	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals.....	358	6.54	140	4.44	498	5.95

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 5,000 feet from the surface, is exceptionally well timbered, and has been driven wide enough for two tracks. Seven levels have been turned to north and south off Main slope. Practically all coal extracted to date has come from development places.

Description and length of tramway, plant, etc.—Plant is modern in every way. Sirocco fan, capacity 150,000 cubic feet a minute; Vulcan hoist, 18 by 36 inches, double-drum second-motion. Edison storage-battery electric locomotives used for underground haulage in part of the mine; remainder by main and tail air-hoists. No mules or horses used underground. The tipples are equipped with rotary dump, Marcus screen, and loading-booms. Railway-cars handled with Fairmont car-retarders. The washery is equipped with Hummer screen, 2-compartment jigs, seven Deister-Overstrom coal-tables, and two Deister Plat-O tables, 75-foot Dorr thickener, flotation-cells, and Oliver filter. Boiler plant is equipped with two Badenhausen boilers fired by Combustion Engineering Corporation type E stokers, and one B. & W. boiler fired with Sanford-Riley mechanical stoker. Ashes flumed to dump. Power plant includes two compressors, generators, and cooling-pond.

King & Foster.

Head Office—Herald Building, Nanaimo, B.C.

Officers.

A. G. King, Jr., Partner
E. R. Foster, Partner.
A. G. King, General Manager.

Address.

Box 655, Nanaimo, B.C.

THE OLD ADIT MINE AND No. 1 SLOPE.

Henry Shepherd, Shiftboss; George Stewart and John Ovington, Firebosses.

These mines are operated by King & Foster under a lease from the Canadian Collieries (Dunsmuir), Limited. There are three openings—Nos. 1, 2, and 3. Nos. 2 and 3 openings are in the Wellington seam and were made with the idea of trying to obtain access to the Old Adit level; but, so far, this has been unsuccessful owing to the heavy caves encountered; coal, however, has been recovered from the pillars along the outcrop.

No. 1 slope is in the Upper seam; the work done this year comprised the continuance of the slope, which is down about 700 feet, and also turning levels off this slope. All work in this mine is on the long-wall system, the coal ranging from 14 to 26 inches in thickness.

During the summer a narrow-gauge tramway 7,000 feet in length has been built from the several openings to the loading-platform; this platform has been extended this year and a shaker screen installed.

I inspected all accessible parts of these mines during the year and found timbering and roadways in good condition. I have never found any explosive gas in these mines since they were opened, which are entirely free from coal-dust.

The following returns show the output of the firm's Adit mine for the year 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	9,121	.....	.....	.....
" export to United States				
" " other countries.....				
Total sales		9,121	.....	.....
Used in making coke.....	27	.....	.....	.....
Used under colliery boilers, etc.				
Total for colliery use.....		27	.....	.....
Stocks on hand first of year.....				
" last of year.....				
Difference { added to } stock during the year.....				
{ taken from }				
Output of colliery for year		9,148	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	2	\$ 6.00	.....	\$ 6.00	26	\$ 6.00
Whites—Miners	15	5.44	.....	.....	15	5.44
Miners' helpers.....	16	4.59	.....	.....	16	4.59
Labourers.....	.....	.....	5	4.52	5	4.52
Mechanics and skilled labour .....	.....	.....	2	5.87	2	5.87
Boys.....	.....	.....	1	2.00	1	2.00
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	33	.....	8	.....	41	.....

Name of seams or pits—Wellington seam, Old Adit mine; No. 2 mine, Upper seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—At Wellington seam or Old Adit mine, two slopes; No. 2 mine, Upper seam, one slope.

Description and length of tramway, plant, etc.—Tramway, 7,000 feet in length; one 15-horse-power boiler; one 15-horse-power hoist; two 5-horse-power gasolene-engines; one 1½-horse-power gasolene engine and pump; one fan; one shaker at loading-platform; loading-platform at Esquimalt & Nanaimo Railway siding; two mules and two ponies.

East Wellington Coal Company.

Officers.

H. W. Maynard, President,
R. S. Jones, Treasurer,
J. S. Grant, Superintendent,

Address.

Vancouver, B.C.
Minneapolis, Minn.
Nanaimo, B.C.

EAST WELLINGTON COLLIERY.

John J. Grant, Superintendent; William Roper, Mine Manager; Daniel McMillan, Ernest H. Devlin, and Walter P. Clark, Firebosses.

This mine is situated about 500 yards west of the Old Jingle Pot mine at East Wellington. This mine has not been in operation since September, 1920, but was opened up again in the latter part of September, 1922.

The operation consists of two slopes being driven in rock on a 25° pitch, which has not reached the coal as yet, but is expected to tap the coal-seam at an early date.

(For description of the surface plant, etc., see Minister of Mines' Report for 1920.)

On my last inspection of the mine I found the ventilation fairly good. Timbering and roadways were in good condition and the mine free from explosive gas.

The following are the official returns for the East Wellington Colliery for the year ending December 31st, 1922:—

No coal mined. Developing shafts and slopes only.

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	1	\$ 2.50	5	\$ 5.74
Whites—Miners	18	5.10	.....	.....	18	5.10
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers .....	.....	.....	.....	.....	.....	.....
Mechanics and skilled labour .....	.....	.....	10	5.35	10	5.35
Boys .....	.....	.....	1	1.00	1	1.00
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	10	2.50	10	2.50
Indians .....	.....	.....	.....	.....	.....	.....
Totals	22	.....	22	.....	44	.....

Name of seams or pits—Wellington seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—Main slope, 6 by 12 in the clear, 880 feet; Counter-slope and crosscuts, 810 feet.

Description and length of tramway, plant, etc.—Two 60 by 16 200-horse-power boilers; two compressors, 14 by 18 C-2 and 16 by 16 C-2; one hoisting-engine; air and steam lines complete; one blacksmith-shop and equipment; one machine-shop and equipment; two air-receivers; one water-tank, 35,000 gallons capacity; 700 feet railway spur and 1,700 feet mine-tracks; mine-fan, 5,000 feet capacity; all water and air lines complete to bottom of slope.

Pacific Coast Coal Mines, Limited.

(IN LIQUIDATION.)

Head Office—Victoria, B.C.

Capital, \$3,000,000.

Officers.

James Carruthers, President,
 John H. Paine, Vice-President and Managing Director,
 D. D. Muir, Secretary-Treasurer,
 George Wilkinson, General Superintendent,
 William Roper, Mine Manager,

Address.

Montreal, Que.
 Victoria, B.C.
 Victoria, B.C.
 Victoria, B.C.

This company did not do any work underground at either its Morden or its Suquash Collieries, employing only one man at each, practically as watchmen.

The company did, however, recover some 4,752 tons of coal from old dump by washing.

The following returns show the combined output of the company's mines for the year 1922:—

AGGREGATE RETURNS FROM MINES OF PACIFIC COAST COAL MINES, LIMITED, FOR 1922.

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	3,963*			
" export to United States.....				
" " other countries.....				
Total sales.....		3,963		
Used in making coke.....				
" under colliery boilers, etc.....	789*			
Total for colliery use.....		789		
Stocks on hand first of year.....		4,752		
" last of year.....				
Difference taken from stock during year.....		4,752		
Output of collieries for year.....				

*Slack recovered from dump.

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.
As watchman.....			3			
Whites—Miners ..						
Miners' helpers ..						
Labourers ..			2*			
Mechanics and skilled labour ..						
Boys ..						
Japanese ..						
Chinese ..						
Indians ..						
Totals.....			5			

* For four months.

Canadian Collieries (Dunsmuir), Ltd.

Head Office—Montreal, Que.

Capital, \$15,000,000.

Officers.

F. Perry, President,
H. B. Walker, Vice-President,
H. S. Adlington, Secretary-Treasurer,
R. S. Fagan, Assistant Secretary,
J. M. Savage, General Manager,
Thos. Graham, General Superintendent,

Address.

Montreal, Que.
Montreal, Que.
Montreal, Que.
Victoria, B.C.
Victoria, B.C.
Cumberland, B.C.

The Canadian Collieries (Dunsmuir), Limited, in 1910 acquired all the holdings of the Wellington Colliery Company, Limited, and since then has been operating the following mines:—

The Extension Colliery, in the Cranberry District (Extension); T. A. Spruston, manager.

The Comox Colliery, in the Comox District; 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 1922.

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	458,306	.....	4,127	.....
" export to United States.....	70,270	.....	.....	.....
" " other countries.....	.....	.....	.....	.....
Total sales.....	.....	528,576	.....	4,127
Used in making coke.....	7,575	.....	.....	.....
Lost in washing.....	108,212	.....	.....	.....
Used under colliery boilers, etc.....	34,123	.....	33	.....
Total for colliery use.....	.....	149,910	.....	33
Stocks on hand first of year.....	9,729	678,486	.....	.....
" last of year.....	9,382	.....	275	.....
Difference taken from stock during year.....	.....	347	.....	275
Output of collieries for year.....	.....	678,139	.....	4,435

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.....	83	.....	49	.....	132	.....
Whites—Miners.....	551	.....	.....	.....	551	.....
Miners' helpers.....	12	.....	.....	.....	12	.....
Labourers.....	263	.....	131	.....	394	.....
Mechanics and skilled labour..	96	.....	169	.....	265	.....
Boys.....	17	.....	42	.....	59	.....
Japanese—Miners.....	162	.....	.....	.....	162	.....
Labourers.....	.....	.....	.....	.....	.....	.....
Chinese—Helpers.....	65	.....	.....	.....	65	.....
Labourers.....	268	.....	123	.....	391	.....
Totals.....	1,517	.....	514	.....	2,031	.....

WELLINGTON EXTENSION COLLIERY.

Thomas A. Spruston, Superintendent; James Strang, Manager, Nos. 1, 2, and 3 Mines.

This colliery, operated by the Canadian Collieries (Dunsmuir), Limited, is composed of Nos. 1, 2, and 3 mines at Extension and No. 5 mine at South Wellington, all situated in the Cranberry district. The Extension mines are connected to Ladysmith, on Oyster harbour, by a railway 11 miles long, over which the entire output from these mines is hauled for shipment.

The No. 5 mine is situated at South Wellington, about 9 miles from Ladysmith, the output being hauled over the Esquimalt & Nanaimo Railway for shipping at Ladysmith and Mainland points. All the mines have worked fairly steadily throughout the year. The coal is a very high-grade domestic fuel and is in great demand in and around the Coast cities.

Nos. 1, 2, and 3 mines are opened up in the Wellington seam, which varies in thickness from 2 to 8 feet. The major portion of the seam being worked at present is very much disturbed by "folds," "small faults," and "barren ground." In some of these "wants" or barren patches silt-fills have taken the place of the coal, while in others the roof and floor have met, completely "pinching" the coal out. These "wants" vary from 50 to 500 feet in extent.

These mines, which were originally opened up by separate slopes on the outcrop of the seam, are now connected by a rock tunnel driven 14 by 7 feet in the clear on a 1-per-cent. grade, and a little over a mile in length, to the intersection of the Nos. 2 and 3 mines. Electric-motor haulage is maintained along the tunnel and continues into No. 2 mine, a distance of $1\frac{1}{4}$ miles, and half a mile into No. 3 mine. The type of electric locomotive used is the 13-ton Baldwin-Westinghouse.

WASH-HOUSE AT EXTENSION.

This combined change and wash-house for the use of the employees is 120 by 30 feet and consists of four separate changing compartments, 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. 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. During the year about 124 new lockers have been added to the wash-house to meet the demands of the workmen in and around the mines.

(For description of power-house equipment, surface plant, and tipple arrangements *see* Minister of Mines' Report for 1920.)

PROSPECTING AND DIAMOND-DRILLING.

Diamond-drilling has been carried out continuously during the year 1922. Four holes have been completed and another commenced—three in the Bright district and two in the Cranberry district. The holes in the Bright district, known as the Haslam flats, gave considerable trouble in sinking through the gravel and quicksand, which reached a depth of 200 feet or more in places and is mixed with boulders of trap-rock and granite. Borehole No. 45 finished at a depth of 1,508 feet, locating the Wellington seam; borehole No. 48 was put down a depth of 1,206 feet, locating the Douglas seam. Boreholes Nos. 46 and 47 were put down adjacent to Nanaimo river in the Cranberry district, their depth being 1,122 and 1,086 feet respectively; the total amount of diamond-drilling for the year being 4,922 feet.

PROSPECTING.

Prospecting was commenced in the fall on the exposures at the extremity of the field in the Haslam Flats district, that being the place where contact could be made, all the rest being buried under large gravel-deposits, prospecting being done by "well" and hand-drilling, but had to be abandoned temporarily owing to the heavy snowfall and bad weather conditions.

Prospecting has also been carried out on the western extremity of the abandoned workings of No. 1 mine, Extension, the coal being exposed in two "prospects." A slope is now being driven into the seam, dipping 20°. A small hoisting-engine is being installed temporarily to assist in the development.

FIRST-AID AND MINE-RESCUE TRAINING.

A competent staff of first-aid and mine-rescue teams are maintained in each of the mines. An up-to-date ambulance-car supplied with steam-heat, hot and cold water, and fitted with electric lights is maintained in constant readiness within a short distance of the mine entrance. In case

of accident the same attention can be given to a patient as he would receive in the hospital, as it is fitted with bed and operating-table, medicine-cabinets, and sterilizing outfit, with extra blankets and several complete sets of splints and bandages.

There are also first-aid rooms at Extension and South Wellington with all the necessary equipment to provide for any emergency. Some changes in the method of mine-rescue training have been tried out during the year. An imitation mine-gallery has been erected in the open, with all the equipment that goes to make up the timbered roadways, caves, overcasts, and smoke-chamber. Bench-work is carried out in a separate building. The equipment consists of six 2-hour sets of the "Paul" breathing apparatus, one oxygen-pump, six oxygen-tanks, one pulmotor, and safety-lamps of the Wolf and Edison types.

SAFETY-FIRST WORK.

The company has a permanent safety engineer who visits at least once every month all the mines, surface and underground, railway, washery, and wharves. The company also has an agreement with the underground employees to appoint a competent safety inspector from amongst themselves, and who is paid by the company, to make an inspection of each mine at least every two weeks. It is gratifying to know that through the forces at work in this direction the results obtained in the year 1922, having no fatal accidents, are very commendable and warrants a continuation of "safety-first" methods for the prevention of accidents in and around the mines.

LADYSMITH.

The shipping-point for the output of this colliery is at Ladysmith, where the coal is either shipped by vessel or on railway-cars by means of transfer-barge to Mainland points. The coal-washery is also situated at this point and consists of three washers (a description of which was given in the Minister of Mines' Report for 1921).

No. 1 OR TUNNEL MINE.

James Strang, Manager, Nos. 1, 2, and 3 Mines; William Wilson, Overman; Thomas Wilson, Walter Joyce, James Glen, John Greenhorn, David J. Gordon, John Mawson, Joseph Travis, and Alex. Orr, Firebosses.

This mine is entered at a point three-quarters of a mile along the Main tunnel and is operating in what is known as the "Underlap" portion of the Wellington seam, which is very irregular in thickness and very much troubled with "steps," "folds," and "pinch-outs."

The method of mining is the long-wall system; owing to the broken and dislocated condition of the field, hand-mining is employed. During the year the cleaning-up and retimbering of the old tunnel siding was completed and is now known as the West Incline district. No. 6 East section off the Main slope has made progress during the year. The face of the Main level has been standing for some time and work centred on the development of the incline headings. Nos. 2 and 3 slope sections were driven at an angle of 45° to the right for a distance of 1,600 feet, where the overlapping fault was met with, when work was begun on the extraction of the slope pillars along the East and West counter-levels; the level sections off the slope being operated on the long-wall method until meeting with the main fault on the West side and barren ground on the East side.

The haulage equipment consists of a 100-horse-power Ottumwa electric hoist situated at the top of the Main slope. The lower development of No. 3 slope haulage is maintained by a 50-horse-power Ottumwa hoist driven by a Westinghouse motor.

Edison storage-battery electric safety-lamps are in use throughout the mine; only 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 35,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 20,000 cubic feet of air a minute passing for the use of thirty-four men and four mules.

In No. 2 split there was 12,000 cubic feet of air a minute passing for the use of twenty men and one mule.

No explosive gas was found. Timbering and roadways were in good condition and the mine practically free from coal-dust.

Burrell gas-detector tests: Return from No. 1 split showing 0.3 per cent. methane in 22,000 cubic feet of air a minute; return from No. 2 split showing 0.2 per cent. methane in 13,500 cubic feet of air a minute; Main return showing 0.3 per cent. methane in 40,000 cubic feet of air a minute.

NO. 2 MINE, EXTENSION.

Robert L. Spruston, Overman; Joseph Watson, Edward Heyes, John Davidson, William Simpson, William Wesnedge, William Bauld, Robert N. Hamilton, William Cosier, William Gilchrist, and John Kirkwood, Firebosses.

This mine has been in continuous operation practically throughout the year and is working in the Wellington seam. The method of mining is part long-wall and part pillar and stall, as the conditions and thickness of seam permit. During the year the West Incline district has been worked out, some very good pillar coal being produced from the seam.

The development during the year has been concentrated on the No. 4 East Motor-road district, where three inclines are operating, covering an area of $1\frac{1}{4}$ miles in length, and developed towards the outcrop, at Nos. 1 and 2 inclines to 3,000 feet, and still in the solid in No. 17 incline.

This mine, like No. 1, is equipped with the Edison storage-battery electric safety-lamp, safety-lamps of the Wolf type being used only by the firebosses for gas-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 a 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 at 1,400 r.p.m.

This mine is ventilated by a Murphy fan of 40,000-cubic-feet-a-minute capacity, against a 1.9-inch water-gauge.

On my last inspection of the mine I measured 30,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 15,000 cubic feet of air a minute passing for the use of forty-six men and seven mules.

In No. 2 split there was 12,000 cubic feet of air a minute passing for the use of thirty-two men and four mules.

No explosive gas was found. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Burrell gas-detector tests: Return from No. 1 split showing 0.2 per cent. methane in 16,400 cubic feet of air a minute; return from No. 2 split showing 0.1 per cent. methane in 13,800 cubic feet of air a minute; Main return showing 0.3 per cent. methane in 38,000 cubic feet of air a minute.

NO. 3 MINE, EXTENSION.

Thomas Strang, Overman; James P. Nimmo, Patrick Malone, George Smith, David Davidson, and Daniel Campbell, Firebosses.

Operations have been carried out successfully during the year, which consists of pillar-and-stall work and pillar-extraction. Development-work has been concentrated on the Nos. 1 and 2 Incline sections off No. 4 West level district, which is being driven with the object of recovering an area of solid coal on the western extremities of the boundary. Some prospecting-work is being carried out on the Main incline, and some very good coal has been produced from the levels of the same.

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 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 electric safety-lamp, with Wolf-type safety-lamps for the firebosses. All blasting is done with permitted explosives, fired by battery.

On my last inspection of this mine I measured 24,000 cubic feet of air a minute passing into the mine, divided into two splits.

In No. 1 split there was 13,000 cubic feet of air a minute passing for the use of thirty men and seven mules.

In No. 2 split there was 10,000 cubic feet of air a minute passing for the use of twenty-five men and four mules.

No explosive gas was found. Timbering and roadways were in good condition and the mine fairly free from coal-dust.

Burrell gas-detector tests: Return from No. 1 split showing 0.4 per cent. methane in 14,000 cubic feet of air a minute; return from No. 2 split showing 0.3 per cent. methane in 12,000 cubic feet of air a minute; Main return showing 0.4 per cent. methane in 38,000 cubic feet of air a minute.

The following are the official returns from the Wellington-Extension Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	126,200	.....	.....	.....
" export to United States.....	47,150	.....	.....	.....
" " other countries.....	.....	.....	.....	.....
Total sales.....	.....	173,350	.....	.....
Lost in washing.....	32,951	.....	.....	.....
Used in making coke.....	1,129	.....	.....	.....
" under colliery boilers, etc.....	13,476	.....	.....	.....
Used by employees.....	4,291	.....	.....	.....
Total for colliery use.....	.....	51,847	.....	.....
Stocks on hand first of year.....	3,342	225,197	.....	.....
" last of year.....	2,099	.....	.....	.....
Difference taken from stock during year.....	.....	1,243	.....	.....
Output of colliery for year.....	.....	223,954	.....	.....

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.....	30	.....	19	.....	49	.....
Whites—Miners.....	290	.....	.....	.....	290	.....
Miners' helpers.....	11	.....	.....	.....	11	.....
Labourers.....	109	.....	35	.....	144	.....
Mechanics and skilled labour.....	24	.....	48	.....	72	.....
Boys.....	.....	.....	24	.....	24	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	5	.....	60	.....	65	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	469	.....	186	.....	655	.....

Coke produced in Comox district only.

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; William Brown and William McPegan, Shiftbosses; Robert Ewing, Neil McIntyre, Thomas Robson, Joseph Lane, Archibald Greenwell, Adam Watson, and William Baden-Powell, Firebosses.

This mine is situated at South Wellington, about 5 miles from Nanaimo to the south, along-side of Esquimalt & Nanaimo Railway. It is operating in the Douglas seam, adjacent to the Old Alexandria mine. The coal is shipped to Ladysmith and Mainland points over the Esquimalt & Nanaimo Railway, a small spur connecting the mine with the main line.

The developments during the year have been mainly concentrated on the North and South Diagonal slopes, which are down a distance of 5,000 feet, and the South "prospect" headings, which have been driven a distance of 3,500 feet from the Main slope and are getting into better ground. The method of mining is the pillar-and-stall system, the coal varying in thickness from 2 to 9 feet, and is very much troubled with "faults" and barren ground throughout the field.

The haulage equipment consists of a steam-driven hoist, 18 by 36, situated on the surface and operating on the Main slope. A 100-horse-power Ottumwa electric hoist, driven by a M.S.D. General Electric motor, hauls the coal from the North Diagonal slope. The South Diagonal slope is operated by a 50-horse-power compressed-air-driven hoist. There are several smaller hoists situated throughout the mine to assist in local development.

The ventilation is produced in this mine by a No. 60 Keith fan, driven by a 50-horse-power, type F, shunt-wound, d.c. Westinghouse motor.

This mine is equipped with the Edison storage-battery electric safety-lamp, with the Wolf-type safety-lamp used only by the firebosses for testing purposes. All blasting is done with permitted explosives fired by electric battery.

(For description of power-house equipment, plant, and buildings see Minister of Mines' Report for 1920.)

On my last inspection of this mine I measured 50,000 cubic feet of air a minute passing into the mine, divided into two splits. In the North side split there was 21,000 cubic feet of air a minute passing for the use of fifty-five men and six mules. In the South side split there was 19,000 cubic feet of air a minute passing for the use of forty-eight men and one mule.

No explosive gas was found; but there was found a $\frac{3}{8}$ -inch gas-cap in face of a slant off No. 20 Left, No. 3 North slope. Timbering and roadways were in good condition, and the mine practically free from coal-dust.

Burrell gas-detector tests: Return from the North side split showing 0.4 per cent. methane in 23,000 cubic feet of air a minute; return from the South side split showing 0.2 per cent. methane in 21,000 cubic feet of air a minute; main return showing 0.4 per cent. methane in 55,400 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, 1922:—

SALES AND OUTPUT FOR YEAR.	COAL.		Coke.	
	Tons.	Tons.	Tons.	Tons
Tons of 2,240 lb.				
Sold for consumption in Canada.....	60,549			
" export to United States.....				
Total sales.....		60,549		
Lost in washing.....	21,780			
Used by employees.....				
Used under colliery boilers, etc.....	5,019			
Total for colliery use.....	26,799			
Stocks on hand first of year.....				
" last of year.....				
Difference taken from stock during year.....				
Output of collieries for year.....		87,348		

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	.....	4	.....	14	.....
Whites—Miners	145	.....	.....	.....	145	.....
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	48	.....	14	.....	62	.....
Mechanics and skilled labour	9	.....	9	.....	18	.....
Boys .....	.....	.....	6	.....	6	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	22	.....	22	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	212	.....	55	.....	267	.....

Name of seams or pits—South Wellington.

Description of seams, tunnels, levels, shafts, etc., and number of same—Slope.

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 separate 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 6; the latter is a shaft acting as a means for drainage and intake air for No. 5 mine. No. 4 mine is located at the east end of Comox lake and is about 3 miles distant from the city of Cumberland. No. 5 mine is about a mile from the city. No. 6 is close to the city.

The mine ventilation of Nos. 1 and 2 slopes, No. 4 mine, is produced by two separate units. No. 1 slope fan consists of a 108-inch double-inlet reversible Sirocco fan on concrete base, with half-housing in steel, and connected to the mine by a reinforced-concrete tunnel fully equipped with explosion-doors. Fan running at 250 r.p.m. will deliver 200,000 cubic feet of air a minute, against a 6-inch water-gauge. The primary power unit has a 500-horse-power synchronous motor, 2,200 volts, equipped with self-starting unit. The motor runs at 500 r.p.m. and is connected to the main shaft of the fan through a jack-shaft with silent chain drive in two sections, each 15 inches wide; motor and fan-speed ratios, 2 to 1. The distance between centres of drive is 106 inches.

In addition to the primary drive there is an emergency unit, 350-horse-power induction-motor, speed 250 r.p.m., which can be connected by a coupling direct to the main shaft. This induction-motor is a duplicate of the motor now in use on the ventilation units of Nos. 4, 5, and 6 mines, and can on emergency be used on any one of the three units. The power unit is housed in a fire-proof concrete building with asbestos roofing, making one of the most complete and efficient ventilating plants in the Province.

No. 4 MINE, COMOX.

William Walker, Manager; John S. Williams, Overman, No. 1 Slope; Charles Parnham, Overman, No. 2 Slope; Charles O'Brien and Norman Huby, Shiftbosses; Sam Horwood, J. Bennie, Nathaniel Bevis, Richard Hodson, Alfred Jones, Peter Myers, William Beveridge, John C. Brown, A. W. Watson, R. Barker, William Herd, Watkin Williams, Robert Reid, Thomas Lewis, D. P. Marsh, F. Hutchison, W. Whitehouse, J. Dando, Thomas Cunliffe, Jonathan Taylor, Jack Davis, J. Vaughan, and H. King, Firebosses.

The mine consists of two slopes with but one main entrance. There is also a manway. No. 1 slope is 7,000 feet in length, running due north. No. 2 slope is 9,000 feet in length and runs 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 they 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 man-trip, which ensures the workmen's safety while riding up the slope.

The ventilation of this mine is produced by a Sullivan reversible fan, motor-driven, 350 horse-power, direct-coupled, running at 245 r.p.m., and capable of delivering 196,000 cubic feet of air a minute, against a water-gauge of 6 inches.

The 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 other employees. Where blasting is done only permitted explosives are used and these are fired by electric battery.

No. 1 Slope.

Electricity is used as the motive power to operate all pumps, winches, and coal-cutting machines. The West side of No. 4 slope has a long-wall system of mining coal. Undercutting is done by a coal-cutting machine, Sullivan type, approved by the U.S.A. Bureau of Mines. 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 side of East side section of No. 4 slope. Seam varies from 3 to 7 feet in thickness.

Haulage from the faces is done by winch and drivers with mules to No. 4 slope. A winch situated at top of this slope, on No. 15 West level, attends to delivery of cars at this point. A $5\frac{1}{2}$ -ton Iron-ton storage-battery locomotive is used for hauling on above level to the bottom of the Main slope, the source of supply. There is a recharging apparatus stationed in above level for the purpose of having the motor recharged.

During my last inspection I measured 33,210 cubic feet of air a minute passing into this part of the mine, divided into two splits.

No. 1 Split Section.—There was 16,000 cubic feet of air a minute passing for the use of sixty-seven men and nine horses. A little explosive gas was found in Nos. 2 and 3 places, dip slant, off No. 3 West level, and a $\frac{1}{4}$ -inch gas-cap in the outer end of No. 1 West level return air. Sections fairly free from coal-dust and general conditions good.

No. 2 Split Section.—There was 16,000 cubic feet of air a minute passing for the use of sixty-six men and three horses. A slight gas-cap was found in the crosscut stoppings and face of No. 1 Right place and No. 3 Left place. Ventilation fair and other conditions good; all sections were free from coal-dust.

No. 2 Slope.

The long-wall system of mining coal is in practice in No. 1 slope off No. 20 East level. The mining-machine has been discontinued and diggers do the work of mining coal. Pillar-and-stall system and extraction of pillars is being employed in No. 15 East level slope. The haulage system is much similar to that which obtains in No. 1 slope, except the motor.

During my last visit of inspection of this mine I measured 33,000 cubic feet of air a minute passing at a point near No. 18 East level. A new 25-horse-power fan has replaced the old fan situated at No. 20 East level. The fan will be permanently placed on No. 19 East level, and when the rock-work and airways are completed the ventilation, though good now, will be greatly increased.

No. 1 Split Section.—There was 11,400 cubic feet of air a minute passing for the use of thirty men and five mules. In No. 18 East level I got a $\frac{3}{8}$ -inch gas-cap at face of No. 11 pillar and $\frac{1}{2}$ -inch gas-cap near the roof at the face of No. 15 pillar. General conditions were good.

No. 2 Split Section.—There was 33,000 cubic feet of air a minute passing for the use of sixty-five men and nine mules. I found no explosive gas, but I got an $\frac{1}{8}$ -inch gas-cap in the air at the face of No. 1 level off the No. 20 East slope. Section free from coal-dust and general conditions good.

I examined all the report-books as required under section 91, Rules 4 and 36, of the "Coal-mines Regulation Act," and found they complied with the Act.

Burrell gas-detector tests made by me in the various returns gave the following results: No. 1 slope: At fan, volume of air a minute equals 80,850 cubic feet, 0.5 per cent. methane; No. 1 split, volume of air 24,000 cubic feet, 1.3 per cent. methane; No. 2 split, volume of air 8,000 cubic feet, 1.2 per cent. methane; old slope, East return, volume of air 7,000 cubic feet, 1.1 per cent. methane. No. 2 slope: At fan, volume of air a minute equals 80,640 cubic feet,

0.3 per cent. methane; No. 20 East level, volume of air 22,800 cubic feet, 0.4 per cent. methane; No. 1 split, volume of air 12,000 cubic feet, no methane; No. 2 split at overcast, volume of air 40,200 cubic feet, no methane.

NO. 5 MINE, COMOX.

John G. Quinn, Manager; Robert Brown, Overman; Frank Crawford and Sam Jones, Shift-bosses; Duncan Thomson, Thomas Eccleston, William Devoy, Thomas Shiel, John E. Splicer, Wm. J. Keenan, Jas. Monks, Tom Wilson, and Jas. Brown, 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. At the bottom of No. 2 Dip slope a 5½-ton Iron-ton motor attends to the haulage on level, 1,600 feet in length; the motor consists of storage-battery equipment. A recharging-station has been fitted up on the level. All the workings at present are in the Upper seam. Long-wall and pillar-and-stall systems are employed. Sullivan type of coal-cutter, approved by the U.S.A. Bureau of Mines, is used. Depth of undercut, 6 feet; height of seam varies from 2 feet 6 inches to 7 feet. 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. Edison electric safety-lamp is used for lighting. Firebosses use safety-lamps of the Wolf type. Part of the output is produced by the extraction of pillars.

During my last inspection of this mine I measured 55,200 cubic feet of air a minute passing into the West side tunnel, divided into two splits.

West Split.—There was 20,000 cubic feet of air a minute passing for the use of fifty men and eight mules.

East Split.—There was 20,000 cubic feet of air a minute passing for the use of fifty-three men and nine mules.

No. 2 Dip Section.—East side of mine I measured 25,000 cubic feet of air a minute passing into this section for the use of fifty-six men and seven horses. I found no gas, the section was free from coal-dust, and the general conditions were good.

NO. 6 MINE, COMOX.

John G. Quinn, Manager; Tom 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 a minute.

During my last inspection I measured 23,000 cubic feet of air a minute passing into this mine. I found a little explosive gas in the counter-heading and in No. 2 stall off No. 7 East level. Other conditions of the mine were fairly good.

Burrell gas-detector tests made by me at regular intervals in the various return airways show from nothing to 0.4 per cent. methane. I measured 140,000 cubic feet of air a minute entering fan, No. 5 mine.

The following are the official returns for the year ending December 31st, 1922, of the aggregate output of all the Comox Collieries:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	271,557		4,127	
" export to United States.....	23,120			
" other countries.....				
Total sales.....		294,677		4,127
Lost in washing.....	53,481			
Used in making coke.....	6,446			
" under colliery boilers, etc.....	5,660			
Used by employees.....	5,677		33	
Total for colliery use.....		71,264		33
Stocks on hand first of year.....	6,387			
" last of year.....	7,283		275	
Difference added to stock during year.....		896		275
Output of collieries for year.....		366,837		4,435

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance.....	43		26		69	
Whites—Miners.....	116				116	
Miners' helpers.....	1				1	
Labourers.....	106		82		188	
Mechanics and skilled labour.....	63		112		175	
Boys.....	17		12		29	
Japanese—Miners.....	66				66	
Miners' helpers.....	15				15	
Labourers.....	40				40	
Chinese—Miners.....	91				91	
Miners' helpers.....	50				50	
Labourers.....	228		41		269	
Totals.....	836		273		1,109	

Name of seams or pits—Comox.

Description of seams, tunnels, levels, shafts, etc., and number of same—Nos. 4, 5, and 6 shafts and Nos. 4 and 7 slopes. No. 7 slope and Nos. 4 and 6 shafts not at present operating.

COMOX INSPECTION DISTRICT.

Pacific Coast Coal Mines, Ltd.

SUQUASH COLLIERY.

Samuel D. Wark, Manager.

This colliery is situated about 12 miles north-west of Alert Bay, on Vancouver island. No work underground has been done during the year. Further location-work on the surface relative to the construction of the shipping wharves and colliery railway was done during the year.

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; 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 up 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; it is very hard and practically smokeless. The thickness of the 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; also superintendent's residence and a model bunk-house of thirty-six rooms. There are also ten four-roomed houses and ten two-roomed houses, also 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 Sheldon fan, 4 by 2.5 feet, steam-driven, and making 125 revolutions a minute.

NORTHERN INSPECTION DISTRICT.

TELKWA COLLIERY.

This mine was operated for a period of a few months during the year 1922 and an output for the same period of 339 tons of coal was made and sold locally. Four men were employed.

AUELING COLLIERY.

BETTY MINE.

This coal-mine is situated some 6 miles from the town of Telkwa up the Telkwa river, on the left bank of the river. The property is owned by Major Aveling, of England, and at present is under lease to J. Gillespie and J. Wilson and is managed by J. Gillespie. The property produced in 1922 some 669 tons of coal which was sold locally. Four men were employed.

The Government had a bridge erected across the Telkwa river to facilitate the transportation of the coal. A new camp has been built to accommodate the men engaged, and coal-bunkers to carry about 20 tons of coal have been erected at the end of the bridge and chutes arranged to permit the loading of the wagons, in which it is shipped to the railway siding at Telkwa.

NICOLA-PRINCETON INSPECTION DISTRICT.

REPORT BY JOHN G. BIGGS, INSPECTOR.

I have the honour to submit my annual report as Inspector of Coal-mines for the Nicola-Princeton Inspection District during the year 1922.

The companies operating during the year are as follows: The Middlesboro Collieries, Limited; Coalmont Collieries, Limited; Fleming Coal Company; Princeton Coal and Land Company; the Chu Chua Coal Company; and Community Coal and Coke Company, Limited; there being no change in the mining companies operating during the year.

Middlesboro Collieries, Ltd.

Head Office—Vancouver, B.C.

Capital, \$1,107,700.

Officers.

E. W. Hamber, President,
G. S. Raphael, Vice-President,
Thomas Sanderson, Managing Director and Secretary,
C. M. O'Brian, Treasurer,
Robert Fairfoull, Mine Manager,

Address.

Vancouver, B.C.
Vancouver, B.C.
Vancouver, B.C.
Vancouver, B.C.
Middlesboro, B.C.

Value of plant, \$250,000.

MIDDLESBORO COLLIERY.

Robert Fairfoull, Manager.

This colliery is situated about a mile west of the Merritt Railway Station; it is operating in the south-west portion of the Nicola basin and is connected by a spur off the Kettle Valley Railway, which serves both the Middlesboro and the Fleming Collieries.

During the present year there has been very little development-work required, the area of the present workings being somewhat extensive, with a corresponding number of roads to maintain, which are generally composed of a new shale, and with the mines working very intermittently during the year makes mining costs rather high. The policy of the management has been to concentrate the work more by drawing the pillars of the present workings rather than open up new ground at present.

No. 4 MINE.

James Fairfoull, Overman; George Hudson, William Halliman, Thomas Archibald, Robert S. Brown, and Robert Drybough, Firebosses.

This mine is the largest and most extensive of the Middlesboro Collieries and is developed by a large and well-timbered level entering the foot of the hill on the same elevation as the mine tittle, and it is generally driven in the rock adjacent to and running parallel with the measures, and developing the Nos. 4, 5, 6, 8, and 9 seams by means of branch drifts driven off this Main level; it is at present operating in the Nos. 6, 8, and 9 seams of this property, which have an average thickness of from 5 to 6 feet of fairly good bituminous coal overlaid by a shale roof.

The method of work being the pillar-and-stall system, the main headings are driven from the No. 4 level and follow the full pitch of the seams to the surface croppings near the top of the hill, which is generally reached at a distance of about 1,000 feet. Roads are opened on the surface for facilitating the handling of timber for the workings and also for ventilation purposes. All operations in this mine are to the raise of the No. 4 Main level, and owing to the pitch of the seams the mine-cars are not taken off the No. 4 level. From these headings levels or "dump-car roads" are driven following the strike of the seams, with the necessary crosscuts driven for ventilation purposes. All the winnings are driven from 6 to 9 feet wide to the various boundaries or fault-lines, which, upon being reached, the coal from the pillars is worked back to close proximity to the headings.

The coal is loaded at the faces into small dump-cars trammed by hand to the headings and dumped into chutes, where it is conveyed to the No. 4 level and loaded into the mine-cars, drawn by mules to the landings, and hauled by trips to the surface by main- and tail-rope haulage.

During the present year practically all the coal has been extracted from the pillars of this mine and hauled from No. 4 level, with the exception of the upper part of No. 9 seam, which coal is hoisted out of a slope to the top of the hill by a compressed-air hoist and lowered over a surface incline to the mine-tipple.

The No. 6 section of No. 4 level has been extended a distance of about 180 feet during the present year, being driven in a hard sand rock a little below the foot-wall of the seam, and will be broken through into the No. 6 seam when required; this system being favoured as it prevents any heavy timbering being required, which would be necessary if this level was driven in the coal-seam, and it assures the level being in good condition and prevents any "squeezing" taking place when the pillars are drawn above.

The coal in this mine being of a friable nature is mined by hand and blasted when required by permitted explosives. All shots are fired by electric detonators under the supervision of certificated shotfirers.

Ventilation is produced by a rope-driven 8.5 double-inlet fan, driven by a 14 by 18 Ideal steam-engine, which is greatly assisted by the natural ventilation of the mine. This fan is situated near the entrance to the No. 4 level and is so constructed as to be reversible when required.

On my last visit to this mine the ventilation showed 48,600 cubic feet of air a minute passing into this mine, divided into three splits, each having separate openings at the surface croppings along the crown of the hill from the Nos. 6, 8, and 9 seams. The No. 6 split ventilation showed 14,000 cubic feet of air a minute passing for the use of fourteen men; No. 8 split, 20,000 cubic feet of air a minute for the use of twenty-four men; No. 9 split, 14,600 cubic feet of air a minute for the use of twenty-eight men. Speed of fan, 120 revolutions a minute; water-gauge, 0.8 inch.

The doors and stoppings were in good condition and the air was well conducted around the working-faces, the ventilation being good. During the year I have not been able to find any trace of explosive gas in this mine. Taking samples of the return air with a Burrell gas-detector shows the return air to contain 0.1 per cent. of methane.

The working-places were well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The roads and airways were in fair condition and not dangerously dusty.

NO. 4 EAST MINE.

A. D. Allen, Overman; Louis Clark, Fireboss.

This mine is situated 1,500 feet east of the entrance to No. 4 mine and is developed by a pair of 15° slopes, following the coal-seam a distance of 1,300 feet, when they encountered a large fault and have not been extended for a number of years.

At the face of the Main slope levels were driven to the right, when a great deal of overlapping and folding was found to take place in the measures. After being driven a few hundred feet, following the contour of the seam, the level turned and was found to be running parallel with the slopes. At a distance of 1,300 feet from the slope the seam was found to rise very quickly, when headings provided with chutes were driven in close proximity to the No. 1 level and the coal at the side of headings extracted and the pillars drawn back. The available coal being restricted, these workings have retreated fast during the year.

The method of haulage is by a hoist situated near the entrance to the mine and a main rope, the mine-cars being collected at the working-faces and hauled by horses to a landing situated near the foot of the slope.

Ventilation is produced by a Sheldon-type 4-foot belt-driven fan, and during my last inspection ventilation showed 16,000 cubic feet of air a minute passing into the mine for the use of eleven men and two horses. Water-gauge, 0.25 inch.

The air was well conducted around the working-faces, while the doors and stoppings were in good order. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the workmen. The roadways were well timbered and in fair condition, and being naturally damp were free from dangerous coal-dust.

The coal is friable and mined by hand; little blasting is required, and when necessary is done under the supervision of a certified fireboss.

PROSPECT MINE.

This mine is operating in a small area of coal situated above the No. 1 level of the No. 4 East mine. The surface croppings, not being accessible from the No. 4 East mine, have been opened up by a slope driven from the surface. Mining is very restricted owing to the limited area of the ground, and most of the coal produced has been extracted from the pillars. Ventilation is produced naturally for the use of five men.

The working-places are well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The roads are in good condition, and being naturally damp are free from dangerous coal-dust. The mine-cars are collected at the working-faces by a horse and drawn to a landing situated near the foot of the slope and hoisted to the surface by main-rope haulage.

This mine is supervised by the No. 4 East officials, being in close proximity to the same.

No. 7 MINE.

Andrew McKendrick, Overman; Thomas Rowbottom and Matthew McKibben, Firebosses.

The entrance to this mine is situated in Coal gully, 400 feet above the tippie. The mine is operating in the No. 4 seam, which has an average thickness of 15 feet and is overlaid with a sand-rock roof. Operations are generally conducted in the upper 10 feet of the seam.

This mine has been developed by a pair of slopes following the full pitch of the seam, with levels turned off each side and spaced about 200 feet, all the stalls being driven to the raise. The method of work is pillar and stall, and owing to the inclination of the seam the coal is brought to the levels and loaded into the mine-cars and drawn by hand to landings situated near the Main slope.

All the work in this mine consists of drawing pillars, the present workings having retreated to the No. 5 levels, and owing to this seam being overlaid with a sand-rock roof, with a shale floor, causes the mine to be subject to "crush" and hard to maintain roads.

Ventilation is produced by a 52-inch Guibal-type fan situated near the entrance to the back slope. During my last inspection ventilation showed 14,850 cubic feet of air a minute passing into this mine for the use of twenty men. Water-gauge, 0.3 inch; barometer, 27.8 inches; thermometer, 10° F. The air was well conducted around the working-faces, while the doors and stoppings were in good order.

The working-places were well timbered and a good supply of suitable timber provided for the use of the workmen. The roads were in fair condition, and being naturally damp were free from dangerous coal-dust.

I have not been able to find any trace of explosive gas in this mine during the year, and the Burrell gas-detector failed to show any trace of methane.

No. 5 WEST MINE.

Andrew McKendrick, Overman; William Adamson, Fireboss.

This mine is situated on the west side of Coal gully, 800 feet below the entrance to No. 7 mine. The mine is operating in the No. 1 seam, which is a large friable seam averaging 13 feet in thickness, overlaid with a soft shale roof, and is subject to a great deal of faulting.

This mine has been developed by a well-timbered 7 by 9 level driven a distance of 350 feet, with raises to the surface for ventilation. From the face of the Main level slopes have been driven to the dip, a distance of 300 feet, with levels started off.

During my last inspection ventilation showed 7,500 cubic feet of air a minute passing into this mine (produced naturally) for the use of eleven men and one horse. The air was well conducted around the working-faces, while the stoppings were in good order.

The working-places were well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The roads were in good condition, and being naturally damp were free from dangerous coal-dust.

The coal is taken from the face of the headings by means of chutes and loaded into the mine-cars on the levels and hoisted by a compressed-air hoist to the Main level.

No. 5 EAST MINE.

This is a small mine situated 300 feet north of the entrance to No. 7 mine, on the east side of Coal gully, and is operating in the No. 5 seam, 5 feet thick.

I found the general condition of this mine to be very good (ventilation produced naturally), free from any trace of explosive gas, and three men employed underground.

The coal produced is mined by hand and blasted when required with explosives of the permitted class; all shots fired with electric detonators under the shotfirer. Edison electric safety-lamps are used by workmen underground and lamps of the Wolf type by the officials for inspections.

Copies of the "Coal-mines Regulation Act," special rules, and plans of the mines are well posted near the entrance to the mines and maintained in good order.

The following are the official returns from the Middlesboro Colliery for the year ending December 31st, 1922 :—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	64,339	.....	.....	.....
" export to United States .....	.....	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	64,339	.....	.....
Used in making coke	4,959	.....	.....	.....
Used under colliery boilers, etc .....	.....	.....	.....	.....
Total for colliery use .....	.....	4,959	.....	.....
Stocks on hand first of year	504	.....	.....	.....
" last of year	536	.....	.....	.....
Difference added to stock during year .....	.....	32	.....	.....
Output of collieries for year .....	.....	69,330	.....	.....

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	52	5.00-12.00	.....	.....	52	.....
Miners' helpers	28	4.20	.....	.....	28	.....
Labourers	45	4.20-5.00	17	4.30-4.70	62	.....
Mechanics and skilled labour .....	.....	.....	15	4.30-5.80	15	.....
Boys .....	.....	.....	10	2.00-2.60	10	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	137	.....	47	.....	184	.....

Name of seams or pits—No. 4, No. 4 East, No. 5 East, No. 5 West, and No. 7 mines.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 4 mine, in which is mined the coal from Nos. 6 and 8 seams; No. 4 East mine, from which No. 4 seam is mined; No. 1 seam is mined from No. 5 West mine; No. 5 seam from No. 5 East mine, and No. 4 seam from No. 7 mine.

Description and length of tramway, plant, etc.—No. 4 mine: Access to the workings of this mine is gained by an entrance near the tippie; thence by a horizontal tunnel first driven in No. 5 seam, then by crosscutting the measures to No. 4, and again from No. 4 to No. 6 and No. 8 seams. The seams in this mine vary in thickness from 4 to 18 feet and pitch south, the angle of inclination being 30°. The coal is conveyed from the face to the mine-cars by chutes, and then hauled to the tippie by means of compressed-air hoists and ropes. Ventilation is produced by a Sheldon fan 8.5 feet in diameter, direct-connected to an Ideal steam-engine, 14 by 18 inches, and is so arranged that the direction of the current can be changed. No. 4 East: This mine is operated by means of a slope driven east. The coal in this mine varies from 12 to 20 feet in thickness; pitches south-east, the angle of inclination being 15°. Haulage-rope is connected to steam-hoist. No. 7 mine: Operations in this mine are now confined to the extraction of the pillars. No. 5 East: This mine is operating in No. 5 seam. A slope is now being driven east in the coal. No. 5 West: Development-work has been continued in this mine throughout the year, a slope being driven south for a distance of 500 feet and from which levels have been turned off to the right and left. Thickness of coal is 18 feet; angle of inclination being 15°, pitching south. Haulage by compressed-air hoist; thence by gravity to the tippie. The main power plant is situated near the tippie, consisting of four return-tubular boilers, each 160 horse-power; Canadian cross-compound compressor with a capacity of 2,000 cubic feet of free air a minute; Ideal compound engine direct-connected to 75-kw. 2,300-volt General Electric generator; 25-kw. direct-current steam-engine set for lighting purposes.

The Fleming Coal Company, Ltd.

(FORMERLY THE INLAND COAL AND COKE COMPANY, LTD.)

Head Office—Vancouver, B.C.

Officers.

Joseph Martin, President,
Joseph Graham, Managing Director,
Jos. Martin, Secretary-Treasurer,
A. E. Smith, Manager,

Address.

209 Metropolitan Bldg., Vancouver, B.C.
Merritt, B.C.
209 Metropolitan Bldg., Vancouver, B.C.
Merritt, B.C.

COAL HILL COLLIERY.

A. E. Smith, Manager.

This colliery is situated south-west of the Middlesboro Collieries, on the west side of Coal gully and about 1½ miles from the city of Merritt, and has operated in the No. 2 seam of this property during the whole of the year.

No. 2 MINE.

John T. Brown, Overman; George Maxwell, John W. Smith, and
James Simm, Firehosses.

This mine is operating in the south-west portion of the Nicola field, 400 feet west of the entrance to the No. 3 seam, and has been developed by a pair of 30-per-cent. slopes, following the full pitch of the seam from the surface croppings to the boundary of the property, a distance of 800 feet.

The No. 2 seam has an average thickness of 6 feet and was subject to a great deal of faulting; it is intersected by bands of shale and bone, which are found to be of variable thickness and which increase or diminish at short distances, making it hard to keep the coal clean. The Nos. 1 and 2 West levels are generally overlaid by a rigid shale-capping, making mining conditions very favourable. This seam has an average pitch of 30° S.W. and is developed by the pillar-and-stall system. The stalls are being driven 12 feet wide, with 50-foot centres and 200-foot lifts. Owing to the pitch of the seam the coal is conveyed from the various faces by means of chutes to the main levels, where it is loaded into the mine-cars.

During the year this mine has been very free from explosive gas. It is ventilated by a single-inlet belt-driven 6-foot Aelos fan. The air is being well conducted around the working-faces, while the doors and stoppings were in good order. The working-places were well timbered and a sufficient supply of timber provided for the use of the workmen. The roadways were in good condition, and being naturally damp were free from dangerous coal-dust.

The area of the No. 2 seam being very limited, it was decided during the early part of the year to again open up the old No. 5 seam from the No. 2 West level. At 800 feet from the slope a rock tunnel was driven across the measures a distance of 150 feet and entered the No. 5 seam 120 feet west of the old workings, where the seam, being found to be badly faulted, was abandoned.

The coal produced at this mine, being extracted from the slope pillars from the No. 1 to the No. 2 levels, makes the life of the mine very limited, and I have no doubt it will be exhausted during the month of January.

The No. 2 mine being about exhausted caused the company to follow a rather vigorous prospecting policy during the year, when a large amount of excavating and ditching was done at the surface to locate a workable seam of coal below the No. 3 seam, and was successful in exposing the croppings of a 9-foot seam overlaid with a sandrock roof, which has the appearance of being a very promising prospect. It is at present being developed by means of an adit level.

The coal is mined by hand and blasted when required by explosives of the permitted class, all shots being fired with electric detonators under the supervision of certificated shotfirers.

The mine-cars have a capacity of 1 ton and are loaded at the various chutes on the levels, and drawn by hand to the landings near the slope and hoisted by main-rope haulage in 4-car trips to the surface. The mine-cars are dumped by an ordinary dump, the coal being cleaned before going into bunkers having a capacity of 500 tons, and drawn off as required into the railway-cars.

No additions have been made at this plant during the year, which consists of two Leonard-type return-tube boilers having a joint capacity of 80 horse-power, which provide power for the main haulage; fan-engine and lighting plant and heat for the wash and change house; a 25-horse-power vertical boiler is situated near the tippie, which provides power for small hoist and pump for forcing the water from storage-tank at tippie to a tank at the mine; while a small pumping plant is situated at the river, delivering water to storage-tank at the tippie.

The surface equipment consists of machine, carpenter, and car-repairing shops, office buildings, and wash and change rooms at the mine. Copies of the "Coal-mines Regulation Act," special rules, and plans of mines are well posted near the mine.

The following are the official returns from the Fleming Collieries for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	36,859			
" export to United States.....				
" " other countries.....				
Total sales.....		36,859		
Used in making coke.....				
Used under colliery boilers, etc.....	1,666			
Total for colliery use.....		1,666		
		38,525		
Stocks on hand first of year.....	120			
" last of year.....	80			
Difference taken from stock during year.....		40		
Output of collieries for year.....		38,485		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTAL.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		\$		\$		\$
Supervision and clerical assistance.....	6	6.00	2	6.00	8	6.00
Whites—Miners	35	7.00	.....	.....	35	7.00
Miners' helpers.....	5	5.00	.....	.....	5	5.00
Labourers	8	4.50	16	.....	24	4.50
Mechanics and skilled labour....	2	5.00	8	5.50	10	5.20
Boys.....	.....	.....	.....	.....	.....	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	56	.....	26	.....	82	.....

Name of seams or pits—No. 2 mine.

Description of seams, tunnels, levels, shafts, etc., and number of same—This seam is some 6 feet thick, but two persistent bands of rock make the mining somewhat difficult and requires an abnormal quantity of explosives. Very little development was carried on, the operations being almost entirely confined to extracting the pillars. A rock tunnel is being driven into the rise of the hill near the head of the tramway to crosscut the lowest seam in the series, which was discovered and opened up by a prospect-shaft some 1,500 feet farther up on the hill. The tunnel is in some 400 feet and is expected to reach the seam about February 1st.

Description and length of tramway, plant, etc.—The plant consists of two 100-horse-power boilers; two 16-horse-power boilers; Aelos fan, 60,000 cubic feet capacity, driven by a 60-horse-power Ideal engine; with numerous electric motors at different points for power and light. The tramway is of the self-acting type, 2,000 feet long, 3-rail, connecting with tippie at the foot of the hill, and is operated by a Stine wheel of a daily capacity of 1,000 tons. Tippie and bunkers connect with spur railway $1\frac{1}{2}$ miles from main line of the Kettle Valley Railway, and have weigh-scales and other facilities to handle 1,000 tons a day, with 400-ton bunker capacity.

Community Coal and Coke Co., Ltd.

Officers.

Joseph Walters, President,
 Thomas C. Preston, Vice-President,
 Harold T. Walters, Secretary,
 William Ewart, Mine Manager,

Address.

1155 Pacific Bldg., Vancouver, B.C.
 Vancouver, B.C.
 Vancouver, B.C.
 Merritt, B.C.

NORMANDALE MINE.

William Ewart, Manager.

This mine is situated 6 miles east of the town of Merritt, $2\frac{1}{2}$ miles south of Nicola, and is operating in the south-east portion of the Nicola basin. This property, being owned by the Nicola Coal Company about the year 1904, was reorganized as the South Nicola Coal Company about the year 1908, both companies apparently making no active attempt to develop the property.

Operations were commenced during the early part of the year by driving a well-timbered 6 by 7 level near the foot of the hill, a little above the main road to Nicola, when 100 feet from the portal a 12-foot seam of bituminous coal was encountered, lying at an angle of 75° and pitching into the foot-hills. This level was driven following the coal-seam a distance of 280 feet, with a raise driven to the surface for ventilation purposes.

During the year a small bunker was erected near the entrance to the mine, with a larger bunker provided with a self-dumping arrangement erected at a spur off the Kettle Valley Railway, also necessary equipment and buildings at the mine.

The system of handling the coal is as follows: The mine-cars are drawn from the mine by hand, dumped into a chute, where it is cleaned and drawn off into wagons and hauled by teams a distance of about $1\frac{1}{2}$ miles to the bunkers at the railway. This road having a hard surface, with an easy grade in favour of the load, makes the coal fairly accessible.

I found the general conditions of this mine to be very good and the provisions of the Act well adhered to. Safety-lamps of the Wolf type are used by the workmen and officials in the mine.

Operations were suspended at this mine during November for the winter.

The following are the official returns from the Normandale Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	223			
" export to United States.....				
" " other countries.....				
Total sales.....		223		
Used in making coke.....				
Used under colliery boilers, etc.....				
Total for colliery use.....				
Stocks on hand first of year.....				
" last of year.....	10			
Difference added to stock during year.....		10		
Output of colliery for year.....		233		

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	\$ 6.00			1	\$ 6.00
Whites—Miners.....	3	5.15			3	5.15
Miners' helpers.....						
Labourers.....			2	4.00	2	4.00
Mechanics and skilled labour.....						
Boys.....						
Japanese.....						
Chinese.....						
Indians.....						
Totals.....	4		2		6	

Name of seams or pits—Normandale seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—This property is situated between Merritt and Nicola, on Hamilton hill, close to the Nicola branch of the Kettle Valley Railway. Practically only prospecting-work has been done on this property. The main tunnel, on the level, is driven through wash and sandstone to a point 100 feet inside where it strikes the coal, and is continued in the coal for a further distance of 150 feet. The

thickness of the coal is irregular, owing probably to its proximity to the outcrop, varying from 10 to 20 feet. The plant consists of about 300 feet of tramways, small bunkers, cottages, and buildings.

Chu Chua Coal Co., Ltd.

Officers.

A. H. B. Jordan, President,
W. H. Glass, Vice-President,
O. A. Thomas, General Manager,
Major H. S. Hodgson, Secretary-Treasurer,
David Brown, Manager,

Address.

Everett, Wash.
Seattle, Wash.
Seattle, Wash.
616 Alaska Bldg., Seattle, Wash.
Chu Chua, B.C.

CHU CHUA COLLIERY.

David Brown, Manager; John Sullivan, Fireboss.

This property is situated 55 miles north of Kamloops, on the north side of the Thompson river, and comprises part of the foot-hills and flats situated on each side of the Newhykulston creek on the Indian reservation. The exposures being at an altitude of 1,500 feet, with a road running down the valley a distance of 3,600 feet to a siding of the Canadian National Railway, makes this property very accessible.

There are several small seams of coal showing on the bank of the creek, the largest of which have been named the Gray, Smith, and the Thomas seams, and until the latter part of the year 1921 all the development-work had been confined to the Thomas seam, which may be considered a double seam separated by 7 or 8 feet of shales and sand rock at the surface.

The upper part of this seam has been developed by a pair of adits driven from the croppings at the side of the creek and following the strike of the seam a distance of 250 feet. About 100 feet from the portal slopes were driven to the dip, a distance of 200 feet, when it was considered the physical character of the measures lent themselves to the development of this seam by long-wall mining; the coal-seam being about 3 feet 6 inches thick, intersected by bands of rock, which are inclined to split and unite at short distances. The coal is a semi-bituminous of a good quality and commands a ready market.

During the summer of 1921 the Gray seam, which is the lowest seam uncovered in these measures, was uncovered by the sapping of glacial drift in the creek and was found to be about 5 feet thick; this seam was again proved by a borehole 200 feet north of the creek, when a 30° slope was driven from the surface and cut this seam at a distance of 80 feet, which upon being encountered had the appearance of fair bituminous coal, which changed at a short distance and was found to lack the perpendicular prismatic jointing so characteristic of bituminous coal, and possesses a laminated structure, was very high in ash, and not able to command a market, with the result that operations were stopped during February of the present year.

During August it was again decided to develop the Thomas or the top seam, and a 250-ton bunker was built on the north bank of the creek, provided with bar-screens for cleaning and preparing the coal. A new hauling-slope was driven from the side of the hill 100 feet above the No. 1 level and connected with the Main slope of the mine.

This mine is developed by the long-wall system, the gates being well brushed and packed, and the roof being a hard sand rock makes conditions favourable for this method of work. All the coal is being mined by machines and very little blasting is required.

During my last inspection I found thirteen men employed underground. The general conditions were good, the mine well ventilated and free from any trace of explosive gas, and the roads were in good condition. The working-face was well timbered and a sufficient supply of suitable timber provided for the use of the workmen. The mine, being naturally damp, was free from dangerous coal-dust.

Electric safety-lamps are provided for the use of the workmen, while safety-lamps of the Wolf type are used by the officials for inspection purposes. Copies of the "Coal-mines Regulation Act" are posted near the entrance to the mine, also a good supply of first-aid appliances is provided.

The power plant consists of a 44-horse-power locomotive-type boiler, with one straight-line steam-driven single-stage compressor with a capacity of 270 cubic feet of free air a minute, while a small electric plant is provided for driving a small mine-fan, lighting purposes, and charging lamp-batteries.

The following are the official returns from the Chu Chua Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	538			
" export to United States.....				
" " other countries.....				
Total sales.....		538		
Used in making coke.....	80			
" under colliery boilers, etc.....				
Total for colliery use.....		80		
Stocks on hand first of year.....				
" last of year.....				
Difference { added to taken from } stock during the year.....				
Output of colliery for year.....		618		

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	8.11	2	16.22
Whites—Miners.....	10	5.44			10	54.40
Miners' helpers.....	4	4.54			4	18.16
Labourers.....			9	4.31	9	38.79
Mechanics and skilled labour.....			3	5.44	3	10.32
Boys.....						
Japanese.....			1	2.74	1	2.74
Chinese.....						
Indians.....						
Totals.....	14		15		29	

Name of seams or pits—Thomas A, Thomas B, and Gray.

Description of seams, tunnels, levels, shafts, etc., and number of same—Thomas A: Developed by adding level which starts from outcrop on the north side of Coal creek and has been driven approximately 500 feet; counter-level has been driven same distance and is being utilized as air-course connecting with fan for ventilation. Coal-seam, 36 inches thick, with three narrow bands of bone and rock; sandstone roof. Coal bituminous; excellent domestic and steam coal. Thomas B: This vein is separated from the Thomas A by about 9 feet of slate and shale; same is 30 inches thick; small band of rock. Coal similar in character to Thomas A. Only work of a prospective nature has been done on this vein. Gray seam: Approximately 300 feet below Thomas B seam; developed by drilling; vein, 60 inches thick, with several small bands of shale and bone, making necessary washing in preparation for market. A good steam and domestic coal. This vein is opened by a slope approximately

200 feet, from which levels have been driven right and left in a counter-slope for ventilation; seam pitches 22°.

Description and length of tramway, plant, etc.—Bunkers of 300 tons capacity have been installed at the Thomas A seam, with the necessary screening arrangement for three products—lump, nut, and slack. The coal is brought to the surface by hoist and delivered to the bunkers. The product is then delivered by haulage to the railway spur of the Canadian National Railway, half a mile distant. The power plant consists of one locomotive-type boiler, air-compressor, electric generating plant, with facility for charging miners' electric lamps, etc.

Coalmont Collieries, Ltd.

Head Office—Coalmont, B.C.

Capital, \$3,000,000.

Officers.

W. J. Blake-Wilson, President,
Gen. J. W. Stewart, Vice-President,
A. H. Douglas, Secretary,
D. J. McLeod, Treasurer,
Donald McLean, Manager,

Address.

Vancouver, B.C.
Winnipeg, Man.
Vancouver, B.C.
Vancouver, B.C.
Coalmont, B.C.

COALMONT COLLIERY.

Donald McLean, Manager; Alex. Bryden, Overman; John McMurtrie, Thomas Bysouth, Thomas Leaman, Robert Gourley, Alfred Gould, John Gilliam, James Webster, William Bradley, and George Carson, Firebosses.

This colliery is situated in the Tulameen district, 170 miles east of the city of Vancouver and 12 miles west of the town of Princeton, and is served by a spur off the Kettle Valley Railway. Mining operations at present are being conducted on the south-western slope of the mountain, where the measures are found to be cropping at the surface, 5 miles from Coalmont, on the north bank of Granite creek, at an elevation of 3,600 feet, or 1,600 feet above the Tulameen river at Coalmont. Mining operations have been very successful during the present year and it has developed into one of the most important in this district.

The present measures that are being operated may be described as one conformable basin having an inclination of 40° at the surface croppings of No. 2 mine and varying to 6° at the face of the No. 1 slope off No. 3 mine, is generally overlaid at the surface with a basalt capping, and may be considered as one large seam of coal having an aggregate thickness of 160 feet, interspersed by small bands of rock, bone, and shale, and is at present being operated in the No. 4 seam of the series, which has an average thickness of 10 feet of good clean bituminous coal.

NO. 2 MINE.

This mine is developed by a well-maintained 7 by 9 level, with the necessary counter, following the strike of the seam a distance of 3,250 feet, when a large intrusive dyke was encountered, where a little prospect-work was done to prove the same. Work ceased at the face of these levels, this fault being penetrated by the No. 3 mine main levels.

All the work done in this mine is to the raise of the No. 2 level and is developed by five sets of headings or chutes following the full pitch of the seam to the surface croppings, which are generally reached at a distance of 700 to 800 feet.

Owing to all operations being to the rise of the No. 2 level, and also the pitch of the seam, which makes it adapted to chutes, the mine-cars are not taken off the No. 2 level. From the main headings levels are driven 10 feet in width following the strike of the seam, with the necessary crosscuts for ventilation purposes and making the pillars about 50 feet square.

The coal is loaded into small dump-cars at the various working-faces and trammed by hand to the headings, where it is dumped into chutes, conveyed to the No. 2 level, and there loaded into the mine-cars, drawn by horses to the entrance to the No. 3 mine.

During my inspections of this mine I have generally found the conditions to be good and free from any indications of explosive gas, and have made several tests with the Burrell gas-detector, which failed to show any trace of methane in the return air-currents. During my last inspection ventilation measured showed 17,280 cubic feet of air, a minute passing into this mine for the use of forty men and five horses. The air was well conducted around the working-faces and the doors and stoppings were in good order. The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the workmen, while the dump-car roads and chutes were in fairly good condition, and being naturally damp were free from dangerous coal-dust.

NO. 3 MINE.

This mine is situated 400 feet east of the No. 2 mine and is developed by a large well-maintained 8 by 12 tunnel known as the Wilson level, and with the necessary counter is following the strike of the same coal-seam as the No. 2 mine, leaving a pillar of coal of 100 feet between the two mines as a protection in case any spontaneous action should take place in the workings of the No. 2 mine. This No. 3 level is on the same elevation as the top terminal of the overhead tramway and is being used as a Main level for developing this property.

These levels have been operated the whole of the year and after reaching a distance of 3,300 feet encountered the same fault or dyke as found at the face of the No. 2 levels. The management decided to cross this intrusion at this point, and during my last inspection of this mine, after driving these tunnels through rock a distance of about 600 feet, it had the appearance of again entering the coal and should develop a new mine in this property.

Operations have been commenced to the dip of the No. 3 mine during the year by three sets of slopes. The No. 1, being the most extensive, has reached a distance of 1,000 feet, with a small amount of work developed on each side. These slopes have been found to be very free from any faulting, but with depth there appears to be a marked change in the character of the measures, which are found to be more friable, causing the roads and the workings to be subject to a general squeeze, with the floor heaving and the roof weighing heavy on the sets, making it hard and costly to maintain roads.

On the high side of No. 3 and near the face, levels have been driven across the pitch and cutting the various seams of coal show the measures to have an unusual thickness; while operations have been commenced in an 8-foot seam of coal 40 feet below the present seam that is being operated, where mining conditions appear to be very favourable.

The coal is mined by hand and blasted when required by permitted explosives under the supervision of certified shotfirers appointed for that purpose.

Ventilation is produced by a 5-foot "booster" fan situated near the entrance to the fan-drift and 200 feet from the No. 2 level, and during my last inspection was producing 25,000 cubic feet of air a minute, divided into two splits. The No. 1 split passing 10,000 cubic feet of air a minute for the use of fifteen men; the No. 2 split 15,000 cubic feet a minute for the use of forty-five men and two horses. The working-places, roads, and airways were free from explosive gas and a good current of air passing around the working-places, while the doors, stoppings, and brattice were in good order.

The roads were in fairly good condition, and being naturally damp were free from dangerous coal-dust, while the working-places were well timbered and in good condition and a sufficient supply of suitable timber was provided for the use of the workmen. Taking a sample of the air in the returns with the Burrell gas-detector showed that the return air was free from methane.

PLANT AND EQUIPMENT.

The power plant of this colliery is situated 4 miles from the mine, at the foot of the mountain at the town of Coalmont, and consists of two 250-horse-power water-tube boilers, which generate power for driving a 600-horse-power cross-compound Corliss engine coupled direct to G.E. 3-phase, 60-cycle alternator, 480 amperes, at a tension of 550 volts at 150 r.p.m. This power is distributed for light and power purposes at the tippie, and a portion of which is transformed to 10,000 volts and transmitted to the mine by high-tension wires, where it is again reduced to 550 volts for power purposes at the mine. Two Jencks return-tube boilers are used at the mine for steam-driven compressor, heating the machine-shops, rooming-house, offices, etc., at the mine.

There has been little change made at the plant during the present year, and the additions may be considered as follows: The installation of a 7-foot belt-driven Sirocco fan is at present being erected near the entrance to the No. 3 counter-level, which will replace the "booster" fan that is at present in use and will be operating during the early part of the year. A new 150-horse-power electric hoist has been installed at the top of No. 1 slope, No. 3 mine, to replace the small air-hoist that was being used, and a 50-horse-power compressed-air hoist is situated at the No. 2 slope and a small air-hoist at the No. 3 slope, while telephones have been installed on this level to communicate with the surface.

During the spring of the year this company had considerable trouble with the running-cable of the overhead tramway, which consisted of several makes of cable, sections of which showed very little indications of wear, while in others it was very pronounced, causing trouble with the grips of the buckets slipping on the grades; and during the month of May this cable was replaced by 31,000 feet of $\frac{7}{8}$ -inch of the same quality and make throughout, and it is at present working very satisfactorily.

(For report of tramway and plant see the 1921 Annual Report.)

Edison electric safety-lamps are in use by all the workmen underground at this colliery, while safety-lamps of the Wolf pattern are used by the officials for inspection purposes. Copies of the "Coal-mines Regulation Act" and special rules are well posted around the mines. A well-equipped doctor's office is provided at the mine under the charge of a first-aid officer, while a doctor is in daily attendance to give treatment to any of the employees that require the same.

During the year five sets of the latest Gibbs-type mine-rescue apparatus have been installed by this company, replacing the old ones of the Draeger type, which were unfit for further use.

The following are the official returns from the Coalmont Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR.	COAL.		CORE.	
(Tons of 2,240 lb.)	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	64,658	.....	.....	.....
" export to United States	72,271	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	136,929	.....	.....
Used in making coke	5,877	.....	.....	.....
" under colliery boilers, etc. ....	.....	.....	.....	.....
Total for colliery use .....	.....	5,877	.....	.....
Stocks on hand first of year .....	.....	.....	.....	.....
" last of year .....	.....	.....	.....	.....
Difference { added to } stock during year .....	.....	.....	.....	.....
{ taken from }	.....	.....	.....	.....
Output of colliery for year .....	.....	142,806	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
Supervision and clerical assistance	7	\$ 6.66	7	\$ 6.10	14	6.38
Whites—Miners	82	7.50	.....	.....	82	7.50
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	52	5.00	74	4.50	126	4.70
Mechanics and skilled labour	1	6.00	15	5.50	16	5.53
Boys	1	2.50	1	3.80	2	3.15
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	1	3.08	1	3.08
Indians .....	.....	.....	.....	.....	.....	.....
Totals	143	.....	98	.....	241	.....

Name of seams or pits—Nos. 2 and 3 mines; at present mining the upper or 10-foot seam.

No. 3 has openings into an 8-foot seam 40 feet below the 10-foot seam.

Description of seams, tunnels, levels, shafts, etc., and number of same—No. 2 mine level, 3,250 feet long, mining upper or 10-foot seam; No. 3 mine level, 4,080 feet long, mining upper or 10-foot seam, also seam immediately below this or 8-foot seam, and has two openings in 7½-foot seam 40 feet below the 10-foot seam; No. 1 slope, 984 feet long, on 10-foot seam.

Description and length of tramway, plant, etc.—Aerial tramway, 15,110 feet long, carrying 1 short ton of coal per bucket at average speed of 60 buckets an hour; tram-road in No. 2 mine, 3,700 feet long; tram-road in No. 3, including yard, 4,880 feet. New Sirocco fan, capacity 100,000 cubic feet a minute, partially installed; one Lidgerwood hoist, 125 horse-power, in No. 3 mine; other equipment same as last year.

Princeton Coal and Land Company, Ltd.

Head Office—15 Great St. Helens, London, E.C.

Capital, \$1,000,000.

Officers.

A. St. George Hamersley, Chairman,
E. S. Neave, Secretary,
Ernest Waterman, General Manager,
Francis Glover, Manager,

Address.

London, England.
London, England.
Princeton, B.C.
Princeton, B.C.

Value of plant, \$77,000.

PRINCETON COLLIERY.

Francis Glover, Manager.

This colliery is situated near the town of Princeton, on the right bank of the Similkameen river, near its junction with the Tulameen, and is situated in the Similkameen Mining Division.

PRINCETON No. 1 MINE.

William James, Overman; John Liddle and Frank Lister, Firebosses.

This mine is situated half a mile east of the town of Princeton, 100 feet above and a little to the east of the Similkameen river, and is developed from the surface by a pair of 12-per-cent. slopes driven directly to the dip. The coal-seam reached 200 feet from the portal of the Main slope, has an average thickness of 20 feet, and is developed by the pillar-and-stall system, work being generally confined to the upper 10 feet of the seam.

During the year the coal produced in this mine has been extracted from the pillars and a small section lying to the west of the slopes. The workable area in this mine is very small and work is at present confined to drawing pillars in close proximity to the Main slope between the Nos. 2 and 4 levels, causing the life of this mine to be limited to a few months.

The coal is mined in the "fast places" by compressed-air machines of the post-puncher type, and in the "skips" it is easily got by hand and little blasting is required.

Ventilation is produced by a small single-inlet belt-driven fan of the Guibal type, situated near the entrance to the counter-slope, and during my last inspection the ventilation measured 6,000 cubic feet of air a minute passing into this mine for the use of fourteen men. The mine was free from explosive gas and the air was well conducted around the working-faces, while the doors and stoppings were in good order.

The working-places were well timbered and a sufficient supply of suitable timber was provided for the use of the workmen, while the roads were in fair condition, and being naturally damp were free from dangerous coal-dust. Edison electric safety-lamps are used exclusively by the workmen, while safety-lamps of the Wolf type are used by the officials for inspection purposes.

NO. 2 PROSPECT.

The company has followed rather an aggressive prospecting policy during the latter part of the year owing to the No. 1 mine being about exhausted, and was successful in opening up what appears to be a promising prospect on the east side of the old No. 2 slope, where an 8-foot seam of coal was exposed, overlaid by a sand-rock roof.

The No. 2 slope is a 30° slope situated 1,500 feet south-east of No. 1 mine, driven from the surface to the No. 1 seam, and all the work opened on the West side and connecting with the workings of the No. 1 mine.

During the year this slope was cleaned and retimbered a distance of 190 feet from the portal and a prospect level commenced on the East side to penetrate a fault, and at a short distance was successful in exposing the above-mentioned 8-foot seam of coal. This level was driven 100 feet in the coal, when a heading was commenced following the full pitch of the seam to the surface croppings.

A 4-inch air-line has been laid from the power-house of No. 1 mine and is used for power purposes, while a surface mine-track connects this mine with No. 1 mine tippie.

NO. 3 MINE.

Hugh Gillespie, Fireboss.

This prospect is situated 4,300 feet south of the entrance to No. 1 mine and consists of a seam of coal 3½ feet thick overlaid with a sand rock. The slope, which has been driven a distance of 200 feet, has not been extended during the year owing to the lack of hoisting equipment and water. Levels have been driven from the side of the hill following the contour of the seam a distance of 600 feet, with a heading driven to the surface for ventilation purposes. These levels are at a lower elevation than the face of the slopes, to which they will be connected and used as an adit for drainage purposes.

This prospect is served by a branch line of the Kettle Valley Railway which was built to the Copper Mountain mines and at present is not in use. There has been a small bar-screen erected near the entrance to this level, where the coal is dumped and loaded into the railway-cars.

I have generally found the conditions at this mine to be good. Ventilation is produced naturally. Edison electric safety-lamps are used by the workmen in the mine and safety-lamps of the Wolf pattern are used by the officials for inspection purposes. Three men employed underground.

PLANT AND EQUIPMENT.

There has been no change made at the surface equipment at this colliery during the year, which consists of a wood tippie provided with a rotary pump, by which the mine-cars are dumped upon a stationary 2-inch bar-screen, from which the large coal is cleaned and loaded into the railway-cars, the small coal falling upon a small hanging shaking screen with a ¾-inch mesh, when the larger portion of the screenings is collected by a belt-conveyor, dumping into a chute.

The power plant consists of three return-tube boilers having an aggregate capacity of 200 horse-power, supplying power for a Canadian Rand air-compressor which has a capacity of 750 feet of free air a minute, used for running the hoists, mining-machines, and pumps in the mine. A 25-horse-power steam-hoist is situated near the tipple and is used for hoisting the mine-cars from the No. 1 mine.

A well-equipped machine-shop, car-repairing and carpenter's shop, with wash and change room, also lamp-room, are maintained, while a 30,000-gallon water-tank provides storage of water for use at the plant and also fire-protection purposes.

Copies of the "Coal-mines Regulation Act," special rules, and plans of the mine are well posted near the entrance to the mine.

The following are the official returns from the Princeton Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKK.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	16,669			
" export to United States	308			
" " other countries				
Total sales		16,977		
Used in making coke				
" under colliery boilers, etc.	2,670			
Total for colliery use		2,670		
		19,647		
Stocks on hand first of year	318			
" last of year	89			
Difference taken from stock during year.		229		
Output of colliery for year.		19,418		

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	\$ 7.00	2	\$ 7.00-4.40	6	
Whites—Miners	12	6.00-7.50			12	
Miners' helpers	5	4.25			5	
Labourers	16	5.00-5.50	10	3.85-4.00	26	
Mechanics and skilled labour			6	4.80	6	
Boys			2	2.50	2	
Japanese						
Chinese						
Indians						
Totals	37		20		57	

Name of seams or pits—No. 1 mine; No. 2 mine, new mine found in August last; No. 3 mine (Gem Bed).

Description of seams, tunnels, levels, shafts, etc., and number of same—Same as last year somewhat; the life of the No. 1 mine has been reduced by the mining of pillars. The No. 2 mine was only found in August, 1922, and it is situated on the East side of our No. 1 mine through an apparent big downthrow fault; this mine looks very promising and is 7 feet thick, with a massive rock roof and good floor. Quality of coal appears good. Surface

track, some 2,200 feet, has been laid across the surface from this mine to the No. 1 mine tippie. The No. 3 mine (Gem Bed) has been further prospected with good results; several cars of this coal have been shipped.

Description and length of tramway, plant, etc.—A new slope 12 by 8 feet in the clear is being driven from the surface to the No. 2 mine on a 25-per-cent. grade.

EAST KOOTENAY INSPECTION DISTRICT.

REPORT BY ROBERT STRACHAN, SENIOR INSPECTOR.

I have the honour to submit the annual report covering the coal-mines in operation during the year 1922 in the East Kootenay Inspection District.

This district is directly in charge of John MacDonald, Inspector of Mines, with office in Fernie, and attached to this report is his description of the various mines in operation and the conditions which prevail in and around them.

The collieries in operation were the same as in the last few years—namely, Coal Creek and Michel, owned by the Crow's Nest Pass Coal Company, Limited, Fernie, and Corbin, owned by the Corbin Coal and Coke Company, of Spokane.

No attempt was made to reopen either the Hosmer Colliery at Hosmer, owned by the Canadian Pacific Railway Company's Natural Resources Department, which closed down in 1914, or the Morrissey Colliery, owned by the Crow's Nest Pass Coal Company, closed down in 1909. Both of these collieries have practically been dismantled and the prospects for their resuming coal production are very remote. Seven mines were in operation during the year at Coal Creek, three at Michel, and two at Corbin.

The agreement entered into between the employees and employers in 1920 expired on March 31st, 1922, and although both parties met thirty days previous, as provided in the agreement, they failed to arrive at a satisfactory basis and work was discontinued. Later, an investigation, as provided for by the "Industrial Dispute Act," was held, H. Oslund representing the workmen, R. G. Drinnan the coal companies, and Mr. Knowles was appointed by the Department of Labour, the other two representatives having failed to agree on a Chairman.

This Board held meetings at the different mining centres in the district, and after carefully considering the evidence two reports were made. The majority report, approved of by H. Oslund, miners' representative, and the Chairman, Mr. Knowles, suggested that there should be a reduction of the war bonus of \$1.17 a day, and a further reduction from the base rates paid under the agreement of June, 1920, of 15 per cent., or a reduction equivalent to about 25 per cent.

The minority report, signed by R. G. Drinnan, representative of the coal companies, proposed an increase in the day-wage rate of 40 per cent. over those in effect in the agreement of March, 1915, and an increase of 25 per cent. in contract rates over the rates existing in the agreement of 1915. This minority report, in basing its agreement on the rates existing on March, 1915, was adopting the conditions as they existed previous to the appointment of the Coal Director by the Dominion Government, during whose term of office the coal companies felt morally bound to accept his decisions.

The result of the Board of Investigation did not seem to be satisfactory to either party, both the coal companies and the workmen rejecting the majority report, and the workmen also rejected the minority report.

Negotiations were not entirely broken off, and about the end of August the same course was adopted as in the United States—namely, that work be resumed on the same terms as formerly until the end of March, 1923, when a new agreement is expected to be arrived at.

Apart from this stoppage of almost five months, work has not been as steady as would have been expected. In this district a great deal of this was due to lack of cars, caused by defective rolling-stock on the Great Northern Railway, where a strike of shop or repair men has existed for the greater part of the year.

The following table shows the output of coal in long tons and the number of days worked during the years 1921 and 1922:—

Colliery.	1921.		1922.	
	Coal.	Days worked.	Coal.	Days worked.
	Tons.		Tons.	
Coal Creek.....	413,523	207	291,671	150
Michel.....	278,301	222	216,668	158
Corbin.....	67,931	177	46,022	130
Totals.....	759,755	...	554,361	...

This table shows a decrease in production of coal amounting to 205,394 tons as compared with the previous year, and is accounted for, as previously explained, by the stoppage of work, principally due to the failure of the workmen and coal companies to agree on a new scale of wages or rates at the expiration of the agreement arrived at in 1920.

The decrease is made up as follows:—

Colliery.	Coal Production.	Days worked.
Coal Creek.....	29.5 decrease.	23.6 decrease
Michel.....	22.2 "	28.0 "
Corbin.....	32.3 "	26.6 "

This shows an average decrease in the amount of coal produced, as compared with the previous year, of about 28 per cent. and in the number of days worked of 26.4 per cent.

ACCIDENTS.

Ten accidents were reported to this office during the year, as provided for by the "Coal-mines Regulation Act," involving death or serious injury to an equal number of workmen.

In addition to these, many small accidents occur, involving loss of time to the workmen, but are not reported to this office, owing to the reading of the Act, which requires only serious or fatal accidents to be reported, except in the case of an explosion of powder, boiler, or mine, and fortunately no accidents of this kind have occurred.

The accidents according to collieries were five (including the only fatal accident) at Coal Creek and five at Michel. No accidents were reported from Corbin Colliery. Three accidents were due to falls of roof or sides (including the fatal accident), four to haulage, and three to timbers falling or breaking.

The only fatal accident, which occurred at Coal Creek, was due to a fall of coal at the working-face, which swung out some of the supporting timbers at the face, allowing more coal to fall, burying the workmen.

VENTILATION.

The general conditions of the mines with respect to ventilation are dealt with in the report of John MacDonald, District Inspector of Mines, which is attached, and shows the conditions to be fairly good.

The case of the No. 3 East mine, Michel Colliery, is peculiar, owing to the small production of coal and the great amount of methane given off. In previous years notice has been taken of hydrogen (free) in the results of the samples taken in this mine, and although active mining was discontinued in this mine early in the year, the amount of methane given off has not diminished.

In the case of this mine, No. 3 East, Michel, while the average production of coal per day only amounted to about 13 tons, the amount of methane given off every twenty-four hours measured 2,037,411 cubic feet, or, in other words, almost as much as given off for the whole of

the mines in operation at Coal Creek. This would tend to confirm the idea that the production of methane in some of the mines does not depend on the amount of coal produced.

COAL-DUST.

The mines have been kept fairly clear of coal-dust, water being used for this purpose, while a great deal of the dust is loaded out previous to watering, and no attention is too great to be paid to this.

BUMPS AND BLOW-OUTS.

No fatal or serious accidents have been reported from either of these sources during the year; small bumps have been fairly regular, and in November a very serious bump occurred in the Main level of No. 1 East mine, Coal Creek. While the amount of destruction was not so great as in the bump which occurred in this mine in 1916, the extent of the earth-tremors, the air-blast which accompanied it, and the dust-clouds places it among the heaviest bumps yet encountered.

Blow-outs have been comparatively common in the same mine during the year, in the Nos. 10 and 14 East districts, without doing very much harm. In the latter part of the year these blow-outs were met with in the No. 10 East, where the workings were travelling through a disturbed area of coal, similar to what was encountered in No. 14 East. The work of drilling the working-faces with a view to allow the methane to escape without undue violence still continues, with satisfactory results.

CONTRAVENTIONS OF THE ACT.

Searches of the workmen for matches, pipes, etc., contrary to the Act, have been carried out regularly at all the mines, with the following result: Three workmen at Coal Creek were prosecuted for having matches in their possession, contrary to Rule 9, section 91, of the "Coal-mines Regulation Act," and convictions obtained. At Michel two workmen were prosecuted and convictions obtained for failing to sprag the undermined coal, contrary to Special Rule 115. A list of these offences is attached.

Crow's Nest Pass Coal Company, Ltd.

Capital, \$3,500,000.

<i>Officers.</i>	<i>Address.</i>
W. R. Wilson, President,	Fernie, B.C.
H. B. McGiverin, Vice-President,	Ottawa, Ont.
J. S. Irvine, 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.
Robert Bonar, 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.

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 1922.

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	124,680	.....	25,742	.....
" export to United States	294,019	.....	15,524	.....
" " other countries .....	.....	.....	.....	.....
Total sales .....	.....	418,699	.....	41,266
Used in making coke	61,497	.....	.....	.....
Used under colliery boilers, etc.	38,560	.....	.....	.....
Total for colliery use .....	.....	100,057	.....	.....
Stocks on hand first of year	10,529	.....	44	.....
" last of year	112	.....	178	.....
Difference { *taken from } stock during year .....	.....	*10,417	.....	†134
Output of colliery for year .....	.....	508,339	.....	41,400

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	44	.....	18	.....	62	.....
Whites—Miners	532	.....	.....	.....	532	.....
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	120	.....	186	.....	306	.....
Mechanics and skilled labour	292	.....	212	.....	504	.....
Boys	13	.....	8	.....	21	.....
Japanese .....	.....	.....	.....	.....	.....	.....
Chinese .....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	1,001	.....	424	.....	1,425	.....

COAL CREEK COLLIERY.

Bernard Caufield, Manager; Jas. Taylor, Assistant Manager.

This colliery, the mines of which are located on both sides of Coal creek, is situated about 5 miles from Fernie, where it has railway connections with the Canadian Pacific and Great Northern Railways by means of a branch line called the Morrissey, Fernie & Michel Railway.

The following mines were operated during the year: Nos. 1 East, 1 South, 1 North; Nos. 2, 3, 9, and B North. The No. 1 mines operate in the No. 1 seam, which varies from 30 to 40 feet thick, only 10 feet of the upper portion being worked; Nos. 2, 3, and 9 mines are mining the No. 2 seam, which has an average height of from 6 to 9 feet; while B North is working the B seam, which is about 5 feet thick, height being obtained for haulage by lifting from 3 to 4 feet of bottom, this consisting chiefly of inferior coal and shales.

The general method of work is pillar and stall, entries being driven in pairs, from which rooms are set off three to a panel, large pillars being left between each pair of entries and set

of rooms; all of the coal is mined from the solid, no pillars having been extracted during the year.

The haulage inside the mines is by horses from the working-faces to convenient partings, from which the loaded cars are conveyed to the tippie by low-pressure compressed-air hoists, compressed-air locomotives, endless-rope haulage, and gravity-planes.

The lamp in general use is the Edison Electric type cap safety-lamp, of which there are 750, while fifty Wolf safety-lamps are used by the officials and bratticemen for testing purposes; all lamps are cleaned and repaired in a very well-equipped lamp-room located in a central position at the colliery.

No additions have been made to the boiler plant, tippie, or surface equipment during the year, a description of which appeared in the 1921 Report.

A large number of houses are provided at Coal Creek for those workmen who prefer to live close to the mines, while a good train service is maintained with the town of Fernie, where the majority of the workmen reside.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines.

Following is a brief description of the mines and the conditions generally prevailing therein throughout the year:—

NO. 1 EAST MINE.

John Caufield, Overman; H. Dunlap, J. Duncan, J. Maltman, and Thos. Reid, Firebosses.

This mine is opened by a crosscut tunnel which reaches the coal at a distance of 215 feet from the entrance. It is ventilated by a fan of the Wilson type, which, running at a speed of 146 revolutions a minute, produced an average quantity of 116,500 cubic feet of air a minute, under a water-gauge of 3.5 inches.

It is ventilated by four separate splits; the quantity passing in each district at the last inspection measured as follows:—Main Return, 1,060 by 104: 110,240 cubic feet of air a minute for the use of ninety-six men and thirteen horses; Burrell gas-detector, 0.8 per cent. methane. North split, 100 by 80: 8,000 cubic feet of air a minute for the use of sixteen men and three horses; Burrell gas-detector, 1 per cent. methane. Second South, 120 by 75: 9,000 cubic feet of air a minute for the use of twenty-five men and three horses; Burrell gas-detector, 1.8 per cent. methane. First South, 320 by 75: 24,000 cubic feet of air a minute for the use of twenty-five men and three horses; Burrell gas-detector, 1.2 per cent. methane. West split, 290 by 60: 17,400 cubic feet of air a minute for the use of thirty men and four horses; Burrell gas-detector, 1 per cent. methane.

Explosive gas has been found eight times during the year in the course of inspection, in nearly every instance in cavities in the roof above the timbers, while the percentage of methane present in the return air, as determined by the Burrell gas-detector, varied from 0.5 per cent. in the West split to 2.2 per cent. in the Second South split.

Conditions in general have been good, roadways and timbering kept in good shape, while the mine has been kept fairly free from coal-dust by the use of spraying systems, which are maintained on all roads and working-places where required; while all main roads are regularly treated with second-burnt ashes.

A good supply of suitable timber has been generally provided for the use of the workmen, while the provisions of the "systematic timbering" rules have been well carried out at the working-faces.

NO. 3 MINE.

J. Biggs, Overman; R. Phillips, W. Brown, and E. Caufield, Firebosses.

This mine is operating the eastern and dip portion of the No. 2 seam and is reached by a slope 2,500 feet in length, from which the coal is delivered direct to the tippie. It is ventilated by a 16- by 8-foot Wilson fan, which, running at a speed of 150 revolutions a minute, produced an average quantity of 55,900 cubic feet of air a minute, under a water-gauge of 3.8 inches.

It is divided into two separate splits; the quantity of air passing in each at the last inspection measured as follows:—Incline split, 330 by 55: 18,150 cubic feet of air a minute for the use of twenty-seven men and five horses; Burrell gas-detector, 1.1 per cent. methane. South split, 450 by 70: 31,500 cubic feet of air a minute for the use of forty men and four horses; Burrell gas-detector, 1.6 per cent. methane. Main return, 950 by 60: 57,000 cubic feet

of air a minute for the use of sixty-seven men and nine horses; Burrell gas-detector, 1.2 per cent. methane.

General conditions have been good all over this mine, no explosive gas being found in the course of inspection, while tests taken regularly with the Burrell gas-detector showed the methane percentage in the return air to vary from 0.4 per cent. in the Incline split to 1.7 per cent. in the South split.

A good supply of timber has been provided for use of the workmen and the requirements of the special rules *re* timbering well attended to at the working-faces.

Spraying systems are maintained on all roads where required, all main roads receiving regular applications of second-burnt ashes; the mine generally has been kept fairly free from coal-dust during the year.

No. 2 MINE.

C. McNay, Overman; J. Bushell, E. Ward, and W. Clarkstone, Firebosses.

This mine is worked on the western portion of the No. 2 seam and is situated on the same level as the tippie, to which the loaded cars are delivered direct from the mine by compressed-air locomotives. It is ventilated by a 16- by 8-foot Wilson fan, running at a speed of 132 revolutions a minute, which has produced an average quantity of 48,200 cubic feet of air a minute, under a water-gauge of 3 inches.

The ventilation is split into two separate districts; the quantity passing in each at the last inspection measured as follows:—Rock tunnel, 240 by 90: 21,600 cubic feet of air a minute for the use of fifty-two men and six horses; Burrell-gas detector, 0.5 per cent. methane. High-line, 2,100 by 2: 4,200 cubic feet of air a minute for the use of eleven men and three horses; Burrell gas-detector, 0.3 per cent. methane. Main return, 590 by 85: 50,150 cubic feet of air a minute for the use of sixty-three men and nine horses; Burrell gas-detector, 0.3 per cent. methane.

No explosive gas has been found during the year in the course of inspection, while tests taken with the Burrell gas-detector in the return airways showed the methane percentage to vary from 0.3 per cent. in the High-line to 1.1 per cent. in the Rock Tunnel split.

This mine was practically closed down during the stoppage of work (April 1st to August 27th), no repair-work being done except to the fan-drift and a portion of the main haulage-road. During the period mentioned several roadways caved in in the inside workings, which were repaired immediately work was resumed.

Conditions have been generally good throughout the year; roadways and timbering kept in a good state of repair (excepting those reported as caved in during the stoppage of work).

A good supply of timber has been provided for the use of the workmen and the requirements of the "systematic timbering" rules fairly well attended to at the working-faces.

The mine has been kept fairly free from coal-dust, spraying systems being maintained on all roads where required; while second-burnt ashes are spread regularly on all main roads.

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 tippie and operates the upper and western portion of the No. 1 seam on the south side of the valley; all workings are to the rise of the main haulage-road and driving toward the outcrop. It is ventilated by an electrically driven 8- by 4-foot Keith fan, running at a speed of 256 revolutions a minute, producing an average quantity of 36,360 cubic feet of air a minute, under a water-gauge of 2.5 inches.

At the beginning of the present year the ventilation was rearranged and the mine divided into two separate splits; the quantity of air passing in each at the last inspection measured as follows:—No. 1 split, 200 by 80: 16,000 cubic feet of air a minute for the use of forty-eight men and twelve horses; Burrell gas-detector, 1.3 per cent. methane. No. 2 split, 140 by 60: 8,400 cubic feet of air a minute for the use of thirty men and four horses; Burrell gas-detector, 1.1 per cent. methane. Main return, 380 by 80: 30,400 cubic feet of air a minute for the use of seventy-eight men and sixteen horses; Burrell gas-detector, 0.5 per cent. methane.

Explosive gas has been found nine times in the course of inspection, while the methane present in the return air, as determined by the Burrell gas-detector, has varied from 0.2 per cent. in No. 2 split to 1.9 per cent. in No. 1 split.

Conditions generally have been fairly good, roadways and timbering kept in fairly good shape, while a good supply of timber has been provided for the use of the workmen, and the requirements of the timbering rules fairly well attended to at the working-faces.

The mine has been kept fairly free from coal-dust, spraying systems being maintained on all roads and working-places where necessary, and all main roads have received regular applications of second-burnt ashes.

No. 1 NORTH MINE.

J. Worthington, Overman; Ed. Rutledge, J. Charnock, and H. Parsons, Firebosses.

This mine is worked on the western portion of the No. 1 seam on the north side of the valley, and, being close to the outcrop, very little trouble is experienced from gas. It is all on one split and ventilated by an electrically driven 7- by 4-foot Keith fan, running at a speed of 210 revolutions a minute, producing an average quantity of 23,000 cubic feet of air a minute, under a water-gauge of 1.8 inches; the quantity passing at the last inspection measuring as follows:—Main return, 460 by 50: 23,000 cubic feet of air a minute for the use of forty-eight men and seven horses.

Explosive gas has been found three times during the year in the course of inspection, while the methane content in the return air, as determined by the Burrell gas-detector, has averaged 0.3 per cent.

The main return airway has been enlarged and repaired, while roads and timbering generally have been kept in good shape. A good supply of timber has always been provided for the use of the workmen, while the requirements of the "systematic timbering" rules have been well attended to at the working-faces. This mine being naturally damp, it has been fairly free from coal-dust at all inspections.

No. 9 MINE.

R. Fowler, Fireboss.

This mine operates the No. 2 seam on the north side of the valley, the principal work consisting of driving two companion inclines with the intention of making connection with No. 1 North mine and repairing the Main return airway, while haulage facilities have been greatly improved by brushing and grading the main haulage-road. It is ventilated by a fan of the Gulbal type, running at a speed of 50 revolutions a minute, producing an average quantity of 7,400 cubic feet of air a minute, under a water-gauge of 1.3 inches. At the last inspection the quantity passing measured as follows:—Main return, 150 by 50: 7,500 cubic feet of air a minute for the use of six men and three horses.

A good supply of timber has generally been provided for the use of the workmen, while the provisions of the "systematic timbering" rules have been well carried out at the working-faces.

The mine has been fairly free from coal-dust, second-burnt ashes being spread regularly on the main roads, and conditions generally have been good during the year.

No. B NORTH MINE.

W. Commons, Overman; J. Whyte and E. Jones, Firebosses.

This mine is situated east of the tipple and operates the B seam. It is ventilated by an electrically driven 10- by 3-foot Brazil fan, running at a speed of 150 revolutions a minute, producing an average quantity of 41,800 cubic feet of air a minute, under a water-gauge of 1.3 inches.

It is ventilated by two separate splits; the quantities passing in each at the last inspection measured as follows:—No. 2 split, 270 by 70: 18,900 cubic feet of air a minute for the use of thirty men and three horses; Burrell gas-detector, 1.3 per cent. methane. No. 1 split, 350 by 65: 22,750 cubic feet of air a minute for the use of thirty-five men and four horses; Burrell gas-detector, 0.5 per cent. methane. Main return, 880 by 50: 44,000 cubic feet of air a minute for the use of sixty-five men and seven horses; Burrell gas-detector, 0.9 per cent. methane.

Explosive gas has been found four times in the course of inspections, while the methane content in the return air, as determined by the Burrell gas-detector, has varied from 0.5 per cent. in No. 1 split to 2.1 per cent. in No. 2 split.

Conditions generally have been fairly good during the year, roadways and timbering kept in good shape, while a good supply of timber has been provided for the use of the workmen, and the requirements of the "systematic timbering" rules fairly well attended to at the working-faces.

The mine has been kept fairly free from coal-dust, spraying systems being maintained on all roads where required, while second-burnt ashes are spread periodically on all main roads.

The following are the official returns from the Coal Creek Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	80,680	.....	.....	.....
" export to United States	191,566	.....	.....	.....
" " other countries .....	.....	.....	.....	.....
Total sales.....	.....	272,246	.....	.....
Lost in washing .....	.....	.....	.....	.....
Used in making coke .....	.....	.....	.....	.....
Used under colliery boilers, etc	26,389	.....	.....	.....
Total for colliery use.....	.....	26,389	.....	.....
Stocks on hand first of year	7,076	.....	.....	.....
" last of year	112	.....	.....	.....
Difference taken from stock during year .....	.....	6,964	.....	.....
Output of colliery for year .....	.....	291,671	.....	.....

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

(Fernie Ovens idle since April 4th, 1919.)

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.....	28	.....	8	.....	36	.....
Whites—Miners	327	.....	.....	.....	327	.....
Miners' helpers .....	.....	.....	.....	.....	.....	.....
Labourers	79	.....	54	.....	133	.....
Mechanics and skilled labour.....	196	.....	101	.....	297	.....
Boys.....	11	.....	8	.....	19	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians .....	.....	.....	.....	.....	.....	.....
Totals	641	.....	171	.....	812	.....

The following shows the number of days Coal Creek Colliery worked each month during the year 1922:—

January	20	August	6
February	20	September	22
March	26	October	16
April	..	November	21
May	..	December	19
June .....	..	.....	.....
July	..	Total	150

Miners on strike from April 1st to August 24th, inclusive.

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.

Robert Bonar, Manager; Archibald Howden, Assistant Manager.

This colliery is situated on both sides of Michel creek, 24 miles north of Fernie, and has rail connection with both the Canadian Pacific and Great Northern Railways. Practically the whole of the coal produced during the year has come from No. 8 and No. 3 mines, the principal work in No. 3 East mine consisting of developing a new seam in No. 16 East level off the Main slope and general repairs to roadways.

The general method of work is pillar and stall, rooms being turned off from the main entries every 60 feet, crosscuts broken off each room at the same distance, leaving pillars measuring 60 by 60 feet. All the coal produced during the year has come from the solid, no pillars being extracted in any of the mines.

The lamp in general use is the Edison electric type cap safety-lamp, Wolf safety-lamps being used by the officials and bratticemen for testing purposes; while Burrell gas-detectors are provided for the purpose of detecting lower percentages of methane than could ordinarily be detected with the Wolf lamp.

No additions have been made to the boiler plant, surface equipment, etc., a description of which, as well as the general system of haulage around the mines, has appeared in previous Reports of the Minister of Mines.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at the colliery.

Following is a brief description of the various mines and the conditions prevailing therein:—

No. 3 MINE.

M. Littler, Overman; A. Davis, A. Frew, T. Owen, and T. James, Firebosses;

W. Picton, O. Winstanley, and J. Strachan, Shotfirers.

This mine operates the upper No. 3 seam and is reached by a crosscut tunnel from the surface, which intersects Nos. 5, 4, 3, and upper No. 3 seams, only the latter seam being mined.

The ventilation is divided into two separate splits and is produced by a 12- by 6-foot Sullivan fan, running at a speed of 140 revolutions a minute, producing an average quantity of 104,870 cubic feet of air a minute, under a water-gauge of 2.4 inches.

At the last inspection the quantity passing in each split measured as follows:—East side, 200 by 160: 32,000 cubic feet of air a minute for the use of fifty-six men and five horses; Burrell gas-detector, 0.5 per cent. methane. West side, 300 by 45; 13,500 cubic feet of air a minute for the use of fifty-four men and six horses; Burrell gas-detector, 0.6 per cent. methane. Main return, 1,000 by 100: 100,000 cubic feet of air a minute for the use of 110 men and eleven horses; Burrell gas-detector, 0.6 per cent. methane.

Explosive gas in small quantities has been found on two occasions during the year in the course of inspection, while the methane content in the return air, as determined by the Burrell gas-detector, has varied from 0.4 per cent. in the West side to 0.7 per cent. in the East side.

Conditions generally have been good, roadways and timbering maintained in good shape, while a good supply of timber has been generally provided for the use of the workmen, and the requirements of the "systematic timbering" rules fairly well attended to at the working-faces.

The mine has been kept fairly free from coal-dust by the use of spraying systems, while all main roads are treated with a combination of second-burnt ashes and water.

No. 3 EAST MINE.

M. McLean, Overman; A. Ball, Fireboss.

The principal work done in this mine during the year consisted of developing a new seam of coal in the No. 16 East Level district off the Main slope. The upper No. 3 seam in this mine has not been operated during the year, with the exception of repairs to airways, etc.

Explosive gas has been found once in the course of inspection, on this occasion in the high-side corner of No. 16 East, and resulted from a check-curtain being damaged, while the methane content in the return air, as determined by the Burrell gas-detector, has varied from 0.6 per cent. in the West side to 2.1 per cent. in the same district.

The mine is ventilated by a 16- by 8-foot Wilson fan, running at a speed of 90 revolutions a minute, producing an average quantity of 97,600 cubic feet of air a minute, under a water-gauge of 2 inches.

At the last inspection the quantities passing in the various splits measured as follows:—No. 6 East split, 450 by 76: 34,200 cubic feet of air a minute. West side, 580 by 50: 29,000 cubic feet of air a minute for the use of two men and one horse; Burrell gas-detector, 1.2 per cent. methane. East of Slope split, 320 by 40: 12,800 cubic feet of air a minute for the use of two men. Main return, 1,300 by 63: 81,900 cubic feet of air a minute for the use of five men and one horse.

Roadways and timbering have been kept in good shape, while a considerable amount of repair-work has been done in the West side return airway.

NO. 8 MINE.

A. Howden, Overman; E. Ainsworth, A. Almond, R. Taylor, and R. McFegan, Firebosses; Geo. Davey and J. Wallbank, Shotfirers.

This mine is situated on the north side of the valley and operates the upper portion of the No. 8 seam. It is ventilated by a compressed-air-driven 8- by 4-foot Murphy fan, running at a speed of 200 revolutions a minute, producing an average quantity of 43,800 cubic feet of air a minute, under a water-gauge of 0.8 inch.

At the last inspection the ventilation was fairly good, the quantities passing in the various splits measuring as follows:—No. 1 split, 180 by 40: 7,200 cubic feet of air a minute for the use of thirty men and four horses; Burrell gas-detector, 0.15 per cent. methane. No. 2 split, 50 by 70: 3,500 cubic feet of air a minute for the use of thirty-five men and five horses; no reading on the Burrell gas-detector. West side, 350 by 40: 14,000 cubic feet of air a minute for the use of sixty-five men and nine horses; no reading on the Burrell gas-detector. Main return, 660 by 70: 46,200 cubic feet of air a minute for the use of 130 men and nineteen horses; no reading on the Burrell gas-detector.

Explosive gas has been found once during the year in the course of inspection, while the methane content, as determined by the Burrell gas-detector, has varied from 0.1 per cent. in the No. 6 Incline district to 0.2 per cent. in the Main return.

A good supply of timber has generally been provided for the use of the workmen, while the requirements of the "systematic timbering" rules have been fairly well attended to at the working-faces.

The mine is kept fairly free from coal-dust by the use of spraying systems, which are fairly well maintained on all roads and working-faces where required.

The following are the official returns of the Michel Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons of 2,240 lb.)	COAL.		COKE.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada.....	44,000	.....	25,742	.....
" export to United States.....	102,453	.....	15,524	.....
" " other countries.....	.....	.....	.....	.....
Total sales.....	.....	146,453	.....	41,266
Used in making coke.....	61,497	.....	.....	.....
Used under colliery boilers, etc.....	12,171	.....	.....	.....
Total for colliery use.....	.....	73,668	.....	.....
Stocks on hand first of year.....	3,453	220,121	44	.....
" last of year.....	.....	.....	178	.....
Difference { *added to { †taken from } stock during year....	.....	*3,453	.....	134
Output of colliery for year.....	.....	216,668	.....	41,400

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.
(Including Coke-ovens and Bush Camps.)

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	.....	10	.....	26	.....
Whites—Miners.....	205	.....	.....	.....	205	.....
Miners' helpers.....	.....	.....	.....	.....	.....	.....
Labourers.....	41	.....	132	.....	173	.....
Mechanics and skilled labour.....	96	.....	111	.....	207	.....
Boys.....	2	.....	.....	.....	2	.....
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	360	.....	253	.....	613	.....

The following shows the number of days Michel Colliery worked each month during the year 1922:—

January.....	18	August.....	6
February.....	23	September.....	24
March.....	27	October.....	16
April.....	..	November.....	21
May.....	..	December.....	23
June.....	..		—
July.....	..	Total.....	158

Miners on strike from April 1st to August 24th, inclusive.

Name of seams or pits—Old No. 3 (lower section of No. 3 seam); New No. 8 (Old No. 8 mine continued).

Corbin Coal and Coke Co., Ltd.

Head Office—Spokane, Wash.

Capital, \$7,000,000.

Officers.

Rush Taggart, President,
J. K. O. Sherwood, Vice-President,
Wm. Weaver Heaton, Secretary-Treasurer,
R. S. Ord, General Manager,
E. L. Warburton, Mine Manager,

Address.

New York, N.Y.
New York, N.Y.
New York, N.Y.
Spokane, Wash.
Corbin, B.C.

CORBIN COLLIERY.

E. L. Warburton, Manager.

This colliery is situated 14 miles from McGillivray Junction on the Crowsnest branch of the Canadian Pacific Railway, is reached by means of a branch line called the Eastern British Columbia Railway, and consists of the following mines: Nos. 4, 5, and 6; the whole of the present year's output coming from Nos. 4 and 6 mines.

No additions have been made during the year to the boiler plant or surface equipment, a description of which appeared in the 1921 Report. The lamps in general use at this colliery are the Edison electric type cap safety-lamp and the Wolf safety-lamp, the latter being used by the officials for testing purposes, while a Burrell gas-detector is provided for the purpose of detecting lower percentages of methane than can ordinarily be detected with the Wolf lamp.

Copies of the "Coal-mines Regulation Act" and special rules are posted up at all the mines. Following is a brief description of the mines and the conditions prevailing therein during the year:—

Nos. 4, 5, AND 6 MINES.

W. Almond, Overman; H. Osborne, Shiftboss; J. Virgo, G. Elmes, H. Ferryman, and E. Hardie, Firebosses.

No. 4 mine operates the No. 4 seam, the bulk of the coal being produced from the 400 and 500 levels, where the pillars are extracted by the caving system on the retreat. No new development-work has been done during the year, but the main haulage-roads in the above districts have been enlarged and repaired. No further trouble has been experienced with fires and a careful watch is always maintained on the sealed-off area in the 400 level.

At the last inspection the ventilation was good and measured as follows: Main intake, 520 by 35: 18,200 cubic feet of air a minute for the use of thirty men and two horses.

No explosive gas has been found by us in the course of inspection, and conditions generally have been very good throughout the year. A good supply of timber has been provided for the use of the workmen and the requirements of the "systematic timbering" rules well attended to at the working-faces.

No. 5 MINE.

This mine has not produced any coal during the year; the principal work done consisted of repairs to the main and counter levels.

No. 6 MINE.

A considerable amount of development-work has been done in this mine during the year; three separate districts have been opened up and are in a position to produce coal. Only the lower seam is being operated at present; this is about 400 feet thick between walls and is being blocked out on the double-stall method, pillars between levels measuring 70 by 120 feet.

It is ventilated by a small Sirocco fan, and at the last inspection the ventilation was good; the quantity passing measured as follows:—Lower district, 200 by 45: 11,700 cubic feet of air a minute for the use of eleven men.

No gas has yet been found in this mine, and roadways, timbering, and conditions in general have been very good. Being naturally damp, it has been found free from coal-dust at all times.

The following are the official returns from the Corbin Colliery for the year ending December 31st, 1922:—

SALES AND OUTPUT FOR YEAR. (Tons 2,240 lb.)	COAL.		Coke.	
	Tons.	Tons.	Tons.	Tons.
Sold for consumption in Canada	14,055			
" export to United States	39,432			
" " other countries				
Total sales		53,487		
Used in making coke				
Used under colliery boilers, etc.	3,220			
Total for colliery use		3,220		
Stocks on hand first of year	10,685	56,707		
" last of year				
Difference taken from stock during year		10,685		
Output of colliery for year		46,022		

NUMBER OF HANDS EMPLOYED, DAILY WAGES PAID, ETC.

CHARACTER OF LABOUR.	UNDERGROUND.		ABOVE GROUND.		TOTALS.	
	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.	No. employed.	Average Daily Wage.
		\$		\$		\$
Supervision and clerical assistance	7	8.32	9	6.08	16	7.20
Whites—Miners.....	35	7.84	.....	.....	35	7.84
Miners' helpers.....	20	6.89	.....	.....	20	6.89
Labourers.....	.....	.....	31	6.80	31	6.80
Mechanics and skilled labour.....	.....	.....	10	7.70	10	7.70
Boys.....	.....	.....	1	4.40	1	4.40
Japanese.....	.....	.....	.....	.....	.....	.....
Chinese.....	.....	.....	.....	.....	.....	.....
Indians.....	.....	.....	.....	.....	.....	.....
Totals.....	62	.....	51	.....	113	.....

Name of seams or pits—No. 3 mine, open-work; Nos. 4, 5, and 6 mines, underground.

Description of seams, tunnels, levels, shafts, etc., and number of same—Owing to five months'

miners' strike and poor business conditions No. 3 mine not in operation during 1922, also No. 5 mine; 300-foot level of No. 4 mine and A tunnel of same not in operation. Above as per last report. Bulk of year's output recovered from caving and retreating on 400- and 500-foot levels of No. 4 mine.

Description and length of tramway, plant, etc.—As per last report. At No. 6 mine the upper levels, elevations 5,390 and 5,456 feet, have been discontinued and work confined to section No. 5315, which has been advanced to the south; the coal at this point is of a much better grade, being hard and of good uniform structure. Plant as per last report, except 200-ton-capacity bunker built at foot of incline, connected to apron-conveyor, so that all coal, both No. 4 and No. 6, can be passed over Marcus screen.

DETAILED STATEMENT OF ACCIDENTS IN B.C. COLLIERIES DURING 1922.

COAST COLLIERIES.

REPORTED BY HENRY DEVLIN, JOHN NEWTON, AND JAMES DICKSON, INSPECTORS.

No.	Colliery.	Date.	Name.	Occupation.	Details.
1	Wakesiah (W.F.C.)	Jan. 35	Hugh Webber	Winch-boy	Slight fracture of right forearm, caused by tripping over tail-chain of horse hooked on to trip and horse started up, and he fell under moving cars.
2	Wellington-Extension (G.C.)	Feb. 9	Edward Carroll	Miner	Simple fracture of right leg; piece of rock fell when putting up set of timbers.
3	Granby No. 1 (G.C.M.S. & P.C.)	" 14	John Maki	"	Squeezed between post and car, causing fracture of pelvis.
4	Wakesiah (W.F.C.)	" 18	William Thornton	"	Sustained three fractured ribs by a fall of top coal.
5	Granby No. 1 (G.C.M.S. & P.C.)	" 19	D. Delucia	Tracklayer	Riding on motor-trip when he fell off and under trip, causing dislocation of five ribs.
6	Reserve (W.F.C.)	Mar. 24	Geo. S. Brown	Miner	Was timbering his place, when he fell off plank, and fractured several ribs on left side.
7	No. 5, South Wellington (G.C.)	" 31	William Rickerby	"	Was in act of unramming a miss-fired shot (breach of C.M.R.A.) when the charge exploded, causing severe injuries to eyes and face, losing eyesight later.
8	No. 1 (G.C.)	April 26	Robert Simpson	"	Compound fracture of left leg, caused by fall of clod from roof.
9	No. 5 (G.C.)	May 10	Innocent Columbo	Driver	Crushed foot, caused by runaway trip.
10	Wakesiah (W.F.C.)	June 27	Dan Buchanan	"	Three ribs broken by being jammed between cars and coys.
11	Wakesiah (W.F.C.)	" 27	Frank Cope	Miner	Fractured tibia of right leg by getting his leg caught in tail-chain of horse.
12	Granby No. 1 (G.C.M.S. & P.C.)	" 30	Murdock McLeod	"	Suffocated by an outburst of gas and coal in No. 3 room, No. 1 slope, No. 6 North level. Fatal.
13	Granby No. 1 (G.C.M.S. & P.C.)	July 6	Richard Barichillo	"	Suffocated by outburst of gas and coal in No. 4 room, No. 6 North level. Fatal.
14	Reserve (W.F.C.)	Aug. 9	John Patterson	"	Fractured fingers of right hand when moving heavy timber.
15	No. 2 Extension (G.C.)	" 14	Joseph Reupute	"	Simple fracture of right leg, caused by fall of cap-rock.
16	Lantzville (N.W.C.)	" 17	Julian Fonn	"	Three toes cut off right foot by fall of cap-rock.
17	Reserve (W.F.C.)	" 18	Joseph Rallison	"	Sustained contusion between shoulder and left side; abrasions; concussion of spinal cord.
18	Harewood (W.F.C.)	Sept. 1	Edward Bridge	Fireboss	Punctured wounds on face, hands, neck, and arms, conjunction of right eye, caused when detonator exploded in his hands.
19	Reserve (W.F.C.)	" 8	Matthew T. Matthews	Miner	Fracture of base of skull, caused by fall of top coal. Fatal.
20	Reserve (W.F.C.)	" 14	Walter Budda	Driver	Running in front of loaded trip, when he fell in front of first car, fracturing right forearm.
21	Granby No. 1 (G.C.M.S. & P.C.)	" 18	Robert W. Morgan	Miner	Fatally injured by fall of top coal, No. 2 pillar, No. 5 South level.
22	Reserve (W.F.C.)	" 20	Mike Crall	"	Fall of coal caused slight fracture of skull, bruised shoulders and arms.
23	Lantzville (N.W.C.)	Oct. 11	William Dawes	Slopeman	Compound fracture of both legs above ankle, caused by being run over by full trip on slope.
24	Harewood (W.F.C.)	" 11	Robt. Morman	Miner	Fractured right leg; fall of rock in working-place.
25	Granby No. 1 (G.C.M.S. & P.C.)	" 23	John Bradley	Rope-rider	Broken neck, back, pelvis, and left arm when run over by full trip. Fatal.
26	Granby No. 1 (G.C.M.S. & P.C.)	Nov. 8	William Hannay	Miner	Sustained fracture of right side of skull, caused by falling to ground when fall of coal broke scaffold.
27	Granby No. 1 (G.C.M.S. & P.C.)	" 13	Samuel Young	"	Severe injuries to back by fall of clod in working-face.
28	Lantzville (N.W.C.)	" 17	Joseph Emerson	"	Severely crushed foot by fall of cap-rock in working-face.
29	Wakesiah (W.F.C.)	" 24	Alfred Odgers	Fireboss	Killed by explosion of gas.
30	Wakesiah (W.F.C.)	" 24	Gilbert McBroom	Pumpman	Killed by explosion of gas. (Same accident as above.)
31	Granby No. 1 (G.C.M.S. & P.C.)	" 25	Hector Guilette	Miner	Asphyxiated by gas; passed through fenced-off working-place, temporarily abandoned. (Breach of C.M.R.A.)
32	Reserve (W.F.C.)	Dec. 1	Harry Cooper	"	Fractured ribs by fall of coal in working-face.
33	Western Fuel Corporation - No. 1 and Protection Shafts	Jan. 24	James Selbie	Machineman's helper	Right tibia fractured by rock and coal falling from roof.
34	Ditto	" 31	Alex. Dunsmore	Miner	Fatally injured; fractured ribs, compound fracture left leg, caused by fall of coal from roof.
35	"	Mar. 21	Patrick Corcoran	Driver	Right fibula fractured by car going over foot.
36	"	" 23	Henry Patterson	"	Fractured rib, bruised head and chest, caused by falling back into empty car, when head struck roof-timber.
37	"	Mar. 24	George McArthur	Stableman	Fractured left foot, caused by mule treading on foot.
38	"	" 29	Gilbert Sykes	Driver	Fractured ribs and bruised right shoulder, caused by car squeezing him.
39	"	July 23	Andrew Flockhart	"	Compound fracture of left tibia, caused by car and horse tail-chain.

COAST COLLIERIES—Continued.

No.	Colliery.	Date.	Name.	Occupation.	Details.
	No. 1 and Protection Shafts—Con.				
40	Ditto.	Aug. 4	George Odgers.	Timberman	Fractured left ankle, caused by fall of rock from roof.
41	"	" 7	Archie Wotherspoon.	Miner	Fractured right ribs, caused by falling against car while putting coal in.
42	"	" 28	John Murray.	Stableman	Fractured collar-bone, right; mule fell on him.
43	"	Sept. 23	Jas. Clarkson.	Miner	Middle finger on left hand amputated; fall of rock from roof.
44	"	Oct. 2	James Phillip.	"	Left rib fractured by coal falling from roof.
45	"	Nov. 1	Thomas Logie.	"	Fractured right clavicle; fall of coal from roof.
46	"	" 9	Geo. E. Jardine.	Fireboss	Finger fractured by trap-door falling on it.
	Canadian Collieries (D.), Ltd.—				
47	Comox, Nos. 4, 5, and 6 mines	Feb. 17	Gee Bow.	Pusher.	Compound fracture of left ulna and radius; fell in front of moving loaded cars.
48	Ditto.	Mar. 14	S. Kigemi.	Miner's helper	Fractured left leg, caused by fall of rock from roof.
49	"	May 25	M. Tsuraka.	Miner	Fractured left tibia; fall of rock from roof.
50	"	" 30	Charles Reid.	Rope-rider.	Crushed hand; car-wheels passing over hand.
51	"	June 7	Yee Sing.	Miner	Right leg broken by empty car.
52	"	July 24	Wong Hong.	Driver	Fractured collar-bone and left ribs; knocked off loaded car.
53	"	Aug. 2	Jung Pah.	Miner's helper	Right tibia fractured by car striking him on leg.
54	"	" 18	William Begley.	Cager	Fractured left femur, caused by cage descending on him.
55	"	Sept. 27	M. Saito.	Miner	Both legs injured; fall of rock from roof.
56	"	Oct. 1	Billy Evans.	Bratticeman	Fractured finger, caused by falling.
57	"	Dec. 29	Jung Gee.	Miner's helper	Fractured right tibia and right fibula; fall of rock from roof.
58	Explosion at No. 4 mine, Comox	Aug. 30	R. K. Dunsire.	Miner's helper	
59	Ditto.	" 30	John Gibson.		
60	"	" 30	John Johnston.		
61	"	" 30	H. Kajiyama.		
62	"	" 30	C. Sayano.		
63	"	" 30	S. Shigimi.		Killed.
64	"	" 30	Leung Hor.		
65	"	" 30	Wee Noon.		
66	"	" 30	Leung Man.		
67	"	" 30	Looy Chun.		
68	"	" 30	Mah Wing.		
69	"	" 30	Wong Yim.		
70	"	" 30	R. Yoshido.		
71	"	" 30	G. Suyamo.		
72	"	" 30	M. Watanaba.		
73	"	" 30	Chin Nan.		
74	"	" 30	Yee Toy.		
75	"	" 30	Loo Foon.		
76	"	" 30	E. McAdams.		
77	"	" 30	J. Irving.		
78	"	" 30	J. Taylor.		
79	"	" 30	J. R. Gray.		
80	"	" 30	T. Tokuyama.		
81	"	" 30	Y. Nomato.		
82	"	" 30	Leung Shen.		
83	"	" 30	Wong Chee.		
84	"	" 30	A. Kelly.		
85	"	" 30	S. Masu.		
86	"	" 30	K. Mourakami.		
87	"	" 30	M. Tanaka.		
88	"	" 30	Wong Sue.		
	Middleboro Col.—				
89	No. 4 mine, Sec. 8.	Feb. 6	Ferdinand Muzzin.	Miner	Suffocated by fall of shale and overhead stringer; accidentally displaced supporting timber, thereby causing fall of overhead shale, etc.
90	No. 7 mine	July 5	David Minto.	Rope-rider.	Fractured rib and other internal injuries; caught between car and roof of slope.
91	"	" 10	Thomas McKeating.	Miner	Fractured leg, caused by being trapped between cars.
92	No. 5 mine	Sept. 13	Lewis Shearer.	Fireboss.	Killed by fall of roof in No. 1 East level, off main slope.
93	"	" 13	Samuel Crawford.	Miner	Killed by fall of roof; at same time as above fatality.
94	Coalmont Collieries, Ltd.	April 3	John Povik.	"	While timbering, fell from scaffold and dislocated hip.
95	Michel (C.N.P.C.C.)	Feb. 2	M. Borsalo.	"	Leg fractured by loose timber falling against it.
96	Michel (C.N.P.C.C.)	" 14	J. Josage.	"	Leg fractured by fall of coal at face.
97	Coal Creek (C.N.P.C.C.)	Mar. 4	Alban Allan.	Driver	Leg fractured and other bruises; fell off trip in motion.
98	Michel (C.N.P.C.C.)	" 16	Wm. Talbot.	Miner	Fractured collar bone, while lifting car on track.
99	Coal Creek (C.N.P.C.C.)	Sept. 6	Dan Bohi.	"	Buried by cave of coal at face. Fatal.
100	Michel (C.N.P.C.C.)	" 11	F. Variola.	"	Fractured vertebrae, due to timber falling on him, while setting it in place.
101	Michel (C.N.P.C.C.)	Oct. 30	M. Joss.	"	Leg fractured by falling off scaffold, while setting timber.
102	Coal Creek (C.N.P.C.C.)	Nov. 2	J. Rauter.	"	Three ribs fractured, by coal falling at working-face.
103	Coal Creek (C.N.P.C.C.)	" 29	M. Kearney.	Rope-rider.	Fractured pelvis due to belt catching on projection, preventing him jumping on trip, and squeezing him between car and door.
104	Coal Creek (C.N.P.C.C.)	Dec. 13	G. Dunwoodie.	Ashman	Caught between car and door to boiler-room, fracturing right arm.

PROSECUTIONS UNDER "COAL-MINES REGULATION ACT."

Date.	Name.	Mine.	Occupation.	Offence charged.	Judgment.
Feb. 1...	Joseph Parisee....	No. 1, Cassidy....	Miner.....	Having matches, contrary to General Rule 9, C.M.R. Act	Fined \$10 and costs.
" 1...	Angelo Clisido....	" ".....	".....	Violation of General Rule 9, C.M.R. Act	" "
" 7....	Alfred Lister.....	" ".....	".....	Riding on loaded trip; breach of Special Rule 95	" "
" 9....	Joseph Bartignon....	" ".....	".....	Riding on loaded trip; breach of Special Rule 95	" "
Oct. 27....	Robert Casely....	No. 4, Comox....	Tracklayer....	Having matches and tobacco, contrary to Rule 9	1 mo.'s imprisonment with hard labour.
Nov. 10....	A. J. Albertson....	No. 1, Cassidy....	Miner.....	Having matches, contrary to General Rule 9	Fined \$10 and costs.
" 10....	John Mills.....	" ".....	".....	Violation of General Rule 9, C.M.R. Act	" "
" 10....	John Mackey.....	" ".....	".....	Having matches, contrary to General Rule 9	" "
" 10....	Andrew Landus- [key].....	" ".....	".....	Having matches, contrary to General Rule 9	" "
" 10....	Arthur W. Hughes....	" ".....	Bratticeman....	Violation of General Rule 9.....	" "
" 10....	James Stewart....	" ".....	Trackman.....	Violation of General Rule 9.....	" "
" 21....	Chow Sing.....	No. 4, Comox....	Helper.....	Having matches and cigarettes; violation of Rule 9	3 mos.' imprisonment with hard labour.
	Wung Wye.....	No. 5, ".....	".....	Storing powder in mine; violation of Rule 11, sec. (a)	Fined \$10 and costs.
	Jong Say.....	" ".....	".....	Storing powder in mine; violation of Rule 11, sec. (a)	" "
Dec. 7....	George Stafford....	No. 1, Cassidy....	Miner.....	Violation of Special Rule 95.....	" "
" 7....	Lewis S. Jones....	" ".....	Switchman.....	Riding on loaded trip, contrary to Special Rule 95	" "
" 7....	John Carson....	Wakesiah, Nanai- [mo].....	Miner.....	Violation of General Rule 9, C.M.R. Act	Fined \$1 and costs.
Jan. 8....	Jacob Kappell....	Coal Creek.....	".....	Having matches in possession, contrary to Rule 9	Fined \$10 and costs.
" 8....	Chas. Ferrari.....	".....	".....	Same offence as above.....	" "
Oct. 5....	D. Ferraraalli.....	".....	".....	Same offence as above.....	" "
Feb. 25....	C. Fonti.....	Michel.....	".....	Failing to set sprags, contrary to Special Rule 115	" "
" 25....	Geo. Canitanio....	".....	".....	Failing to set sprags, contrary to Special Rule 115	" "

METALLIFEROUS MINES SHIPPING IN 1922.

NORTH-WESTERN DISTRICT (No. 1).

ATLIN MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Maid of Erin.....	Rainy Hollow.....	R. W. Wiley.....	Seattle.....	Gold, silver, copper.
Cherokee.....	Atlin.....	J. M. Ruffner.....	Atlin.....	Silver, lead.
Barber.....	Atlin.....	J. M. Ruffner.....	Atlin.....	Silver, lead.

SKEENA MINING DIVISION.

Belmont-Surf Inlet..	Surf inlet	Belmont-Surf Inlet Mines, Ltd...	Surf Inlet	Gold, silver, copper.
Paterson	Porcher island.....	F. Paterson.....	Welcome Harbour ..	Gold, silver.

QUEEN CHARLOTTE MINING DIVISION.

Early Bird.....	Gold harbour.....	J. G. McLellan.....	Queen Charlotte....	Gold.

NASS RIVER MINING DIVISION.

Esperanza.....	Kitsault river.....	R. Armour	Anyox.....	Gold, silver, copper, lead.
Golskeish	Anyox	H. W. Heidman	Anyox..	Gold, silver.
Granby (Hidden Ck.)	Anyox	Granby Cons. M. S. & P. Co.....	Anyox.....	Gold, silver, copper.

PORTLAND CANAL MINING DIVISION.

Silverado.....	Stewart	J. W. Stewart.....	Stewart	Silver, copper.
Premier	Premier	Premier Gold Mines, Ltd.....	Premier	Gold, silver.
Sunshine.....	Glacier creek.....	Fred Young	Stewart	Silver.

NORTH-EASTERN DISTRICT (No. 2).

OMINECA MINING DIVISION.

Silver Standard.....	Hazelton.....	D. McLeod.	Vancouver.....	Gold, silver, lead, zinc.
Cordillera	Kitsalas mountain	Kitsalas Mt. M. Co.....	Usk	Gold, silver, copper.

CENTRAL DISTRICT (No. 3).

YALE, ASHCROFT, KAMLOOPS MINING DIVISIONS.

Windpass.....	Chu Chua	Ole Johnson	Chu Chua	Gold, silver, copper.
Emancipation.....	Vernon.....	Liberator Mining Co.....	Vancouver.....	Gold, silver.

NICOLA, AND VERNON MINING DIVISIONS.

White Elephant	Ewing's Landing.....	A. P. Clark.....	Okanagan Centre ...	Gold, silver.

LILLOOET AND CLINTON MINING DIVISIONS.

Pioneer.....	Cadwallader creek	C. L. Copp.....	Lorne Mine.....	Gold.

SOUTH-WESTERN DISTRICT (No. 4).

GREENWOOD MINING DIVISION.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Bell.....	Beaverdell.....	J. N. Paton.....	Beaverdell.....	Gold, silver, lead.
Etheopaa.....	Greenwood.....	J. H. Duhamel.....	Greenwood.....	Gold, silver.
Highland Lass.....	Beaverdell.....	John McKeellar.....	Beaverdell.....	Gold, silver, lead.
Revenge.....	Beaverdell.....	G. M. Barrett.....	Beaverdell.....	Gold, silver, lead.
Sally.....	Beaverdell.....	H. B. Morley.....	Penticton.....	Gold, silver, lead.
Rob Roy.....	Beaverdell.....	James Sutherland.....	Beaverdell.....	Silver, lead.
Standard Fraction.....	Wallace mountain.....	W. Rambo.....	Beaverdell.....	Silver, lead.
Twin.....	Greenwood.....	James Drum.....	Greenwood.....	Silver, lead.
Castor Fr.....	Beaverdell.....	J. Sutherland.....	Beaverdell.....	Silver, lead.

GRAND FORKS MINING DIVISION.

First Chance.....	Lightning peak.....	Wm. Williams.....	Edgewood.....	Silver, lead.
Rock Candy.....	Grand Forks.....	Consolidated M. & S. Co.....	Trail.....	Fluorspar.

OSOYOOS AND SIMILKAMEEN MINING DIVISIONS.

Nickel Plate.....	Hedley.....	S. L. Smith.....	Hedley.....	Gold, arsenic.
Horn Silver.....	Similkameen.....	E. W. Condit.....	Similkameen.....	Gold, silver.

SOUTHEASTERN DISTRICT (No. 5).

FORT STEELE MINING DIVISION.

Sullivan.....	Kimberley.....	Consolidated M. & S. Co.....	Kimberley.....	Silver, lead, zinc.

GOLDEN AND WINDERMERE MINING DIVISIONS.

Paradise.....	Toby creek.....	R. Randolph Bruce.....	Invermere.....	Silver, lead.
Monarch.....	Field.....	J. R. Macphail.....	Vancouver.....	Silver, lead, zinc.

AINSWORTH MINING DIVISION.

Silver Hoard.....	Ainsworth.....	H. Giegerich.....	Kaslo.....	Silver, lead.
Bluebell.....	Riondel.....	S. S. Fowler.....	Riondel.....	Silver, lead.
Caledonia.....	Ainsworth.....	G. E. McCready.....	Zincton.....	Silver, lead.
Florence.....	Ainsworth.....	D. E. Sanders, Sec.....	Spokane.....	Silver, lead.
Tariff.....	Ainsworth.....	E. Peterson.....	Ainsworth.....	Silver, lead.
Highland.....	Ainsworth.....	Consolidated M. & S. Co.....	Trail.....	Silver, lead.
Lincoln.....	Adamant.....	J. H. Thompson.....	New Denver.....	Silver, lead.
Neosho.....	Ainsworth.....	Consolidated M. & S. Co.....	Ainsworth.....	Silver, lead.
No. 1.....	Ainsworth.....	Consolidated M. & S. Co.....	Trail.....	Silver, lead.
Black Bear.....	South fork, Kaslo creek.....	James McDougal.....	Kaslo.....	Silver, lead.
Spokane-Trinket.....	Ainsworth.....	W. H. Burgess.....	Ainsworth.....	Silver, lead.
Whitewater.....	Retallack.....	W. H. Burgess.....	Kaslo.....	Gold, silver, lead, zinc.
Utica.....	Paddy peak.....	O. C. Thompson.....	Kaslo.....	Silver, lead.

SLOCAN MINING DIVISION.

Black Colt.....	Sandon.....	G. A. Petty.....	Sandon.....	Silver, lead.
Silversmith.....	Sandon.....	Silversmith Mines, Limited.....	Sandon.....	Gold, silver, lead.
Bosun.....	New Denver.....	Rosebery-Surprise Mining Co.....	Sandon.....	Silver, lead, zinc.
Surprise.....	Sandon.....	Rosebery-Surprise Mining Co.....	Sandon.....	Silver, lead, zinc.
Monitor.....	Sandon.....	Rosebery-Surprise Mining Co.....	Sandon.....	Silver, lead, zinc.
McAllister.....	Three Forks.....	R. A. Grimes.....	Three Forks.....	Silver.
Majestic and Unex- pected.....	Sandon.....	F. H. Bourne.....	Revelstoke.....	Gold, silver, lead, zinc.
Gem.....	Carpenter creek.....	M. J. Byrne.....	Sandon.....	Silver, lead.
Rambler.....	Three Forks.....	W. A. Cameron.....	New Denver.....	Silver, lead, zinc.
Noble Five.....	Sandon.....	Paul Lincoln.....	Sandon.....	Silver, lead, zinc.
Noonday.....	Sandon.....	J. A. Greer.....	Sandon.....	Silver, lead.
Carnation.....	Sandon.....	W. G. Clark.....	Sandon.....	Silver, lead.
Queen Bess.....	Sandon.....	C. Cunningham.....	Sandon.....	Silver, lead.
Van Roi.....	Silverton.....	C. Cunningham.....	Sandon.....	Silver, lead, zinc.
Wonderful.....	Sandon.....	C. Cunningham.....	Sandon.....	Silver, lead.
Mountain Con.....	Sandon.....	Johnson & McLanders.....	Sandon.....	Silver, lead.
Ruth.....	Sandon.....	J. B. Sunderland.....	Vancouver.....	Silver, lead.
Standard.....	Silverton.....	W. H. North.....	Silverton.....	Lead, zinc.
Mollie Hughes.....	New Denver.....	H. Clever.....	New Denver.....	Gold, silver.

SLOCAN MINING DIVISION—Continued.

Mine or Group.	Locality.	Owner or Agent.	Address.	Character of Ore.
Number One.....	Sandon.....	J. M. Harris.....	Sandon.....	Silver, lead.
Mountain Chief.....	New Denver.....	Frank Edwards.....	New Denver.....	Silver, lead.
Last Chance.....	London ridge.....	R. Cunning.....	Sandon.....	Silver, lead.
Metallic.....	.....	.....	.....	Gold, silver, lead.
Payne.....	Sandon.....	.....	Sandon.....	Silver, lead.
Alamo.....	Alamo.....	C. Cunningham.....	Sandon.....	Silver, lead.
Sovereign.....	Sandon.....	C. Cunningham.....	Sandon.....	Silver, lead.
Ore Bin.....	Sandon.....	.....	Sandon.....	Silver, lead.
Galena Farm.....	Silverton.....	.....	Silverton.....	Silver, lead, zinc.

SLOCAN CITY MINING DIVISION.

Anna.....	Springer creek.....	Kurt Zimmerman.....	Slocan.....	Silver.
Arlington.....	Springer creek.....	H. D. Curtis.....	Slocan.....	Silver, lead.
Hampton.....	Springer creek.....	J. Water.....	Slocan.....	Silver, lead.
L. T.....	Springer creek.....	D. B. O'Neill.....	Slocan.....	Silver, lead.
Lilly B.....	Springer creek.....	G. Long.....	Slocan.....	Gold, silver, lead.
Ottawa.....	Slocan.....	.....	Slocan.....	Silver.
Black Prince.....	Springer creek.....	C. E. Cartwright.....	Vancouver.....	Silver, lead.
Meteor.....	.....	.....	.....	Gold, silver.

NELSON AND ARROW LAKE MINING DIVISIONS.

Molly Gibson.....	Kokanee creek.....	W. A. Cameron.....	New Denver.....	Gold, silver, lead.
Emerald.....	Salmo.....	W. J. Turner.....	Salmo.....	Silver, lead.
Gold Hill.....	49 creek.....	Alex. McDonald.....	Nelson.....	Gold, silver, lead.
Nugget.....	Sheep creek.....	Harold Lakes.....	Sheep Creek.....	Gold.
California.....	Nelson.....	W. R. Orndorff.....	Spokane.....	Gold, silver.
Silver Dollar.....	Salmo.....	.....	Salmo.....	Silver, lead, zinc.
Granite-Poorman.....	Nelson.....	.....	Nelson.....	Gold, silver.
Millie Mack.....	Burton.....	H. E. Forster.....	Wilmer.....	Gold, silver, lead.

TRAIL CREEK, TROUT LAKE, REVELSTOKE, AND LARDEAU MINING DIVISIONS.

I.X.L.....	Rossland.....	R. B. Shelledy.....	Rossland.....	Gold, silver, copper.
Le Roi No. 2.....	Rossland.....	D. Lay.....	Rossland.....	Gold, silver, copper.
Mountain Chief.....	Renata.....	M. McDaniel.....	Renata.....	Gold, silver, copper.
Le Roi, etc.....	Rossland.....	Consolidated M. & S. Co.....	Trail.....	Gold, silver, copper.
Nettie L.....	Trout lake.....	James Anderson.....	Kaslo.....	Gold, silver, lead.
Lanark.....	Illecillewaet.....	Dormberg.....	Illecillewaet.....	Gold, silver, lead.

~~SLOCAN~~ WESTERN DISTRICT (No. 6).

VANCOUVER AND SMALLER ISLANDS; VANCOUVER AND NEW WESTMINSTER DIVISIONS.

Indian Chief.....	Sidney inlet.....	Tidewater Copper Co.....	Sidney inlet.....	Gold, silver, copper.

LIST OF CROWN GRANTED MINERAL CLAIMS.

CROWN GRANTS ISSUED IN 1922.

CASSIAR.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Annex.....	Atlin.....	Maurice Egerton and Otto Honoka Partridge.....	1274	50.09	April 24
Blue Jacket.....	".....	".....	1265	50.76	April 24
Ensign.....	".....	".....	1267	51.65	April 24
Gold Bottom.....	".....	".....	1273	51.62	April 24
Index.....	".....	".....	1266	49.34	April 24
Little Johnny.....	".....	James Allen Fraser, Official Administrator of the estate of William Powell, deceased, intestate.....	223	42.28	Aug. 14
Princess Pat Fraction.....	".....	Horace McNaughton Fraser.....	2095	18.59	Aug. 7
Silver King No. 1.....	".....	Emily M. Dalton.....	1268	50.67	April 24
Silver King No. 2.....	".....	Maurice Egerton and Otto Honoka Partridge.....	1269	45.73	April 24
Silver King No. 3.....	".....	Fanny Kate Partridge.....	1270	51.53	April 24
Silver Tip.....	".....	Maurice Egerton and Otto Honoka Partridge.....	1271	42.85	April 24
Tyee.....	".....	".....	1272	51.43	April 24
Armes.....	Nass River.....	Joshua Debell Meenach, Ralph Dexter Brown, John Holmgren, and Charles Z. Frey.....	4068	45.06	Sept. 7
Athos.....	".....	Joshua Debell Meenach, Ralph Dexter Brown, John Holmgren, and Charles Z. Frey.....	4066	32.39	Sept. 7
Britania.....	".....	Alice Arm-La Rose Mining Co. (N.P.L.).....	4245	51.65	Jan. 24
Britania No. 1.....	".....	".....	4246	51.64	Jan. 24
Britania No. 3.....	".....	".....	4247	33.29	Jan. 24
D'Artagnon.....	".....	Joshua Debell Meenach, Ralph Dexter Brown, John Holmgren, and Charles Z. Frey.....	4071	29.25	Sept. 7
D'Artagnon No. 1.....	".....	Joshua Debell Meenach, Ralph Dexter Brown, John Holmgren, and Charles Z. Frey.....	4069	23.18	Sept. 7
Devil's Club.....	".....	Joseph Newton McPhee.....	4260	28.27	Nov. 16
Porthes.....	".....	Joshua Debell Meenach, Ralph Dexter Brown, John Holmgren, and Charles Z. Frey.....	4067	25.38	Sept. 7
Red Bluff.....	".....	Joseph Newton McPhee.....	4259	51.64	Nov. 16
St. Elol.....	".....	Alice Arm-La Rose Mining Co. (N.P.L.).....	4248	21.22	Jan. 24
Swiftwater.....	".....	George Alexander Young.....	4336	35.88	Sept. 25
La Rose No. 2.....	".....	Alice Arm-La Rose Mining Co. (N.P.L.).....	4249	21.92	Jan. 24
Aeroplane.....	Omineca.....	The Cats Mining Co., Ltd. (N.P.L.).....	3312	2.58	June 26
Camille.....	".....	Kitsalas Mountain Copper Co.....	6723	51.65	June 1
Cordillera.....	".....	".....	6720	48.40	June 1
Cork Fraction.....	".....	The Cats Mining Co., Ltd. (N.P.L.).....	3316	12.08	June 26
Gold Dust.....	".....	Kitsalas Mountain Copper Co.....	6722	51.65	June 1
Golden Sentinel.....	".....	".....	6724	51.65	June 1
Golden Sentinel Fraction.....	".....	".....	6726	2.56	June 1
Monoplane.....	".....	The Cats Mining Co., Ltd. (N.P.L.).....	3313	36.77	June 26
Mascot.....	".....	".....	3314	34.91	June 26
Queen Ann.....	".....	Kitsalas Mountain Copper Co.....	6719	23.67	June 1
Yellow Pearl Fraction.....	".....	".....	6729	0.45	June 1
Yellow Pearl.....	".....	".....	6721	49.51	June 1
Ag Fraction.....	Portland Canal.....	Silver Crest Mines, Limited.....	4171	20.63	Mar. 13
Bella Coola.....	".....	Christian W. Frank and John V. Clegg.....	4086	41.52	Jan. 7
Boundary.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3926	19.20	May 1
Cabin.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3922	41.90	May 1
Daley.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3929	33.49	May 1
Grey Copper.....	".....	William Forrest, G. A. Clarke, J. A. Sayward, A. Gonnason.....	4187	39.22	April 20
Grey Copper No. 1.....	".....	".....	4188	45.11	April 20
Group.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3927	51.65	May 1
Grub.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3924	51.65	May 1
Grub Stake.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3928	28.60	May 1
International Fraction.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3923	27.80	May 1
Kitchener.....	".....	David O'Leary.....	4046	31.90	Feb. 13
Loser.....	".....	John Hovland.....	4056	34.69	Feb. 13
Ladybird No. 2.....	".....	Richard Burrage, executor, etc.....	4040	51.65	Mar. 1
Lake Shore.....	".....	Andrew Lindeborg.....	4176	51.65	Mar. 13
Lucky.....	".....	Amos Bliss Trites, Roland William Wood, and William Ritson Wilson.....	3925	51.65	May 1
Maybee.....	".....	John Wardlaw Stewart.....	3226	51.65	July 3
May P. J.....	".....	Christian W. Frank.....	4088	34.51	Jan. 3
Northern Light No. 1.....	".....	William Bunting.....	4058	33.10	Feb. 13
Northern Light No. 2.....	".....	".....	4049	29.94	Feb. 13
Northern Light No. 3.....	".....	".....	4063	4.44	Feb. 13
Northern Light No. 4.....	".....	Charles Bunting.....	4047	49.18	Feb. 13
Northern Light No. 5.....	".....	".....	4050	44.78	Feb. 13
Northern Light No. 6.....	".....	".....	4052	29.62	Feb. 13
Northern Light Fraction.....	".....	".....	4057	20.98	Feb. 13
Northern Light No. 1 Fraction.....	".....	".....	4048	9.31	Feb. 13

CASSIAR—Continued.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Northern Light No. 5.	Portland Canal.	Charles Henry Lake	4051	34.89	Feb. 13
Northern Light No. 7.	"	"	4055	37.72	Feb. 13
Polybacite Fraction	"	Silver Crest Mines, Limited.	4177	34.11	Feb. 13
Silver Leaf	"	Christian W. Frank and John V. Clegg	4039	51.41	Jan. 10
Texada Fraction	"	B. C. Silver Mines (N.P.L.)	4134	31.22	Mar. 13
Woodbine No. 1 Fraction	"	Charles Henry Lake	4126	1.43	Feb. 13
Woodbine	"	David O'Leary	4045	32.20	Feb. 13
Entente Cordiale	Skeena.	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Gardé	6508	51.65	July 3
Gold Coin	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Gardé	6510	41.07	July 17
Maybell No. 1.	"	Florence Howard	2567	49.62	Feb. 13
Molly	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Gardé	6509	51.44	July 3
Sparrow	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Gardé	6506	40.99	July 3
Violet	"	George Bath, Michael McFadden, Neil McTavish, John Alexander McLeod, Gordon C. Denison, Ford Robertson, Alfred E. Wright, and Alfred C. Gardé	6511	42.25	July 3
Copper Cent	Queen Charlotte	Norman Fraser	2841	42.37	Nov. 16

EAST KOOTENAY.

Agnes	Fort Steele	The Veronica Gold Mining Co.	10226	33.22	Dec. 18
Anna	"	"	10224	38.37	Dec. 18
Eclipse	"	"	10223	45.80	Dec. 18
Evening Star	"	"	10229	33.62	Dec. 18
Oyster	"	"	10228	48.38	Dec. 18
Pioneer	"	"	10227	49.08	Dec. 18
Standard	"	"	10225	41.50	Dec. 18
Silver King	Windermere	Arthur Murray Chisholm and John Edgar Stoddart, Administrators of the estate of Willis Benson Abel, deceased; Edward Berry and James Arthur Arnold, Administrators of the estate of George Geary, deceased	12306	41.15	Jan. 9

WEST KOOTENAY.

Copper Fraction	Ainsworth	William Steart Drewry	4862	20.25	Feb. 3
Copper Queen	"	"	4861	51.65	Feb. 3
Crown	"	Charles Rossiter	1284	51.65	Jan. 10
Kirby	"	Freida Burgess, Edith Lascelles Kirby, Walter Thomas Kirby, Alfred John Curle, and Rupert Victor Davidson Guthrie	13007	51.65	Feb. 17
Kirby No. 3	"	Freida Burgess, Edith Lascelles Kirby, Walter Thomas Kirby, Alfred John Curle, and Rupert Victor Davidson Guthrie	13008	43.97	Feb. 17
Kirby No. 4	"	Freida Burgess, Edith Lascelles Kirby, Walter Thomas Kirby, Alfred John Curle, and Rupert Victor Davidson Guthrie	13011	37.06	Feb. 17
Kirby No. 5	"	Freida Burgess, Edith Lascelles Kirby, Walter Thomas Kirby, Alfred John Curle, and Rupert Victor Davidson Guthrie	13009	32.29	Feb. 17
Kirby Fraction	"	Freida Burgess, Edith Lascelles Kirby, Walter Thomas Kirby, Alfred John Curle, and Rupert Victor Davidson Guthrie	13012	14.29	Feb. 17
Kirby Fraction No. 1	"	Freida Burgess, Edith Lascelles Kirby, Walter Thomas Kirby, Alfred John Curle, and Rupert Victor Davidson Guthrie	13013	31.89	Feb. 17
Kirby No. 2	"	Freida Burgess, Edith Lascelles Kirby, Walter Thomas Kirby, Alfred John Curle, and Rupert Victor Davidson Guthrie	13010	38.61	Feb. 17
Peacock	"	Mary Burnham Drewry	4860	36.45	Feb. 3
True Blue	"	"	4859	48.62	Feb. 3
Boncheer	Nelson	Letitia McIntosh	12686	51.65	Jan. 24
Curlew	"	Reno Gold Mines, Ltd.	12681	33.20	Jan. 26
Dandy	"	"	12682	29.73	Jan. 26
Delware	"	Abraham Lincoln Davenport	5136	39.95	Aug. 3
Echo	"	Harris Ginsberg	13014	42.20	July 3
Echo Fraction	"	"	13015	1.6	July 3
Goodenough Fraction	"	Harry Lee Jackson, Alex. McDonald, and Orlando Alvin Lovell	13025	21.66	Oct. 30
Idaho	"	Harris Ginsberg	13019	35.60	July 3
Jumbo No. 1	"	Daniel McIntosh Mowat	12687	33.71	Jan. 24
Jumbo No. 2	"	John Waldbeser	12688	45.27	Jan. 24
Latham	"	Reno Gold Mines, Ltd.	12683	45.02	Jan. 26
Ontario	"	Harris Ginsberg	13016	35.00	July 3
Portland	"	"	13017	49.40	July 3

WEST KOOTENAY—Continued.

Claim.	Division.	Grantee.	Lot.	Acres.	Date.
Red Rock.....	Nelson.....	Reno Gold Mines, Ltd.....	12680	51.33	Jan. 26
Reno.....	".....	".....	12684	32.33	Jan. 26
St. Elmo.....	".....	Harris Ginsberg.....	13018	50.10	July 3
Snowdrop.....	Trail Creek.....	Andrew Garvey.....	3513	30.40	Jan. 19
Annie E.....	Trout Lake.....	Margaret Frances Elliott as to an undivided 2/3 interest..	7268	51.65	May 1
Bosum.....	".....	".....	7171	51.56	May 1
Fidelity.....	".....	".....	7260	51.39	May 1
Nipissing.....	".....	".....	7270	51.65	May 1
Spokane.....	".....	".....	7272	47.29	May 1
We Two.....	".....	".....	7273	51.65	May 1

BOUNDARY.

London.....	Grand Forks...	James William Hayes.....	2234	46.20	Feb. 2
Great Hesper.....	Greenwood.....	James Lamont Munroe.....	1887s	51.65	March 2
Waterloo No. 3.....	".....	Charles Morgan Kingston and Frances Edward Rendell..	4815	51.65	Jan. 14
Kitchener Fraction.....	Osoyoos.....	Gomer Phillip Jones.....	2903s	23.75	Nov. 30
Mound Fraction.....	".....	".....	2905s	0.07	Nov. 30
Salt Lake Fraction.....	".....	".....	2904s	4.22	Nov. 30
Copper Head.....	Kamloops.....	John R. Hull.....	2564	50.40	March 2
Noonday.....	".....	William Wentworth Wood.....	2563	24.03	March 2
Python.....	".....	Susan A. Wood.....	2565	45.10	March 2
Python No. 2.....	".....	John Beaton.....	2562	51.63	March 2
Fairmount.....	Similkameen.....	John Oswald Coulthard.....	1029	51.45	Nov. 16
Malone Fraction.....	".....	Canada Copper Corporation, Ltd.....	2580s	12.23	Feb. 1
Mime.....	Lillooet.....	Richard Samuel Hanna.....	5084	48.79	Oct. 3
Sunset.....	".....	John Henry Anthony.....	5080	51.65	Dec. 4
The Aspin.....	".....	".....	5081	39.09	Dec. 4
Windfall.....	Clinton.....	Ewin Jay Taylor.....	2643	37.24	Nov. 17
Windfall No. 2.....	".....	".....	2644	51.57	Nov. 17

VANCOUVER ISLAND AND COAST.

Apache.....	Nanaimo.....	Harvey W. Wells.....	59	32.70	April 27
Black Prince.....	".....	Richard F. Hill.....	318 R. 1	42.08	Jan. 5
Bonanza.....	".....	Dugald Carmichael.....	1178	35.69	Aug. 7
Champhness Fraction.....	".....	Andrew Dixon.....	280 R. 1	8.40	Jan. 5
Colossus.....	".....	".....	256 R. 1	46.80	Jan. 5
Olympian.....	".....	John D. Edwards and John N. McLeod.....	461	50.23	Feb. 13
Good Hope Fraction.....	".....	Henry Wolburn.....	329	22.55	June 12
Pendrell.....	".....	Edmund Friedolin Pabst.....	5157	51.10	Sept. 7
Pendrell No. 1.....	".....	".....	5158	51.65	Sept. 7
Pendrell Fraction.....	".....	".....	5156	21.13	Sept. 7
Protection.....	".....	Henry Wolburn.....	328	25.69	June 12
Dry Hill.....	Quatsino.....	Laura Gray, Ole Anderson Sherberg, and Mary Smith Gibbens.....	1543	41.02	Jan. 3
Independent No. 3.....	".....	Walter Cecil Keeling and Laura Gray.....	1557	29.33	Jan. 3
Independent No. 4.....	".....	William James Vaughan and Laura Gray.....	1559	28.57	Jan. 3
Rambler Fraction.....	".....	Laura Gray, Walter Cecil Keeling, and William James Vaughan.....	1537	3.43	Jan. 3
Alex. Crawford.....	New Westminster	Catherine Edith Mary Dickson and William Molson Alexander.....	774	49.92	Oct. 30
Cecil Dunlap.....	".....	Catherine Edith Mary Dickson and William Molson Alexander.....	773	51.20	Nov. 16
Ensign.....	".....	John Ensing.....	1082	46.80	April 20
Herstad.....	".....	Frederick John Herstad.....	2172	48.51	March 6
James McKenzie.....	".....	Catherine Edith Mary Dickson and William Molson Alexander.....	771	51.65	Oct. 30
John Loughheed.....	".....	Catherine Edith Mary Dickson and William Molson Alexander.....	772	49.20	Oct. 30
Last Chance.....	".....	Joseph Rowan Grant.....	574	51.65	May 8
Wm. Alexander.....	".....	Catherine Edith Mary Dickson and William Molson Alexander.....	775	38.58	Oct. 30

DEPARTMENT OF MINES.

VICTORIA, B.C.

HON. WM. SLOAN, *Minister of Mines.*R. F. TOLMIE, *Deputy Minister.*WM. FLEET ROBERTSON, *Provincial Mineralogist and Assayer.*D. E. WHITTAKER, *Provincial Analyst and Assistant Assayer.*JAS. MCGREGOR, *Chief Inspector of Mines.**Resident Mining Engineers.*HENRY DEVLIN, *District Inspector, Nanaimo.*

GEO. A. CLOTHIER, No. 1 District, Prince Rupert.

T. R. JACKSON, *District Inspector, Nanaimo.*

J. D. GALLOWAY, No. 2 District, Hazelton.

ROBERT STRACHAN, *District Inspector, Fernie.*

A. W. DAVIS, No. 3 District, Kamloops.

JOHN MACDONALD, *District Inspector, Fernie.*

P. B. FREELAND, No. 4 District, Grand Forks.

JOHN G. BIGGS, *District Inspector, Merritt.*

A. G. LANGLEY, No. 5 District, Revelstoke.

THOS. J. SHENTON, *District Inspector, Prince Rupert.*

W. M. BREWER, No. 6 District, Nanaimo.

H. H. JOHNSTONE, *Temporary Inspector, Nelson.*

GOLD COMMISSIONERS AND MINING RECORDERS.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Atlin Mining Division..	Atlin	C. L. Monroe.....	C. L. Monroe.....	
Sub-office	Telegraph Creek..			H. W. Dodd.
"	Haines (U.S.)		(Com. for taking Affidavits)	Risdon M. Odell.
"	Juneau (U.S.).....		Ditto.....	Harold E. Brown.
Stikine Mining Division ..	Telegraph Creek..	H. W. Dodd	H. W. Dodd	
Sub-office	Boundary	"	"	John Wynne.
Liard Mining Division ..	Telegraph Creek..	"	"	
Sub-office	Porter			Chas. H. Smith.
"	McDame Creek			Mike Larsen.
"	Fort St. John			F. W. Beaton.
Skeena Mining Division..	Prince Rupert....	J. H. McMullin...	J. H. McMullin...	
Sub-office	Alice Arm			E. P. Riel.
"	Kitimat			G. L. Anderson.
"	Swansen Bay			S. C. White.
"	Copper City			L. G. Skinner.
"	Terrace			L. H. Kenny.
"	Rosswood			Mrs. C. Warner.
"	Stewart (Portland Canal)			J. P. Scarlett (Act-ing).
Nass River	Anyox	J. H. McMullin ..	J. Conway	
Sub-office	Aiyansh	"		A. F. Priestly.
Portland Canal M.D.	Stewart	J. H. McMullin (at Prince Rupert)	J. P. Scarlett (Act-ing)	
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. Tyson.
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 Graham			T. A. Perry.
"	Fort St. James			Alex. C. Murray.
"	Manson Creek			W. B. Steele.
"	Telkwa			T. J. Thorp.

GOLD COMMISSIONERS AND MINING RECORDERS—Continued.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Omineca M.D.— <i>Con.</i>				
Sub-office	Fort St. John			F. W. Beaton.
"	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.
"	Tatla Landing			R. C. McCorkell.
Peace River Mining Div.	Fort St. John	S. H. Hoskins (at Hazelton)	F. W. Beaton	
Sub-office	Hudson Hope			F. F. Monteith.
"	Pouce Coupe			J. D. Moore.
Cariboo Mining Division	Barkerville	H. Beech		
Sub-office	Quesnel	"		E. C. Lunn.
"	Fort George	"		T. W. Herne.
"	McBride	"		S. Service.
Quesnel Mining Division	Williams Lake	W. B. Campbell	R. M. McGusty	
Sub-office	Quesnel			E. C. Lunn.
"	Quesnel Forks.			Wm. Lowden.
"	Barkerville.			H. Beech.
Clinton Mining Division	Clinton	Geo. Milburn		
Lillooet Mining Division	Lillooet	John Dunlop	John Dunlop	
Kamloops Mining Division	Kamloops	E. Fisher	L. S. Brown	L. J. Price.
Sub-office	Chu Chua			George Fennell.
"	Vavenby			Hyde Finley.
"	Albas			C. O. Sjouquist.
Ashcroft Mining Division	Ashcroft	E. Fisher (at Kam.)	W. C. Adams	Miss Ada C. Astell.
Sub-office	Lytton			W. Greenwood.
Nicola Mining Division	Merritt	E. Fisher (at Kam.)	W. H. Boothroyd.	
Yale Mining Division	Yale	" "		
Sub-office	Hope	" "		Mrs. D. A. Hazel-
Similkameen Mining Div.	Princeton	Hugh Hunter	Hugh Hunter	[ton.
Sub-office	Hedley			Jas. Clarke.
Vernon Mining Division	Vernon	L. Norris	M. S. Morrell	
Greenwood Mining Div.	Greenwood	P. H. McCurrach	P. H. McCurrach	
Sub-office	Vernon			M. S. Morrell.
"	Rock Creek			Owen Wheeler.
"	Beaverdell			E. F. Ketchum.
Grand Forks Min. Div.	Grand Forks	Chas. Mudge	Chas. Mudge	
Osoyoos Mining Division	Penticton	W. R. Dewdney	W. R. Dewdney	
Sub-office	Olalla			R. W. Northey.
"	Hedley			Jas. Clarke.
"	Fairview			J. R. Brown.
Golden Mining Division	Golden	G. E. Sanborn	G. E. Sanborn	H. C. Moore.
Windermere Mining Div.	Wilmer	" (at Golden)	E. M. Sandilands	
Fort Steele Mining Div.	Cranbrook	F. A. Small	F. A. Small	
Sub-office	Steele			
"	Fernie			R. J. Stenson.
"	Moyie			W. H. Laird.
Ainsworth Mining Div.	Kaslo	Ronald Hewat	A. McQueen	A. W. Anderson.
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 (at Kaslo)	Angus McInnes	
Sub-office	Sandon			W. J. Parham.
Slocan City Mining Div.	Slocan	Ronald Hewat	Thos. McNeish	
Trout Lake Mining Div.	Trout Lake	"	Oscar Jacobson	

GOLD COMMISSIONERS AND MINING RECORDERS—Continued.

Mining Division.	Location of Office.	Gold Commissioner.	Mining Recorder.	Sub-Recorder.
Nelson Mining Division ..	Nelson	J. Cartmel	J. Cartmel	
Sub-office	Creston			T. W. Lytle.
"	Ymir			Wm. Clark.
"	Sheep Creek			Geo. Leece.
"	Salmo			M. C. Donaldson.
Arrow Lake Min. Division	Nakusp	J. Cartmel (at Nelson)	Walter Scott	
Sub-office	Vernon			M. S. Morrell.
Revelstoke Mining Div...	Revelstoke	J. Lee (Acting)...	J. Lee	Newton R. Brown.
Lardeau Mining Division.	Beaton	" (at Revelstoke)	Ernest Roberts	
Trail Creek Mining Div...	Roseland	W. H. Reid	W. H. Reid	
Nanaimo Mining Division	Nanaimo	L. A. Dodd	L. A. Dodd	
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	R. J. Steenson	R. J. Steenson	
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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